Analysis of Perfect Competition

Contents:

Introduction:

Firms operate within their market, which consists of:
- Supply side: all of the firms producing similar products
- Demand side: all buyers willing to purchase the products

Markets differ; the auto market is far different from the tomato market, for example. Thus economists separate markets into 4 categories:
- --perfect competition
- --monopolistic competition
- --oligopoly
- --monopoly.
- Behold the qualities of each category of market below:

Perfect competition: There are many, many small sellers (technically, there must be an infinite number of sellers), each of whom produces an **identical** product. It is very easy for new sellers to enter this market, and it is easy for existing sellers to leave the market.

Examples: There are no real world examples of perfectly competitive markets. Some agricultural markets come close. The stock market comes close.

Monopolistic competition: There are many small sellers in this type of market, each of whom produces a slightly **different** product. It is very easy for new sellers to enter this market, and it is easy for existing sellers to leave the market.

Examples: Chinese restaurants, lawyer services, plumbing services, haircuts.

Oligopoly: There are a few large sellers which dominate the market, each of whom produces either an identical product or a slightly different product. It is difficult for new sellers to enter this market, and it can be difficult for existing sellers to leave the market.

Examples: Oil refining, autos, copper, airlines, computers.

Monopoly: There is one large seller with no direct competition. It is extremely difficult for new sellers to enter this market, and it can be difficult for the existing seller to leave the market.

Examples: U.S. letter delivery, residential electricity service, residential natural gas service.

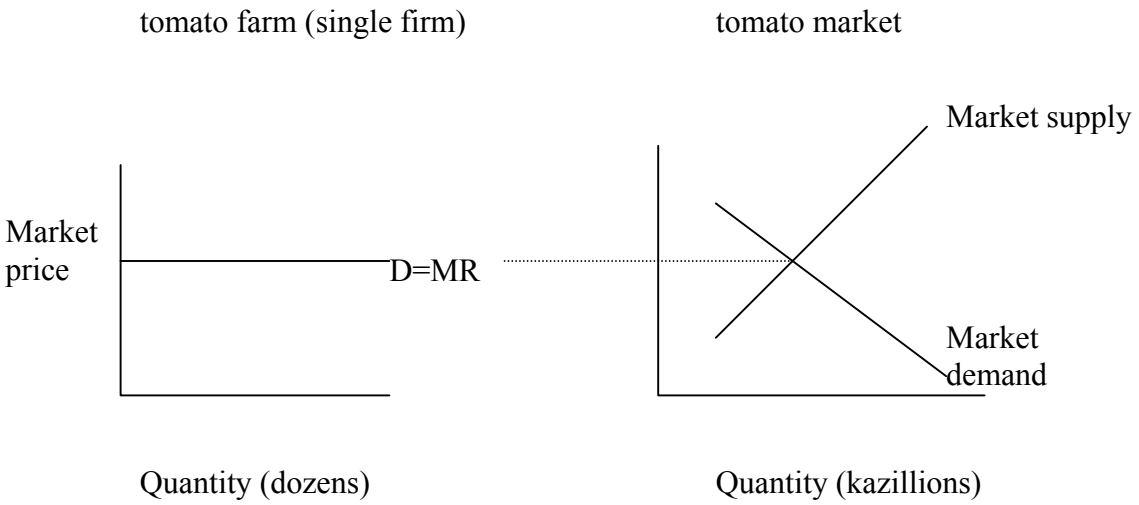
In this set of notes, we shall examine the attributes of a **perfectly competitive** firm. We begin by examining the firm's revenues.

Revenues of a perfectly competitive firm

In a perfectly competitive market, the market price is established by the interaction of buyers in total and sellers in total. Each individual firm is so small in the market that nothing it does can affect the market price of the product. (Suppose, for example, that you wish to sell 100 shares of Microsoft stock. You can find out today's market price of Microsoft stock from your broker; the equilibrium price equates the total demand for the stock to equal the total supply of it, yet no single buyer or seller influences the price! Since 20 million shares of Microsoft stock are sold daily, your sale will not by itself affect this established market price. You *take* the price from the market.)

Hence each perfectly competitive firm (seller) is a *price-taker*; it can sell as little or as much of its product at the established market price. It cannot charge a penny more than the market price, since it has thousands of competitors who produce an identical product. (It could charge less than the market price, but what's the point?)

