Finding the Least-cost Factor Combination

**Key Concepts:**

- A firm chooses a capital-labor combination that minimizes its total cost of production.
- The exact combination of capital and labor that a firm would choose depends on the relative prices of **capital** and **labor**.
- If the relative prices of capital and labor change, the firm substitutes away from the relatively more expensive factor.
- In the short run the firm can only change its labor and cannot choose the least-cost combination of capital and labor.

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**Using the Isocost Line**

The slope of the isocost line is the relative price of capital and labor. In the example on the left, the price of labor is $10, and the price of capital is $30. The slope of the isocost curve is the fraction wage/rent or

\[
\frac{10}{30} = -\frac{1}{3}
\]

The curve slopes downward so it has a negative sign.

**Recall:** Rent is the price paid for capital; the wage is the price paid for labor.

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**Calculating the Total Cost of Production**

The firm chooses the output level that it wants and then finds the least-cost combination of capital and labor to produce that output. In the example on the left the firm chooses to produce 12 units of output and finds the combination of factors of production at the point where the slope of the isocost curve is tangent to the isoquant line that represents 12 units.

In this example the firm chooses six units of labor and two units of capital at a total cost of $120.

Cost of Production = (wage)(# of workers) + (cost of capital)(# units of capital)

\[= ($10)(6) + ($30)(2)
\]

\[= $60 + $60
\]

\[= $120\]
The firm could choose another combination of capital and labor to produce the same output, but any other combination would not be the cost-minimizing combination.

For example, the firm could choose 12 units of labor and one unit of capital to produce 12 units of output. This combination of capital and labor would cost the firm $150.

Suppose that the relative price of capital and labor changes. If the price of labor increases more than the price of capital, the slope of the isocost curve changes, and the firm chooses a new combination of factors to produce the output.

In the example on the left, the firm substitutes in the direction of the factor that has become relatively less expensive and away from the factor that has become relatively more expensive.

If the firm wants to increase its output to 24 units, it can increase only its labor in the short run. The amount of its capital is fixed. To produce 24 units in the short run, it must use the two units of capital that it previously used and increase labor to 12 units. As you can see on the left, this is not the least-cost combination because the isocost curve is not tangent to the isoquant.
In the long run the firm can adjust labor and capital and find the least-cost combination of factors. The firm finds the tangency point on the desired isoquant.

Note that long-run costs are always less than short-run costs because a firm has the flexibility to adjust both capital and labor.