Econ 201 Lecture 12

A Note on the Firm's Shut-Down Condition

It might seem that a firm that can sell as much output as it wishes at a constant market price would *always* do best in the short run by producing and selling the output level for which price equals marginal cost.

But there are exceptions to this rule. Suppose, for example, that the market price of the firm's product falls so low that its revenue from sales is smaller than its variable cost at all possible levels of output. The firm should then cease production for the time being.

By shutting down, it will suffer a loss equal to its fixed costs. But by remaining open, it would suffer an even larger loss.

If P denotes the market price of the product and Q denotes the number of units produced and sold, then PxQ is the firm's total revenue from sales, and if we use VC to denote the firm's variable cost, the rule is that the firm should shut down in the short run if PxQ is less than VC for every level of Q.

Average Variable Cost and Average Total Cost

Suppose that the firm is unable to cover its variable cost at any level of output—that is, suppose that PxQ < VC for all levels of Q.

Then P < VC/Q for all levels of Q, since we obtain the second inequality by simply dividing both sides of the first one by Q.

VC/Q = **average variable cost**—its variable cost divided by its output.

The firm's short-run shut-down condition may thus be restated a second way—namely, discontinue operations in the short run if the product price is less than the minimum value of its average variable cost (AVC).

Short-run shut-down condition (alternate version):
P < minimum value of AVC

Average total cost:

ATC = TC/Q.

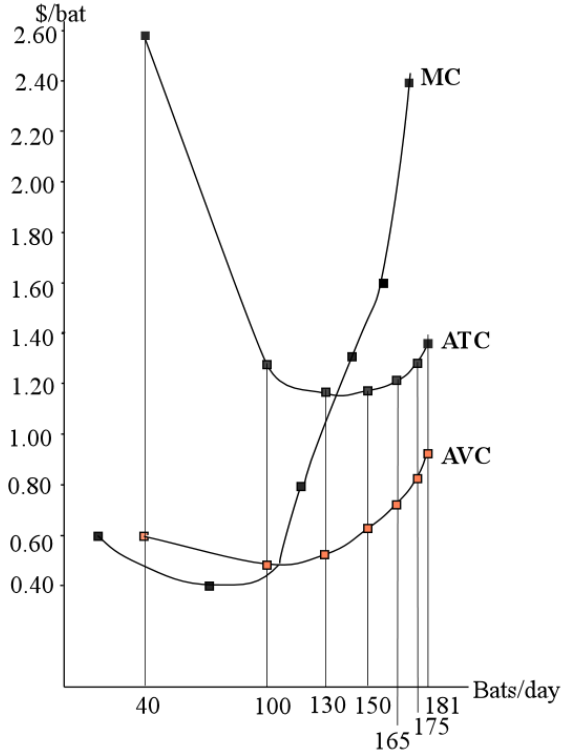
Profit = total revenue (PxQ) – total cost = PxQ – ATCxQ

A firm can be profitable only if the price of its product price (P) exceeds its ATC for some level of output.

A Graphical Approach to Profit-Maximization

For Louisville Slugger, we have

Employees per day	Bats per day	Variable cost ($/day)	Average variable cost ($ per unit of output)	Total cost ($/day)	Average total cost ($ per unit of output)	Marginal cost ($/bat)
0	0	0		80		
						0.60
1	40	24	0.60	104	2.60	
						0.40
2	100	48	0.48	128	1.28	
						0.80
3	130	72	0.554	152	1.169	
						1.20
4	150	96	0.64	176	1.173	
						1.60
5	165	120	0.727	200	1.21	
						2.40
6	175	144	0.823	224	1.28	
						4.00
7	181	168	0.928	248	1.37	



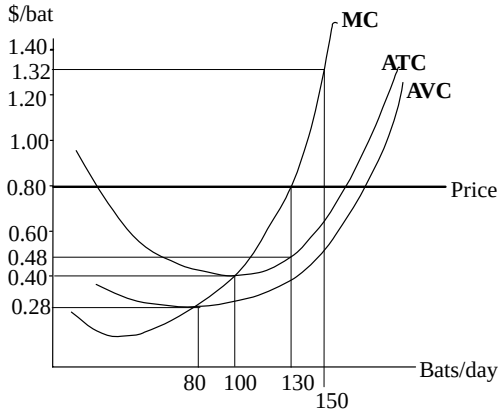
Properties of the cost curves:
1. The upward sloping portion of the marginal cost curve (MC) corresponds to the region of diminishing returns. Thus, as the firm moves beyond two employees per day (100 bats per day), the increments to total output become smaller with each additional employee, which means that the cost of producing additional bats (MC) must be increasing in this region.
2. The definition of marginal cost implies that the marginal cost curve must intersect both the average variable cost curve (AVC) and the average total cost curve (ATC) at their respective minimum points. (The reason is similar to the logic that explains what happens to the average weight of a third grade class when a new student joins the class.)

Price = Marginal Cost: The Maximum-Profit Condition

In earlier examples, we implicitly assumed that the firm could employ workers only in whole number amounts. Under these conditions, we saw that the profit-maximizing output level was one for which marginal cost was somewhat less than price (because adding yet another employee would have pushed marginal cost higher than price).

But when output and employment can be varied continuously, the maximum-profit condition is that price be equal to marginal cost.