Let's illustrate the huge tomato market next to a single tomato farm. (Note the difference in the scales of the horizontal axes.)



(In the firm graph above, "D" is demand and "MR" is marginal revenue.)

Note 1 about the graphs: Since the single firm can sell as much or as little as it produces at a constant price, the perfectly competitive firm has a horizontal demand curve.

Note 2 about the graphs: For the single firm, the price is constant. Recall that the price equals the firm's average revenue; hence the firm's average revenue is constant. This means that the firm's marginal revenue is constant (just as a student who keeps getting the same test score keeps her average constant), and equal to the price. Hence the demand curve and marginal revenue curve are horizontal and on top of each other, thus the "D=MR" label.

Note 3 about the graphs: It is a too common error for the student to confuse the *market* demand curve with demand curve for the individual *firm's* product. The market demand curve slopes downward; a lower price in the U.S. would induce Americans to buy more tomatoes. But the individual firm's demand curve is horizontal. A tomato wholesaler would be willing to pay a constant price per tomato to buy tomatoes from the individual tomato farmer.

Since the firm's selling price is constant, if we know the market price and the quantity sold by the firm then we know everything that we need to know about the firm's revenues. Observe:

Example 1: The market price for apples (a perfectly competitive market) is $8. Show how an apple seller's total, average, and marginal revenue vary with its level of production for Q = 0 to 6

Q	Price (= average revenue)	Total revenue (= P x Q)	Marginal revenue
0	8	0	not applicable
1	8	8	8
2	8	16	8
3	8	24	8
4	8	32	8
5	8	40	8
6	8	48	8

Example 2: The market price for pears (a perfectly competitive market) is $4. Drive equations representing a pear seller's total, average, and marginal revenue.

AR = price → AR = 4

TR = p x q → TR = 4Q

MR = $\frac{dTR}{dQ}$ → MR = 4

(Above, "AR" is average revenue, "TR" is total revenue, and "MR" is marginal revenue.)

Short Run Costs of A Perfectly Competitive Firm

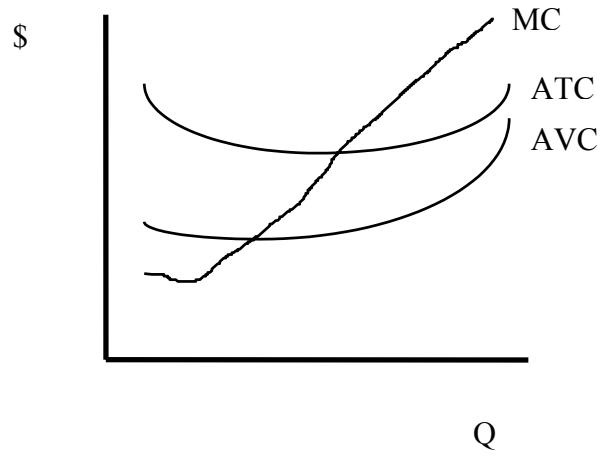
In the notes file "mana-costs" we discussed short run costs. I review the analysis here, to refresh your recollection:

GRAPH: A fairly realistic representation of any firm's short run costs:

(Below, "MC" is marginal cost, "AVC" is average variable cost, and "ATC" is average total cost.)

Any and all firms face rising MC, AVC, and ATC, beyond some level of Q, due to the law of diminishing returns. Hence it is reasonable to represent any and all firms' short run costs with the graph below:

A single firm's short run costs



Note on the graph above how ATC, AVC, and MC all eventually rise. Note also that *MC intersects AVC and ATC at the minimum points of both the AVC and ATC curves* (the bottom of each "U".)

EQUATION: Example of a short run cost function:

