Microeconomic Theory — ECON 323 503
Chapter 6: Firms and Production

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Outline

1. The ownership and management of firms: Who owns the firm and makes decisions about what/how much to produce?

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6. Productivity and technical change: output changes with time for fixed amount of input.

Kinds of firms

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2. Public sector: Owned by the government.
3. Non-profit: Not owned by government, but pursue social objectives.

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3. Corporations: Owned *shareholders* who are not liable for the firm's debts.

Limited liability

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This allows firms to raise funds and take risks that wouldn't be possible under the other ownership structures.

Decision making

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We will ignore the fact that this isn't often the case in reality.

The owners' interest

Profit maximization.

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Profit (π) is the difference between revenue (R) and cost (C).

$$\pi = R - C.$$

R—what the firm earns from selling goods.
If there's only one good: $R = pq$.

C—what the inputs of producing the goods cost.

Efficient production

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Not a *sufficient condition* though: the output level needs to be right as well.

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3. Material (M): raw inputs. E.g. wood for a paper company.

Production functions

Given certain amounts of inputs, what is the most output that a firm can produce?

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If a firm uses only capital and labor,

$$q = f(L, K)$$

Variability of inputs over time

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Long run: Everything is variable.

Short-run production

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This is the *total product of labor.*

Marginal product

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The *marginal product of labor*:

$$MP_L = \frac{\delta q}{\delta L} = \frac{\delta f(L, \overline{K})}{\delta L}.$$

Average product

What is the *average* output from each unit of labor being used?

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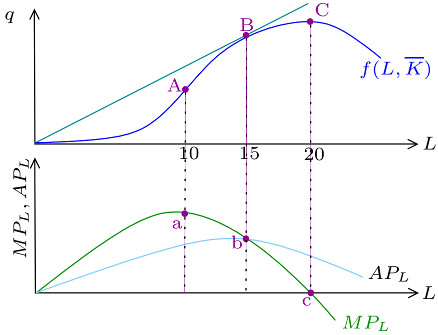
The *average product of labor*:

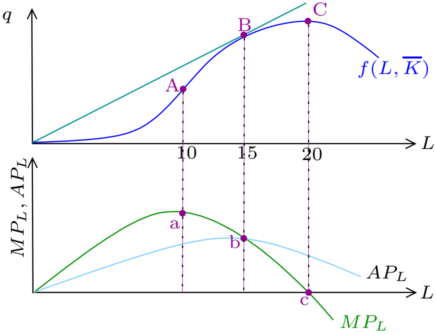
$$AP_L = \frac{q}{L} = \frac{f(L, \overline{K})}{L}.$$

The relationship between MP_L and AP_L



Total output increases up to 20 units of labor and then decreases.

The relationship between MP_L and AP_L



Typically AP_L rises (due to specialization) and then falls (because other factors are limiting).

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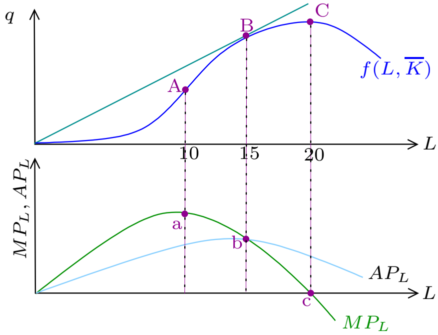
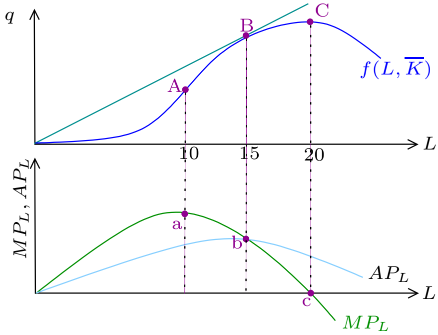


Beyond 15 units of labor, the increase in total output is less than in proportion to labor. So AP_L falls.

The relationship between MP_L and AP_L



If $MP_L > AP_L$, AP_L is increasing: an additional unit of labor is more productive than average. So the new average is higher.

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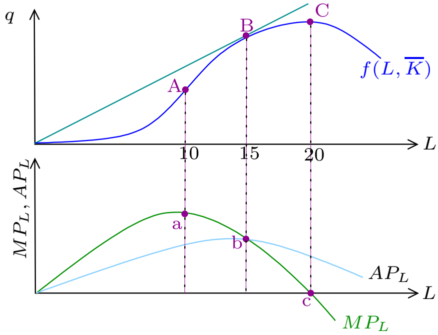
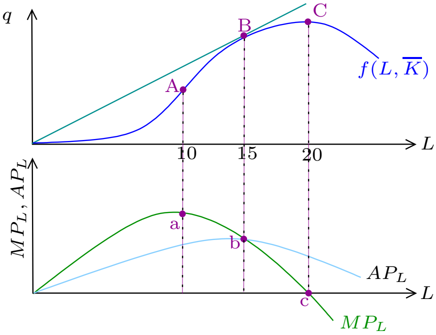


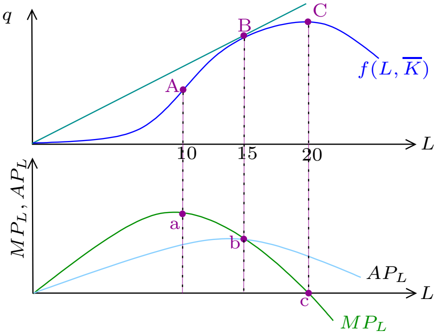
If $MP_L < AP_L$, AP_L is decreasing: an additional unit of labor is less productive than average. So the new average is lower.

The relationship between MP_L and AP_L



AP_L is the slope of the straight line from the origin to the total product of labor. This is highest at point B.

