

Least-Cost and Profit-Maximizing Inputs

AP Microeconomics | Unit 5 | marginal product per dollar

1. Output per dollar

Do not compare inputs by marginal product alone. Compare **marginal product per dollar**: $MP \div \text{price}$.

Example. One more worker adds 20 boxes an hour and costs \$10. One more robot adds 60 boxes and costs \$60.

$$\frac{MP_L}{P_L} = \frac{20}{\$10} = 2 \qquad \frac{MP_K}{P_K} = \frac{60}{\$60} = 1$$

A dollar spent on labor buys twice as much output, even though the robot is the stronger machine. (K stands for capital.)

2. The least-cost rule

Move \$60 from robots to workers: one robot fewer loses 60 boxes, six more workers gain up to 120. Same cost, more output. As the firm keeps switching, the marginal product of labor *falls* (diminishing marginal returns) and the marginal product of capital *rises*, until the ratios are equal.

Least-cost rule

$$\frac{MP_L}{P_L} = \frac{MP_K}{P_K}$$

The last dollar spent on each input adds the same amount of output. No reshuffling of the budget can produce more.

3. Which input to use more of

If the ratios are not equal

Use **more** of the input with the **higher** marginal product per dollar, and less of the other.

Example. Labor: $MP = 30$, price \$15. Capital: $MP = 80$, price \$20.

$$\frac{30}{\$15} = 2 < \frac{80}{\$20} = 4$$

The firm is not minimizing cost: it should use more capital and less labor.

If the wage rises, labor's ratio falls, and the firm substitutes capital for labor.

4. Least cost is not yet maximum profit

The least-cost rule gives the cheapest *mix* for a given output. For maximum profit each input must also be hired until its MRP equals its price:

Profit-maximizing rule

$$\frac{MRP_L}{P_L} = \frac{MRP_K}{P_K} = 1$$

Ratio greater than 1: hire more of that input. Less than 1: hire less.

Example. Each box brings in \$1. Labor: $\$20/\$10 = 2 > 1$, so hire more workers. Capital: $\$60/\$60 = 1$, the right number of robots.

Where students lose points

1. Comparing marginal products alone: divide each by its price first.
2. Flipping the ratio: it is MP over price, not price over MP.
3. Wrong direction: use more of the input with the higher MP per dollar.
4. Not explaining why the ratios become equal: diminishing marginal returns.
5. Mixing the rules: least cost uses MP/P , maximum profit uses $MRP/P = 1$.

Now practise it

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