Cost and Benefit Optimization for Producers

by Sophia Tutorial

WHAT'S COVERED

This tutorial will cover cost and benefit optimization for producers, discussing key aspects used by a firm to maximize profit when faced with resource constraints.

Our discussion breaks down as follows:

1. Constraints
2. Cost Minimization/Profit Maximization
3. Profit Maximization: Example
    a. Producer Optimization

1. Constraints

Thinking like a business, we know that all businesses have to make three major decisions:

- How much should we produce?
- How should we produce it?
- How much land, labor, and capital do we need to buy?

We know that in order to produce, businesses need to purchase resources, also known as factors of production by economists.

We also know that businesses face **constraints**, just as consumers do. A constraint is an element that interrupts production of a firm or consumption by individuals.

In this tutorial, we are focusing on the production of a firm.

Now, we as consumers are constrained by time and income, as are firms. However, firms are additionally constrained by their resources--the land, labor, and capital.

Especially in the short run, resources are constrained. Some element is fixed and cannot be changed in the short run.

EXAMPLE For example, suppose your business is doing very well and you want to start producing more. Certainly, you could hire more workers, but do you have enough land or enough capital to make it worthwhile?

In other words, you can hire all the workers you want, but if their space is limited or they don't have enough machines, it won't make it worthwhile to hire more labor. Therefore, in the short run, when an element is fixed, like your ability to expand your business size, these things are very much constraints for you.

TERM TO KNOW

Constraints
An element that interrupts production of a firm or consumption by individuals

2. Cost Minimization/Profit Maximization

Now, firms decide how much land, labor, and capital they need by evaluating two major factors:

1. How much they are producing
2. The price of each resource

Businesses all want to minimize cost. **Cost minimization** is the output strategy that incurs the least amount of cost, which helps lead a business to **profit maximization**, the procedure of determining quantity and cost that yields the greatest profit.

Whereas we as consumers seek to maximize our utility or our satisfaction when making purchases, based on individual preferences, firms seek to maximize their profit.

Firms base their profit maximization decisions on the opportunity costs of their resources--land, labor, and capital.

Consumers Maximize Utility	Firms Maximize Profit
Based on individual preferences	Based on opportunity costs of land, labor, and capital

Circling back to the three major decisions that all businesses must make, let's focus on the first one:

- How much should we produce?

This is the first step in profit maximization, which is that a business has to find the ideal quantity to produce.

TERMS TO KNOW

Cost Minimization
Output strategy that incurs the least amount of cost

Profit Maximization
Procedure of determining quantity and cost that yields the greatest profit

3. Profit Maximization: Example

Here is a chart for a hypothetical business to help determine how much it should produce, outlining the various quantities that the business is producing, as well as the total costs of producing at each quantity.

The price of the product is $15, meaning this is what they are selling the product for once it is produced.

Price of Product = $15

Quantity	Total Costs	"Additional" Marginal Cost	Total Revenue (P x Q)	"Additional" Marginal Revenue (P)	Profit (TR - TC)
0	$10	--	$0	--	
1	$20	$10	$15	$15	
2	$25	$5	$30	$15	
3	$30	$5	$45	$15	
4	$40	$10	$60	$15	
5	$60	$20	$75	$15	
6	$90	$30	$90	$15	

As you can see, as they decide to produce more, their total costs logically go up.

We also outline marginal cost, total revenue, marginal revenue, and profit.

For now, we're going to leave the profit column blank, but note that this is obviously the column that a business owner cares about the most, since their goal is to maximize profit. We will come back to this column shortly.

Now, any time you see the word "marginal," as you see in the marginal cost and marginal revenue columns, think the word "additional," because it represents an *incremental* analysis in economic terms.

Marginal cost, therefore, is based off of total cost, and shows the additional, or incremental, cost incurred when producing one additional product.

> EXAMPLE For example, when we go from producing nothing to producing one unit, the total costs go up by $10. When we go from producing one unit to two units, our incremental, or marginal, cost increases by an additional $5, and so on.

