

Measuring Market Power from the Production Side

a toy model, after De Loecker, Eeckhout, and Unger (2020)

Felix Muñoz-Garcia

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How much more than marginal cost does a firm charge? It seems you would need its demand curve, or a direct reading of its marginal cost, to say. De Loecker, Eeckhout, and Unger (2020) show you need neither. A firm that minimizes cost reveals its markup through two numbers from its books: how much its output responds to a variable input, and how large that input's bill is next to sales. Applied to US firms, the method shows the average markup climbing sharply after 1980. This note builds the one-line derivation and shows what drives the climb.

1 The model

A firm produces output Q with a variable input V , the materials and labor it hires freely each period, bought at price P_V , alongside other inputs it cannot adjust as quickly. Its technology is $Q = Q(V, \dots; \Omega)$, with productivity Ω . Whatever its target output, the firm chooses the variable input to minimize cost, the problem of Chapter 4. With λ the multiplier on the output constraint, the Lagrangian

$$\mathcal{L} = P_V V + \dots + \lambda(\bar{Q} - Q(V, \dots))$$

has first-order condition for the variable input

$$P_V = \lambda \frac{\partial Q}{\partial V}.$$

The multiplier λ is marginal cost, the addition to the cost-minimizing bill from one more unit of output.

Write $\mu \equiv P/\lambda$ for the markup, price over marginal cost, and $\theta_V \equiv \frac{\partial Q}{\partial V} \frac{V}{Q}$ for the output elasticity of the variable input. The derivation takes three steps:

- The first-order condition says $\frac{\partial Q}{\partial V} = \frac{P_V}{\lambda}$, so $\theta_V = \frac{P_V}{\lambda} \cdot \frac{V}{Q}$.
- Solving for marginal cost, $\lambda = \frac{P_V V}{\theta_V Q}$.
- Dividing price by marginal cost, $\mu = \frac{P}{\lambda} = \frac{\theta_V P Q}{P_V V}$, which is θ_V divided by the ratio $\frac{P_V V}{P Q}$.

Therefore,

$$\mu = \frac{\theta_V}{s_V}, \quad \text{where } s_V \equiv \frac{P_V V}{P Q}$$

is the variable input's share of sales. The markup is the output elasticity of a flexible input divided by that input's revenue share.

2 What the formula needs

Nothing on the right comes from the demand side. There is no price elasticity, no guess about how firms compete, no direct measure of marginal cost. Two ingredients do the work: the elasticity θ_V , estimated from the production function, and the share s_V , taken straight from the firm's accounts as variable cost over revenue. The one requirement is that the input be flexible, chosen to minimize cost period by period with no adjustment frictions, so the static first-order condition holds.

Intuitively, a firm with market power sells each unit well above the cost of the variable input that produced it, so it spends little on flexible inputs per dollar of sales. The markup is that gap: a large output elasticity θ_V sitting next to a small revenue share s_V .

3 The rise of market power

Hold technology fixed, and the formula ties the markup to a single number, the variable input's share of sales: when s_V falls, μ rises. Across US firms the output elasticity moved little while the share of sales going to variable inputs fell steadily after 1980, and De Loecker, Eeckhout, and Unger find the sales-weighted average markup rose from 1.21 in 1980 to 1.61 in 2016.

A numerical example. Take a stable output elasticity $\theta_V = 0.85$ and let the variable input's share of sales fall from 0.70 to 0.53. The markup climbs from $\frac{0.85}{0.70} \approx 1.21$ to $\frac{0.85}{0.53} \approx 1.60$, tracking their finding, while the technology never moves. Equivalently, marginal cost as a share of the price, $\frac{1}{\mu} = \frac{s_V}{\theta_V}$, falls from $\frac{0.70}{0.85} \approx 82$ percent to $\frac{0.53}{0.85} \approx 62$ percent. Figure 1 plots the curve: as the input share falls, the firm moves up it from 1980 to 2016.

Year	Elasticity θ_V	Input share s_V	Markup $\mu = \theta_V / s_V$
1980	0.85	0.70	1.21
2016	0.85	0.53	1.60

Table 1. A stable elasticity and a falling input share lift the markup ($\theta_V = 0.85$ throughout).

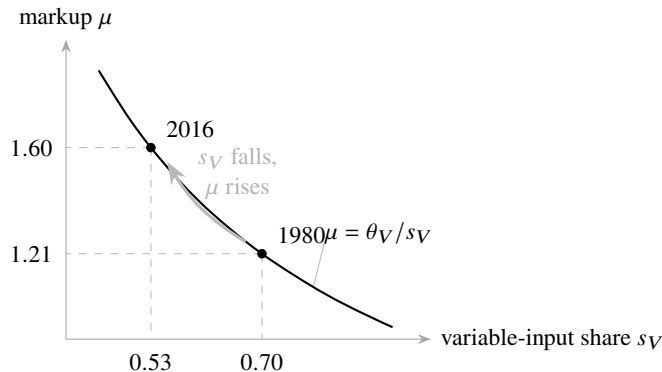


Figure 1: The markup $\mu = \theta_V / s_V$ against the variable-input share of sales, for a fixed elasticity $\theta_V = 0.85$. A falling input share moves the firm up the curve, lifting the markup from 1.21 to 1.60 with technology unchanged.

Lesson: A firm's market power can be recovered from its production and its accounts, without ever drawing its demand curve. The markup is high when a firm sells a lot per dollar it spends on flexible inputs, and the climb since 1980 is the mirror image of a falling variable-input share of sales. $\square$

References

De Loecker, J., J. Eeckhout, and G. Unger (2020) "The Rise of Market Power and the Macroeconomic Implications." *Quarterly Journal of Economics* 135(2): 561–644.