$TC = 1000 + 5Q^2$

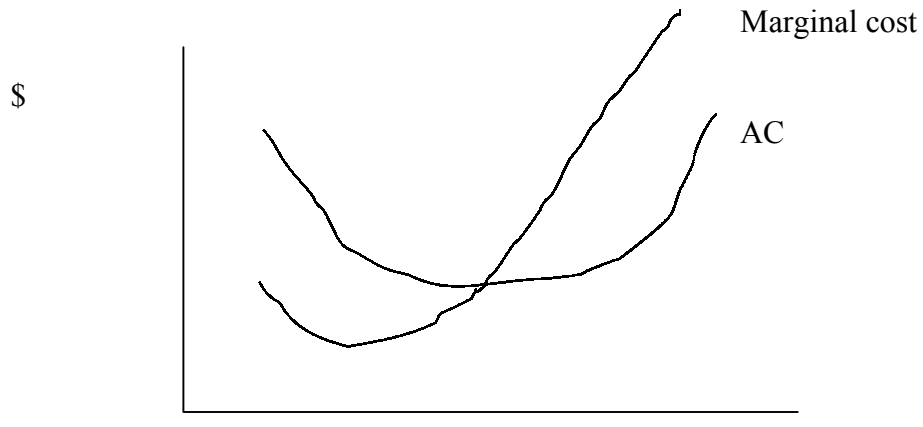
The "1000" in the above equation is total fixed costs; the "$5Q^2$" is total variable costs.

Long Run Costs of A Perfectly Competitive Firm

In the notes file "mana-costs" we discussed long run costs. I review some of the discussion here.

Graph: Different shapes for a firm's long run cost curves are possible, depending upon the importance of scale economies in the production of the firm's product. I will usually represent a perfectly competitive firm's long run costs with this graph:

One Possible Depiction of a single firm's long run costs



(Above, "AC" is long run average cost.)

Equation: here is an example of a long run cost equation:

$TC = 6Q^2$

(Note that there is no constant term, since there are no fixed costs in the long run.)

Profit-maximizing short run strategy for a perfectly competitive firm:

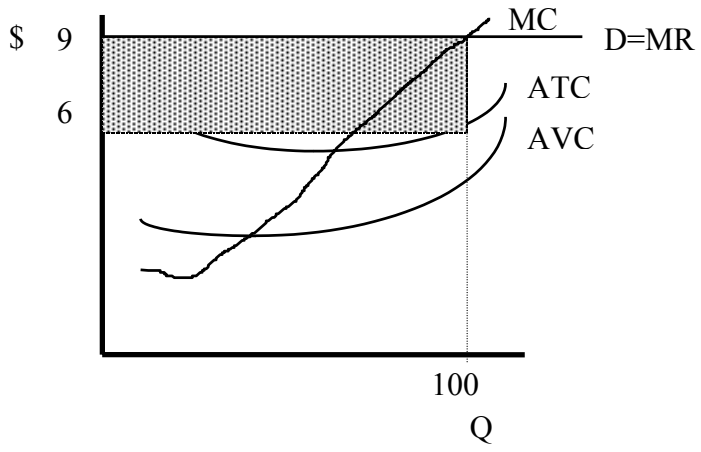
Recall from the notes file "mana-profit" that according to the profit-maximizing rule a firm should:

→ produce the level of output where MR = MC, unless P<AVC at that level of output (in which case the firm should shut down, producing Q=0).

There is a bit of luck determining whether a perfectly competitive firm makes a profit. Within their control: they must always produce output at the least possible cost, and they must follow the profit-maximizing strategy. Out of their control: they cannot pick their selling price.

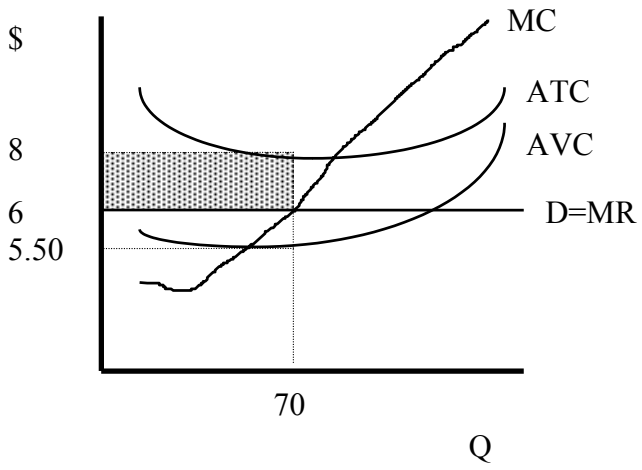
Let's look at three graphs, each representing a perfectly competitive firm in the short run. The major thing differentiating the graphs is the height of the demand curve.

Graph 1: A perfectly competitive firm making a profit in the short run



The above firm is making a profit; the price of $9 is above the average total cost of $6. The firm is making $9-$6 = $3 per unit sold, and they're selling 100 units, making total profit = $300 (the area of the shaded rectangle).

