Measuring Firm Wage-Setting Power

Jonathan Garita

UT Austin

March 12, 2019

Motivation

- There is an increasing attention on market power thanks to attractive empirical tools and better data
- A growing body of research is relying on this empirical frameworks to make strong inference in many areas
- In the meanwhile, the literature on the identification of production functions has recently made a remarkable progress
- This —unfortunately— means bad news for the standard approaches to estimate market power
    - "The lack of reliability of the markup measurements raises doubts on the robustness of the results." (Jaumandreu, 2018):
- We must revisit our empirical tools, otherwise we would be producing inconsistent estimates and making biased inference

Cost Side Approach

- For a flexible input v and labor we have:

$$\frac{\theta_{it}^{v}}{s_{it}^{v}} = \mu_{it}$$

$$\frac{\theta_{it}^{L}}{s_{it}^{L}} = \mu_{it}\left(1 + \frac{1}{\varepsilon_{it}^{w}}\right)$$

- If θ_{it}^{L} and θ_{it}^{M} are known, we can recover parameters on product and labor market power
- Standard strategy: De Loecker and Warzsynski (2012) based on the "proxy" literature (OP/LP/ACF)

This presentation

- How meaningful is the departure from perfect competition in labor markets?
- Propose an empirical strategy to identify labor market power in production data
- But acknowledging the presence of product market power
- Use traditional firm-level data and incorporate additional sources (employer-employee data)
- Exploit firm-level measures for future analysis

Outline for today

1. Identification problems
   1.1 Why do we need to be careful with proxy approaches?
   1.2 Is DLW (2012) enough for identification?
2. Possible alternatives
   2.1 Adjust the proxy approach
   2.2 Dynamic Panel techniques
3. Other issues
4. Simple model on the efficiency cost of labor market power

Related literature

Measuring Product Market Power

- *De Loecker and Warzynski (2012)*, Jaumandreu and Yin (2017); Jaumandreu and Lin (2017); Jaumandreu (2018), Flynn and Gandhi (Dec, 2018), Flynn, Gandhi and Traina (March, 2019)

Implications of Product Market Power

- Autor et al. (2017), Edmond et al. (2019), De Loecker and Eeckhout (2018), De Loecker et al. (Nov, 2018), Syverson (2019)

Measuring Labor Market Power

- Azar et al. (2017, 2018); Benmelech et al. (2018), Hershbein et al. (2019), Dube et al. (2018), Berger, Herkenhoff and Mongey (March, 2019)
- *Manning (2003); Webber (2015)*
- *Dobbelaere and Mairesse (2013)*, Tortarolo and Zarate (2018)

Implications of Labor Market Power

- *Naidu et al. (2018)*, Berger, Herkenhoff and Mongey (March, 2019), Hershbein et al. (2019)

The Proxy Structure

$$q_t = f(l_t, k_t, m_t; \beta) + \omega_t + \varepsilon_t$$

- m_t is chosen flexibly each period, with no dynamic implications. Capital is quasi-fixed and labor is chosen before m_t
- ω_t follows exogenous first order Markov process:

$$\omega_t = g(\omega_{t-1}) + \xi_t$$
$$E(\xi_t \mid k_t, l_{t-s}, k_{t-s}, m_{t-s}) = 0 \text{ for all s} \geq 1$$

- Scalar unobservable and strictly monotonicity imply that:

$$m_t = m_t(l_t, k_t, \omega_t)$$
$$\Rightarrow \omega_t = m_t^{-1}(l_t, k_t, m_t)$$

Estimation of output elasticities

- Substitute ω_t for $m_t^{-1}(l_t, k_t, m_t)$ and run:

$$q_t = f(l_t, k_t, m_t; \beta) + m_t^{-1}(l_t, k_t, m_t) + \varepsilon_t$$

- Obtain $\phi_t = f(l_t, k_t, m_t; \beta) + \omega_t$ and ϕ_{t-1}. Then have:

$$\phi_t = f(l_t, k_t, m_t; \beta) + g(\phi_{t-1} - f(l_{t-1}, k_{t-1}, m_{t-1}; \beta)) + \xi_t$$

- Based on timing assumptions, can construct moments:

$$E\left(\xi_t(\beta) \otimes \begin{pmatrix} k_t \\ l_{t-1} \\ m_{t-1} \end{pmatrix}\right) = 0$$

Advantages

- Intuitive and treats large parts of the model non-parametrically
- No need to fully specify the firm input choice process
- Standard timing assumptions in IO literature
- Computationally easy to implement

What's wrong?

