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Principles of Economics

Profit-Maximizing Resource Use

Introduction

We shall develop a rule that a firm can follow that will tell it how many units of each type of resource that it should employ in order to maximize its profits.

(Recall that a *resource* is anything used in the production process. Categories of resources include land, labor, and capital. In this set of notes I will use labor as an example, but the rule that we develop could be used (slightly modified) for any resource.)

Concepts: *Marginal Revenue Product* and *Marginal Resource Cost*

Suppose a firm is considering hiring 1 more worker. It must consider the two ways this worker will impact its profits:

1) The worker increases the firm's costs, since the firm must pay the worker.

Marginal resource cost (aka marginal factor cost) is the increase in a firm's total cost that occurs when 1 additional unit of a resource is hired.

Example: Suppose that fast food workers are paid \$6.50 an hour in a hypothetical town. In this case, the marginal resource cost of an extra hour of labor for a fast food restaurant is the wage that it must pay -- \$6.50.

2) The worker will enable the firm to increase its output; then, the firm can sell the extra output and earn extra revenue.

Marginal revenue product is the increase in a firm's total revenue made possible by employing an additional unit of a resource.

Example: Suppose that hiring one more fast food cook allows the firm to produce and sell 15 more fast food meals for \$3 each. In this case, the cook's marginal revenue product is $15 \times \$3 = \45 .

Profit-maximizing resource use

A firm interested in profits will hire more units of a resource as long as that action adds to the firm's profits; this will be the case if the marginal resource cost is less than the marginal revenue product.

Profit-maximizing rule #2: A firm should continue to hire and employ units of a resource as long as the resource's marginal resource cost is less than its marginal revenue product.

A Closer Look at Marginal Revenue Product

How can we measure marginal revenue product? Well, first recall the concept of marginal product. Marginal product is the extra units of output made possible by employing 1 more unit of a resource. (In our fast food cook example on p.1, the cook's marginal product was 15 fast food meals). The revenue that the firm will generate when it sells these extra units = marginal product x price per unit of output. Hence:

marginal revenue product = marginal product x price per unit of output

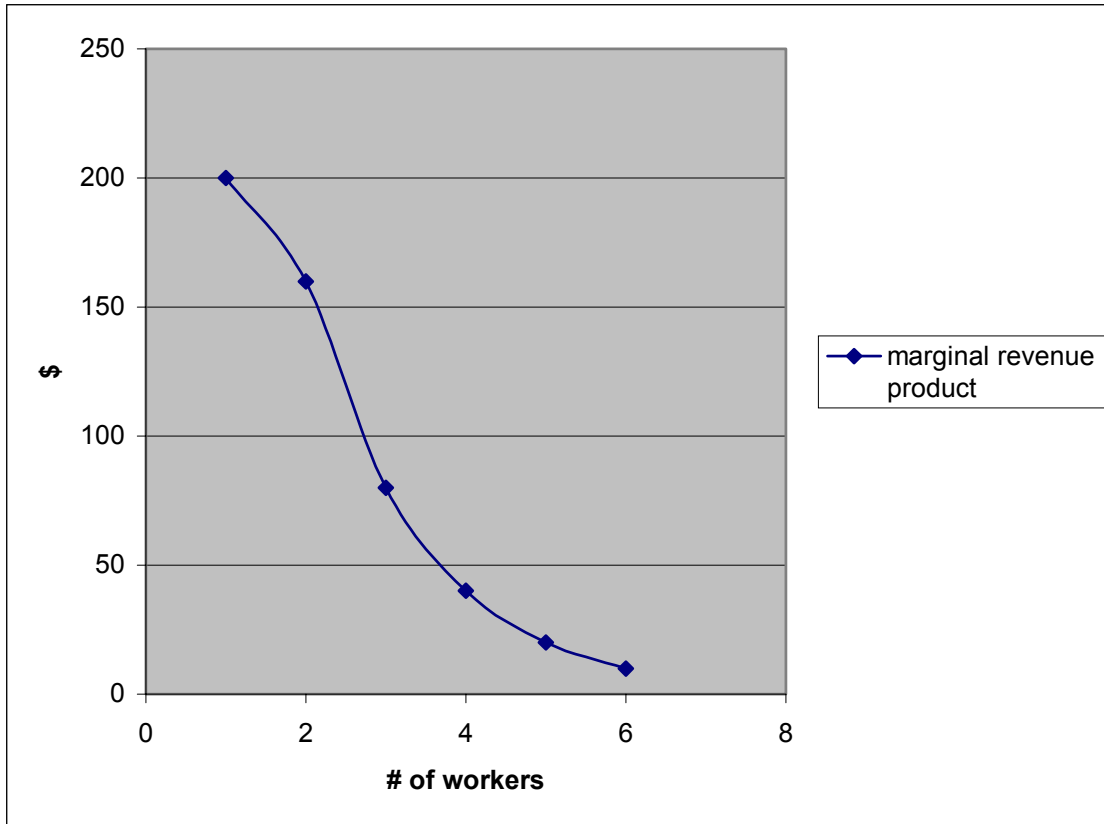
Example: Suppose that a tomato farm owner is trying to decide how many workers to use on her farm. The marginal product of each worker is listed here:

