# Markups and Mergers in the US Hospital Industry

Jan De Loecker, Sebastian Fleitas

Discussant: Andre Veiga

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# Great Paper!

- Super-important topic!
- Great data
- Clever and transparent approach

# Markup Estimation

- Hospital $i$, time $t$
- $P_{it}^{v}$ is price of input $v$
- $P_{it}$ is price of output
- $K_{it}$ is capital, $r_{it}$ is interest
- $\omega_{it}$ is a productivity shock
- Output is

$$Q_{it} = \mathscr{Q}_{it}\left(X_{it}^{1}, ..., X_{it}^{V}, K_{it}, \omega_{it}\right)$$

- $\mathscr{Q}_{it}$ emphasizes possible dependence on $\omega_{it}$
- Hospitals minimize static cost & are input price-takers

$$\mathscr{L} = \sum_{v} P_{it}^{v} X_{it}^{v} + r_{it} K_{it} + \lambda_{it}\left(Q_{it} - \mathscr{Q}_{it}\left(\cdot\right)\right)$$

# FOC

- FOC wrt $X_{it}^v$ is

$$P_{it}^v = \lambda_{it} \frac{\partial \mathscr{Q}_{it}(\cdot)}{\partial X_{it}^v}$$

where $\lambda_{it}$ is marginal cost at level of output $\mathscr{Q}_{it}(\cdot)$. Then

$$\frac{P_{it}}{\lambda_{it}} = \frac{P_{it}}{P_{it}^v} \frac{\partial \mathscr{Q}_{it}(\cdot)}{\partial X_{it}^v}$$

- Markup is $\mu_{it} = P_{it}/\lambda_{it}$, so

$$\mu_{it} = \underbrace{\frac{\partial \mathscr{Q}_{it}(\cdot)}{\partial X_{it}^v} \frac{X_{it}^v}{Q_{it}}}_{\theta_{it}^v} \underbrace{\frac{P_{it} Q_{it}}{P_{it}^v X_{it}^v}}_{1/\alpha_{it}^v}$$

- $\alpha_{it}^v$ : expenditures on $v$ as a share of total revenues (data)
- $\theta_{it}^v$ : output elasticity with respect to input $v$ (must estimate)

# CRS

- But also

$$P_{it}^{v} = \lambda_{it} \frac{\partial \mathscr{Q}_{it}(\cdot)}{\partial X_{it}^{v}}$$

$$\frac{P_{it}^{v}}{\lambda_{it}} \frac{X_{it}^{v}}{Q_{it}} = \frac{X_{it}^{v}}{Q_{it}} \frac{\partial \mathscr{Q}_{it}(\cdot)}{\partial X_{it}^{v}} = \theta_{it}^{v}$$

- With constant returns to scale, $\lambda_{it}$= MC = AC, so

$$\theta_{it}^{v} = \frac{\text{Expenditure}^{v}}{\text{Total Expenditure}}$$

# Estimating $\theta$

- A group is a combinations of ownership status, teaching status, urban status, and quintile of inpatients service
- $\theta^{v}_{gt}$ is median share of the input expenses over total costs across all hospitals in each group $g$, year $t$.

# Advantages & Assumptions

- No need to estimate demand, specify competition, bargaining with insurers, etc
- For hospitals there is good output data, not just sales
- Very transparent

- Assumptions:
  - interior optimum
  - single output
  - $\theta^v$ same for all diagnostics within a hospital
  - constant returns to scale
  - All hospitals in a group use inputs in the same way
  - same DRG composition within each group
  - capital costs = 10% of total fixed assets
  - hospitals price takers in input markets (but generalizable)

# Thoughts 1 (markup estimation)

- Increasing returns, especially in labor?
  - surgeons can specialize, etc
- Hospitals set wages?
  - median HSA has 1 hospital $\rightarrow$ monopsony power
- Labor adjustment costs? (eg, interviews for hiring a new doctor)
- Inference on $\mu$?
  - What is the residual? What are SE? To what do we attribute the unexplained variation?
- Hospital groups do not account for other things that could affect $\theta^v$
  - competition, network size, insurer bargaining power
- Do hospitals only minimize static cost?
  - reduce turnover, improve teaching quality
- Estimate of $\mu$ differs by input $v$
  - Implies that at least some of them have frictions?

# Thoughts 2 (mergers)

- Merger indicator = at least one hospital in market had a merger by time $t$
  - what if most mergers happened before the sample?
  - LHS is a level but merger indicator is effectively a change
- Measuring markups using labor yields coefficients on mergers that are 2x larger.
- Account for error in estimating $\mu$
  - OLS biased if error in $\mu$ is correlated with mergers
- Selection bias?
  - maybe low-markup hospitals go into financial distress and get acquired

# Suggestions

- Show variation in DRG composition of hospitals within each group.
- Show variation in $\theta_{ht}^{v}$ within each group $g$
- Show robustness to assumption about capital costs

- Use instruments for mergers (Dafny 2009)
- Project markups on health outcomes
- Look at the effect on markups of
  - entry/exit (endogenous)
  - organization of insurance market