Structure insufficient to identify $f(.)$

- ACF (2015), Ackerberg (2016): Proxy structure previously described does not identify β_m (any variable input elasticity!)
- Under no input price variation, m_t is correlated with ω_{it}, so we need instrument
- If we use lagged input as instrument:

$$m_t = m_t(l_t, k_t, g(l_{t-1}, k_{t-1}, m_{t-1}) + \xi_t)$$

- Conditional on $(l_t, k_t, l_{t-1}, k_{t-1}, m_{t-1})$ all variation of m_t is via ξ_t, so no variation left to estimate β_m
- Need m_{t-1} uncorrelated with ξ_t (exclusion restriction) but need m_{t-1} correlated with ξ_t (instrument strength)

What's wrong?

Allowing input price variation is not a solution

- Give lagged inputs validity as instrument by adding an extra state variable

$$m_t = (l_t, k_t, g(l_{t-1}, m_{t-1}, k_{t-1}, p^m_{t-1}) + \xi_t)$$

- m_{t-1} correlated with price of firm's inputs, but uncorrelated with ω_t
- Bond and Sonderbom (2005), FG (2019): Not a practical solution:
  - Firm level input prices are hard to observe
  - If prices are unobserved, we are introducing an omitted variable bias.
  - Even if prices are observed, we need exogenous firm-level variation in prices.
  - FGT (2019): if prices are orthogonal to productivity, DLW estimator still provides bias

What's wrong?

Scalar Unobservable Assumption (SUA)

- $\omega_t \in \mathbb{R}$ is the **only** unobservable affecting m_t
- This rules out optimization error, measurement errors, unobserved firm specific input prices, ...
- DLW (2012) propose to include firm characteristics that potentially can explain such heterogeneity:

$$m_t = m_t(l_t, k_t, z_t)$$

- But usually $m_{it} = m_t(l_{it}, k_{it}, z_{it}, \delta_{it})$, with unobserved demand heterogeneity embodied in δ_{it}.
- Ignoring demand heterogeneity is a potential source of biases and may be internally inconsistent

Alternatives

- Simultaneously estimate markups and output elasticities
  - Jaumandreu (2018), Jaumandreu and Lin (2018), Jaumandreu and Yin (2018), Doraszelski and Jaumandreu (2013, 2018)
- Impose more economic structure and partial identification
  - Flynn and Gandhi (2018), Flynn, Gandhi and Traina (2019)
- Relax scalar unobservable assumption
  - ABBP (2007), Bond and Soderbom (2005)
  - Hu, Huang and Sasaki (2019), Brand (Work in progress)

Other issues

- So far, we have omitted labor adjustment costs, which is an issue.
- Doraszelski and Jaumandreu (2013) suggest that:

$$\frac{\theta_{it}^{L}}{s_{it}^{L}} = \mu_{it}\left(1 + \frac{1}{\varepsilon_{it}^{w}} + \Delta_{it}^{L}\right)$$

- Existent PFE literature either omits adjustment costs or use invalid shortcuts
- Possible solutions:
  - Joint estimation and control for Δ_{it}^{L} non-parametrically
  - Parametrically estimate Δ_{it}^{L} (Cooper and Willis (2003), Aguirregabiria et al. (2014))

Model

- Based on Naidu, Posner and Weil (2018)
- Unit mass of firms with identical technology

$$Y = A\left[\alpha K^{\frac{\sigma-1}{\sigma}} + (1-\alpha)L^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}$$

- $p = A = 1$
- Labor supply follows a two-stage nested structure:
  - Agents decide to work based on prevailing wage rate
  - If so, then decide the employer
- Each firm j faces an isoelastic labor supply curve:

$$L(w_j) = \bar{L}(w_{-j})w_j^{\beta}$$

Model

- Want a symmetric equilibrium since firms are identical: $w_j = w$ and $L = \bar{L}(w)w_j^{\beta}$ for all j
- Conditional on w, workers decide to supply labor according to participation elasticity $\eta > 0$
- Then aggregate employment is $L^{agg} = \kappa w^{\eta}$.
- Since mass of firms is normalized to one, $L^{agg} = L = \bar{L}(w)w^{\beta}$
- Firms are small enough compared with overall labor market, so they take $\bar{L}(w)$ as fixed when choosing w_j