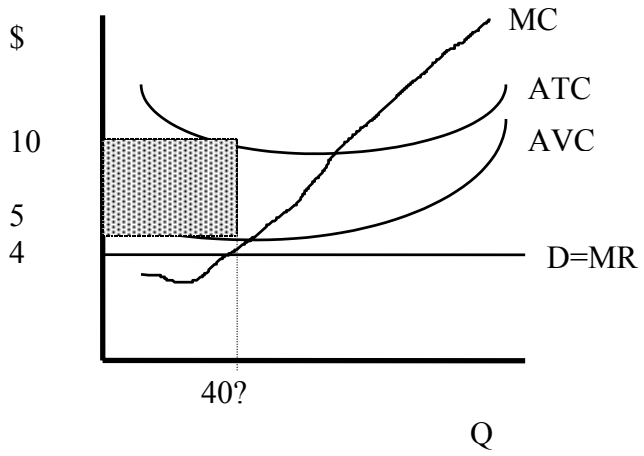
Graph 2: A perfectly competitive firm operating at a loss in the short run



The above firm is operating at a loss; the price of $6 is below the average total cost of $8. The firm is losng $8-$6 = $2 per unit sold, and they're selling 70 units, making total loss = $140 (the area of the shaded rectangle).

Note that the firm would do worse if it shut down, since P>AVC. Indeed, the firm would lose (8-5.50) x 70 = $175, its fixed costs, if it shut down.

Graph 3: A perfectly competitive firm in the short run which is shut down.



The above firm does best if its shuts down, since P<AVC. If it shuts down it loses its fixed costs, (10-5) x 40 = $200. If it were dumb enough to operate, it would lose (10-4) x 40 = $240.

Two algebraic examples:

1st example: A perfectly competitive firm has cost equation $TC = 100 + Q^2$. Market price is $50. What is its profit-maximizing strategy?

Set MR = MC

Note : MR is $50, the market price

Note: $MC = \frac{dTC}{dQ} = 2Q$

50 = 2Q

Q = 25

Hence the firm should produce 25 units. Its profit will be:

Profit = revenue – cost

= p x q – C

= 50 x 25 – ($100 + 25^2$)

= 1250 – 725 = $525

2nd example: A perfectly competitive firm has cost equation TC = $100 + Q^2$. Market price is $4. What is its profit-maximizing strategy?

Set MR = MC

Note : MR is $4, the market price

Note: MC = $\frac{dTC}{dQ} = 2Q$

4 = 2Q

Q = 2

Hence the firm should produce 2 units. Its profit will be:

Profit = revenue – cost

= p x q – C

= 4 x 2 – ($100 + 2^2$)

= 8 – 104 = $-96 a loss of 96

This is still better than shutting down, in which case the firm would lose its total fixed costs of $100.

Long run in perfect competition: maximum profits are zero !!!! Bummer, dude!

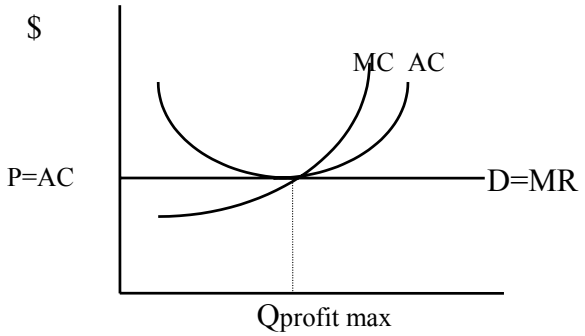
The combination of intense competition with ease of entry/exit means that the best a perfectly competitive firm can hope for is zero profits. "Proof:"

Suppose firms had profits in the short run, Well, new firms would enter the industry, driving prices down until the profits were eliminated in the long run.

Suppose firms had losses in the short run, Well, some firms would leave the industry, driving prices up until the losses were eliminated in the long run.

Note: Zero profits doesn't mean that the firm owner is starving to death, since implicit costs are included in her costs. Instead, she is earning a normal rate of return—roughly speaking, no better than if she had kept her money in interest-bearing assets.

