

Marginal Rate of Technical Substitution

Marginal rate of substitution is a term that is usually applied to consumers. It is the maximum amount of one good (good Y) a consumer would give up to get a second good (good X), **and** still achieve the same amount of satisfaction. Marginal rates of substitution are usually diminishing. The less a consumer has of the first good, the less that consumer is willing to give up to get the second good.

$$MRS_{xy} = -\frac{\Delta Y}{\Delta X}$$

$\Delta Y = \text{Change in } Y$

$\Delta X = \text{Change in } X$

Marginal rate of **technical** substitution (MRTS) is a similar concept, except that it applies to businesses and their need for inputs. MRTS is the amount of one input a business would give up to get a second input, **and** still be able to produce the same amount of output.

For instance, the marginal rate of technical substitution of capital for labor is a measure of how many units of labor a firm would give up to get one unit of capital; or equivalently, it is a measure of how much capital can be substituted for labor, **and** still be able to produce the same amount of output.

$$MRTS_{KL} = -\frac{\Delta L}{\Delta K}$$

$\Delta L = \text{Change in } L$

$\Delta K = \text{Change in } K$

Like marginal rates of substitution, marginal **technical** rates of substitution usually decline. The reason for declining marginal rates of technical substitution is that inputs tend to complement each other. Each can substitute for the other, but only imperfectly.

Firms producing at minimum cost will use variable inputs in ratios in which the marginal rate of technical substitution of one variable input for another equals the ratio of the price of that input to the other. Therefore, if you can determine the price of firm's inputs, you gain some insight about its marginal rate of technical substitution. For instance, if you can determine a firm's cost of capital and cost of labor, you can get at least a rough estimate of its MRTS of capital for labor.

$$MRTS_{KL} = \frac{P_K}{P_L}$$

$P_K = \text{Price of capital}$

$P_L = \text{Price of labor}$