<u>worker</u>	<u>marginal product</u>
1 st worker	100 tomatoes
2 nd worker	80 tomatoes
3 rd worker	40 tomatoes
4 th worker	20 tomatoes
5 th worker	10 tomatoes
6 th worker	5 tomatoes

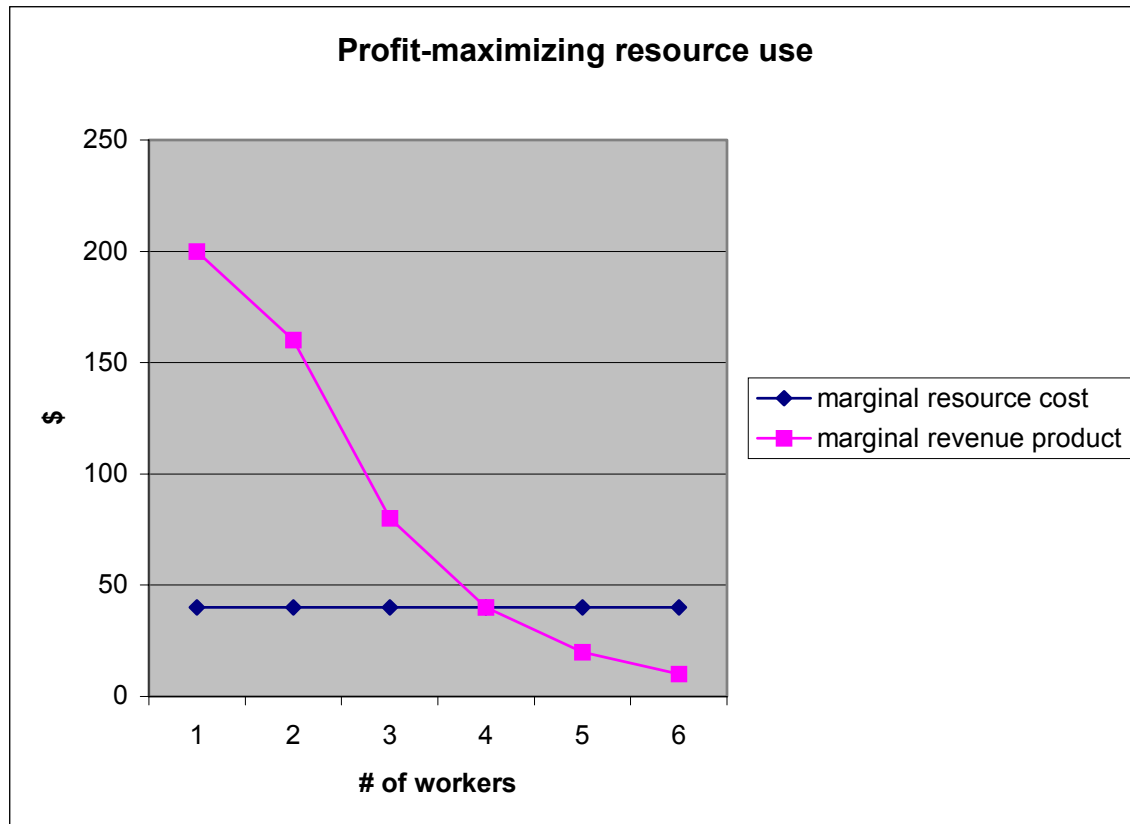
Now suppose that each tomato can be sold for \$2 each. Now we can calculate the marginal revenue product of each worker:

<u>worker</u>	<u>marginal product</u>	<u>marginal revenue product (=marginal product x \$2)</u>
1 st worker	100 tomatoes	100 x \$2 = \$200
2 nd worker	80 tomatoes	80 x \$2 = \$160
3 rd worker	40 tomatoes	40 x \$2 = \$80
4 th worker	20 tomatoes	20 x \$2 = \$40
5 th worker	10 tomatoes	10 x \$2 = \$20
6 th worker	5 tomatoes	5 x \$2 = \$10

Let's graph this marginal revenue product:



Now suppose that each worker can be hired for \$39.99 each. Using profit-maximizing rule #2, we see that 4 workers should be hired. Shall we graph this? Of course! What a blast!



Notice that the profit-maximizing choice—4 workers—is located directly below the intersection of the two curves.

Indeed, in a hypothetical world in which a firm could hire little fractions of workers, we can restate the profit-maximizing rule #2:

Profit-maximizing rule #2 (mathematical version): A profit-maximizing firm should hire units of a resource at which the resource's marginal revenue product equals its marginal resource cost.