Graph: Since maximum profits are zero, there's only 1 graph needed to represent a perfectly competitive firm in the long run. Here it is:



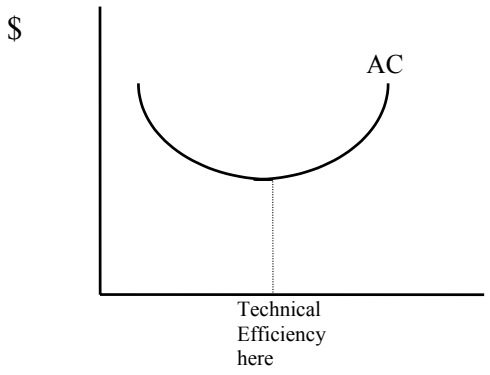
We have seen profit-maximizing strategies under perfect competition. But is profit-seeking "good" for society? Under perfect competition, it is. Read on.

Perfect Competition, Worldly Philosophers, and Economic Efficiency

Suppose you are a worldly philosopher, and want to measure if production in your economy is serving your citizens. You might have a couple of measures as follows:

1. *Technical Efficiency*: Production is occurring at the cheapest feasible average cost. That is, there is no way on Earth that any other level of output or production method could produce the product more cheaply.

Graphically, production would have to take place at the bottom of the long run average cost curve:



2. *Social (or allocative) Efficiency*: Extra production occurs as long as society feels that the benefit from the extra production exceeds the cost of extra production. Production does not occur if it costs more to produce the thing than the benefit of the production.

How do we measure the benefit of extra production? It is the PRICE that a buyer is willing to pay for the product!!! Why? Well, if someone is willing to pay for a product then they must be getting at least that much value from it.

How do we measure the cost of extra production? Marginal cost!!!

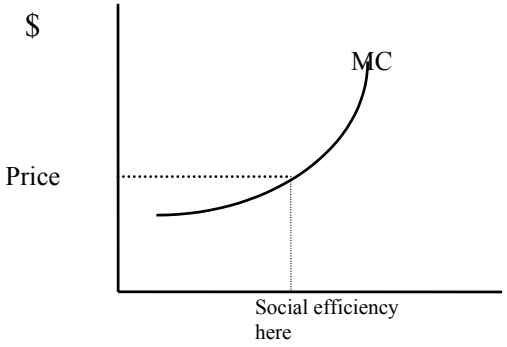
Summary of social efficiency:

If P > MC → more production is warranted, since the benefit to the buyer outweighs the cost to the producer

If P< MC → less production is warranted, since the benefit to the buyer is less than the cost to the producer

So if P=MC → socially efficient level of production!!!

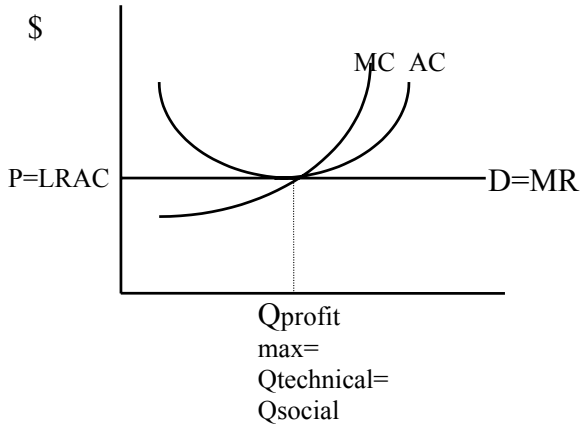
See the graph below:



So, you're a worldly philosopher, and you want production to have qualities of technical and social efficiency. What kind of economy would you desire? Before the time of Adam Smith, philosophers thought that a government-controlled economy would be the only way to achieve technical and social efficiency; they believed that the greed of free enterprise ran counter to the benefit of the masses.

Well, the idiots were wrong!!!! A perfectly competitive marketplace, where all firms seek MAXIMUM profit, but face intense competition from other greedy producers, will achieve social and technical efficiency. This is not a goal of the greedy producers—they seek profit, nothing else—but, in irony of ironies, the greedy firm owners competing with each other eliminate all possibilities of exploiting the consumer.

Don't believe me? Check out the perfectly competitive graph again:



Production takes place at the lowest possible average cost, satisfying technical efficiency. And production takes place where P=MC, satisfying social efficiency.

So…to promote an efficient economy, government should promote competition, but that's it! No socialism, no communism, no totalitarianism. This is the strongest economic justification for freedom, and the profit-seeking and private property that goes along with it.

(Note: there are other considerations for a well functioning economy, such as fairness, that may not be satisfied by perfect competition.)