Total revenue represents the total amount of money that a business takes in from selling their product. So, if they produce nothing, then they take in no money. If they produce and sell one, they take in $15; if they produce and sell two, they take in $30.

This doesn't take costs into account; it simply reflects how many they are producing--the quantity--times the price that they are selling them for ($15 each).

Marginal revenue is the additional revenue resulting from the increase of product sales by one unit. Again, you could look at this as the change in total revenue, but if you think about it, every time they sell one more, given that the price of the product is the same, marginal revenue will simply equal the price of the product.

3a. Producer Optimization

Now, **producer optimization** occurs when they achieve maximum profitability through revenue maximization and cost minimization.
It is necessary to combine both the revenue coming in and the cost going out in order to optimize a producer's situation.

BIG IDEA

Producers will always optimize their choices when they produce up to the point where marginal revenue equals marginal cost.

Marginal Revenue = **Marginal Cost**

HINT

For a producer, marginal revenue is their marginal benefit.

Let's revisit our profit maximization example. We have indicated in green where marginal cost is less than marginal revenue, in which case the firm should continue producing, because remember, profit is the bottom line.

Profit is what they want to maximize, and if they are taking in more money by selling the next unit than what it costs them, profits should be rising--which is exactly what is happening.

Notice, though, that when the quantity produced reaches five units, marginal cost and marginal revenue is indicated in red, because the additional cost to produce it is greater than the additional revenue garnered by selling it.

The firm will never want to spend more money to bring a product to market than they are going to receive for it. Once marginal revenue is less than the marginal cost, their profit will fall.

color:#0f0>Where MR > MC, producing more yields greater profit.

Where MC > MR, producing more yields less profit.

Price of Product = $15

Quantity	Total Costs	Marginal Cost	Total Revenue (P x Q)	Marginal Revenue (P)	Profit (TR - TC)
0	$10	--	$0	--	-$10
1	$20	$10	$15	$15	-$5
2	$25	$5	$30	$15	$5
3	$30	$5	$45	$15	$15
4	$40	$10	$60	$15	$20
5	$60	$20	$75	$15	$15
6	$90	$30	$90	$15	$0

Most people are under the assumption that a producer should simply produce as much as they possibly can. However, their cost structure is set up so that at some point, it is not going to benefit them, because their profit begins to drop--as you can see on the chart.

So, at what point should they produce up to? Well, on this chart, marginal cost never exactly equals marginal revenue, because this is typically the case in real life.

Looking at the chart, you will see that they would never go past producing a quantity of four. They would go up to the point where marginal cost equals marginal revenue, in theory, but as soon as they realize that the marginal cost of producing that fifth unit is greater than the marginal revenue, they would back it up and stop at four.

At four units, the profit is highest.

TERMS TO KNOW

Marginal Cost
Additional cost incurred when producing one additional product

Marginal Revenue
The additional revenue resulting from the increase of product sales by one unit

Producer Optimization
Achieving maximum profitability through revenue maximization and cost minimization

SUMMARY

Today we learned that firms must choose how much to produce and how to produce, but face resource **constraints**. We also learned that firms are always seeking to **minimize costs** in order to **maximize profits**. Lastly, we explored an **example of profit maximization** to fully understand that **producer optimization** occurs when firms achieve maximum profitability through revenue maximization and cost minimization. It is important to remember that firms will maximize profit by

producing up to the point where marginal revenue/benefit equals marginal cost.

Source: Adapted from Sophia instructor Kate Eskra.

TERMS TO KNOW

Constraints
An element that interrupts production of a firm or consumption by individuals.

Marginal Cost
Additional cost incurred when producing one additional product.

Marginal Revenue
The additional revenue resulting from the increase of product sales by one unit.

Producer Optimization
Achieving maximum profitability through revenue maximization and cost minimization.

Profit Maximization
Procedure of determining quantity and cost that yields the greatest profit.