Model

- Government also distorts the labor market through labor taxes τ, with τwL fiscal revenues
- Taxes are then paid back to workers with a multiplier of m, i.e, $G := m\tau wL$
- Can show that total ouput $Y + G$ is affected by β. To what extent?
- Let $Y^*$and G^* the output and public spending levels when firms behave as wage-takers
- Then efficiency or deadweight loss —relative to the perfectly competitive baseline is then:

$$
\begin{aligned}
DWL &= \frac{Y^* + G^* - Y(\beta) - G(\beta)}{Y^* + G^*} \\
&= 1 - \frac{1 + \frac{\beta}{\beta+1}\gamma}{1+\gamma}\left(\frac{\beta}{\beta+1}\right)^{\eta}
\end{aligned}
$$

Model

- Similarly, can express:

$$\frac{wL+G}{Y+G} = \frac{\beta}{\beta+1}\frac{(1-\alpha)^{\sigma}\tilde{w}^{1-\sigma}+\gamma}{1+\frac{\beta}{\beta+1}\gamma} \quad \text{(Labor Share)}$$

$$\frac{rK}{Y+G} = \frac{\alpha^{\sigma}r^{1-\sigma}}{1+\frac{\beta}{\beta+1}\gamma} \quad \text{(Capital Share)}$$

$$\frac{\Pi}{Y+G} = 1-\frac{wL+G}{Y+G}-\frac{rK}{Y+G} \quad \text{(Profit Share)}$$

$$\frac{G^{*}-G(\beta)}{G^{*}} = 1-\left(\frac{\beta}{\beta+1}\right)^{\eta+1} \quad \text{(Fiscal loss)}$$

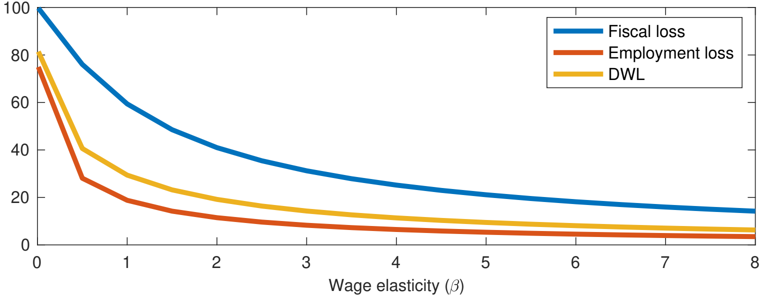
$$\frac{L^{*}-L(\beta)}{L^{*}} = \left(\frac{\beta}{\beta+1}\right)^{\eta}-1 \quad \text{(Employment loss)}$$

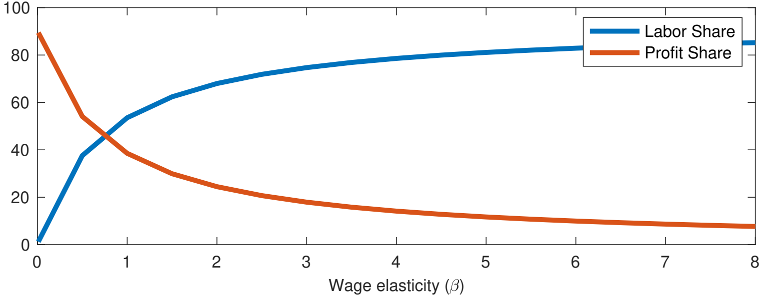
Efficiency Costs and Factor Shares

β	**Wage Markdown**	**Labor Share**	**Profit Share**	**Employment loss**	**Fiscal Loss**	**DWL**
0.5	66.7	37.6	54.1	28.1	76.0	40.6
1	50.0	53.5	38.5	18.8	59.4	29.4
2	33.3	68.0	24.5	11.5	41.0	19.2
3	25.0	74.7	17.9	8.3	31.2	14.3
100	1.0	92.4	0.7	0.3	1.0	0.6

Estimation based on a calibration of $m = 1.3$, $\tau = 0.3$, $\alpha = 1/3$, $r = 0.04$, $\sigma = 0.4$ and $\eta = 0.3$.

Efficiency Costs and Factor Shares





What's next?

- Find robust ways to estimate output elasticities
- Have preliminary results on labor market power based on empirical strategy described
- Incorporate adjustment costs into the analysis
- Work on a general equilibrium model with both product and labor market power

Identification of LMP

Wage-Taking Behavior

$$\frac{\theta_{it}^{L}}{s_{it}^{L}} = \mu_{it}$$

Bargaining

$$\theta_{it}^{L} = \mu_{it} s_{it}^{L} - \mu_{it}\gamma_{it}(1 - s_{it}^{L} - s_{it}^{M})$$

Monopsony

$$\frac{\theta_{it}^{L}}{s_{it}^{L}} = \mu_{it}\left(1 + \frac{1}{\varepsilon_{it}^{w}}\right)$$

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