The relationship between MP_L and AP_L



MP_L is the slope of the tangent to the total product of labor.
It is increasing until A and then starts to fall.

Law of diminishing marginal returns

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In other words: MP_L eventually diminishes.

Mathematically:

$$\frac{\delta MP_L}{\delta L} = \frac{\delta \left(\frac{\delta q}{\delta L} \right)}{\delta L} = \frac{\delta^2 q}{\delta L^2} = \frac{\delta^2 f(L, \overline{K})}{\delta L^2} < 0.$$

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There is no "law of diminishing returns."

Long-run production

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Example:

$$q = L^{0.5} K^{0.5}$$

For a fixed $\overline{q}$ we can draw a line through every pair of L and K that yields $\overline{q}$ units of output.

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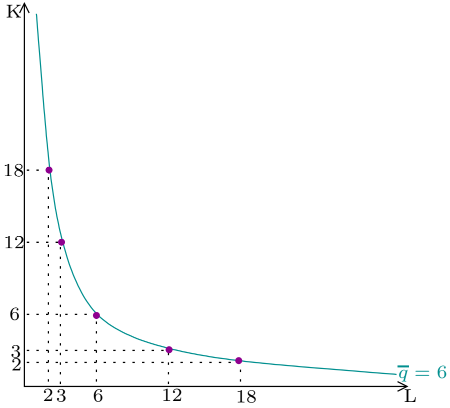
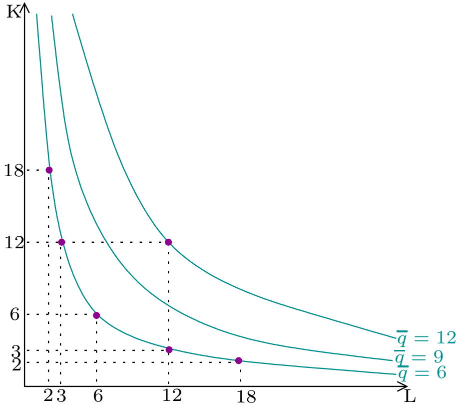
Each of (1,36), (2,18), (3,12),(4,9),(6,6),(9,4),(12,3),(18,2), and (36,1) yield 6 units of output.

Isoquants



The isoquant is a curve through all of those points.

Isoquants



For higher values of $\overline{q}$ we get higher isoquants.

Properties of isoquants

Much like indifference curves, they

1. correspond to higher levels as you move $\nearrow$.

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Biggest difference: the number associated with an isoquant (the quantity produced) has meaning, unlike utility which we can represent using more than one function.

Shapes of isoquants

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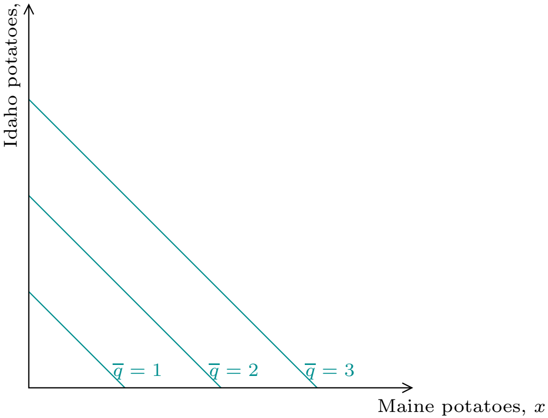
Straight lines of slope -1 and intercept $\overline{q}$.

Isoquants: perfect substitutes



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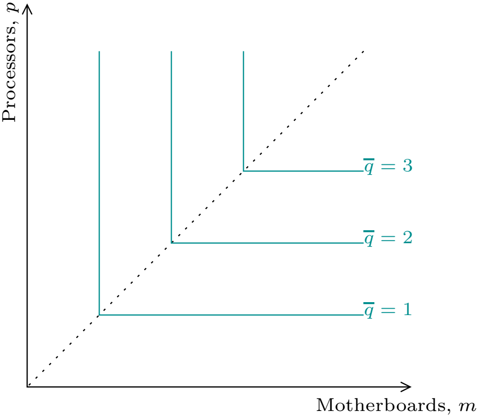
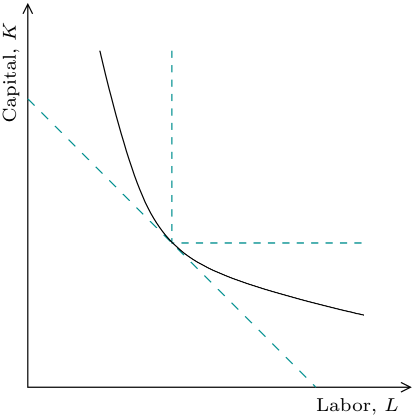


Shapes of isoquants

Of course, between these two extremes, we have *imperfect* substitution between inputs. As with Cobb-Douglas production.



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This is negative since isoquants slope downwards.

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Differentiating both sides of this equation with respect to L:

$$\frac{d\overline{q}}{dL} = 0 = \frac{\delta f}{\delta L} + \frac{\delta f}{\delta K}\frac{dK}{dL} = MP_L + MP_K\frac{dK}{dL}.$$

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Rearranging this:

$$MRTS = \frac{dK}{dL} = -\frac{MP_L}{MP_K}.$$

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If we start substituting L for K, $\frac{K}{L}$ grows, so the isoquant gets flatter and flatter.

Returns to scale

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Specialization can yield IRS: a bigger factory with more workers who can specialize in their jobs can be more productive.

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Varying returns to scale: The most usual situation is that production technology exhibits IRS when output is low and DRS when it is high.

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A *non-neutral* technical change would alter the ratios of the inputs used.

Organizational changes

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HP shares are up 7.1% today, reflecting that investors believe that his will be a more productive organization of the firm.