Example 12.1. For the bat-maker whose cost curves are shown below, find the profit-maximizing output level if bottles sell for $0.80 each. How much profit will this firm earn? What is the lowest price at which this firm would continue to operate in the short run?



The cost-benefit principle tells us that this firm should continue to expand as long as price is at least as great as marginal cost.

If the firm follows this rule it will produce 130 bottles per day, the quantity at which price and marginal cost are equal.
Suppose that the firm had sold some amount less than 130—say, only 100 bats per day.
Its benefit from expanding output by one bat would then be the bat's market price, 80 cents.
The cost of expanding output by one bottle is equal (by definition) to the firm's marginal cost, which at 100 bats per day is only 40 cents.
So by selling the 101st bat for 80 cents and producing it for an extra cost of only 40 cents, the firm will increase its profit by 80 – 40 = 40 cents per day. In a similar way, we can show that for *any* quantity less than the level at which price equals marginal cost, the seller can boost profit by expanding production.

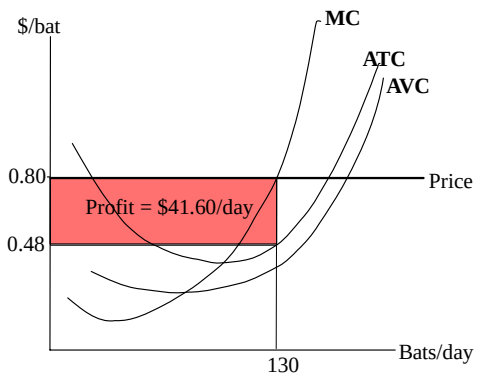
Conversely, suppose that the firm were currently selling more than 130 bats per day—say, 150—at a price of 80 cents each. Marginal cost at an output of 150 is 1.32 per bat. If the firm then contracted its output by one bat per day, it would cut its costs by 1.32 cents while losing only 80 cents in revenue. As a result, its profit would grow by 52 cents per day.
The same arguments can be made regarding any quantities that differ from 130.

Thus, if the firm were selling fewer than 130 bats per day, it could earn more profit by expanding; and that if it were selling more than 130, it could earn more by contracting.
So at a market price of 80 cents per bat, the seller maximizes its profit by selling 130 units per week, the quantity for which price and marginal cost are exactly the same.

At that quantity the firm will collect total revenue of PxQ = ($0.80/bat)x(130 bats/day) = $104 per day. Its total costs are equal to

ATCxQ = $0.48/bat x 130 bats/day = 62.40

So the firm's profit is $41.60/day.



Profit is equal to (P – ATC)xQ, which is equal to the area of the shaded rectangle.

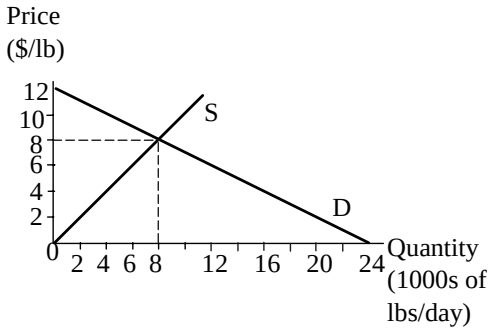
SUPPLY AND PRODUCER SURPLUS

The economic surplus received by a buyer is called consumer surplus. The analogous construct for a seller is **producer surplus**, the difference between the price a seller actually receives for the product and the lowest price for which she would have been willing to sell it (her reservation price, which in general will be her marginal cost).

Producer surplus sometimes refers to the surplus received by a single seller in a transaction, sometimes to the total surplus received by all sellers in a market or collection of markets.

Calculating Producer Surplus

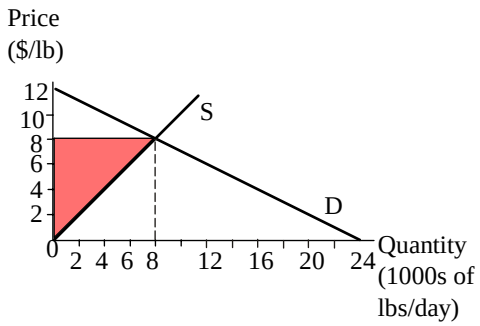
Example 12.2. How much do sellers benefit from their participation in the market for cashews?



For all cashews sold up to 8,000 pounds per day, sellers receive a surplus equal to the difference between the market price of $8 per pound and their reservation price as given by the supply curve.

Total producer surplus received by buyers in the cashew market is the area of the shaded triangle between the supply curve and the market price.

(1/2)(8,000 lbs/day)x($8/lb) = $32,000/day.



Producer surplus is the highest price sellers would pay, in the aggregate, for the right to continue participating in the cashew market.

Supply is About Marginal Cost

Example 12.3. An electric utility has two means of generating power:

A hydroelectric generator

A coal-fired steam turbine

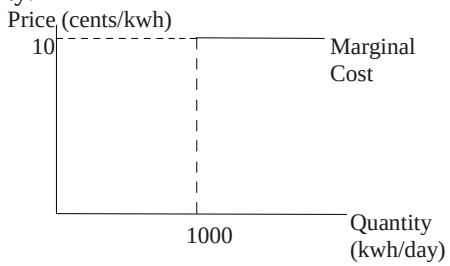
The hydroelectric generator runs without maintenance cost and can supply 1000 kilowatt-hours each day. All additional power is supplied by the steam generator at a cost of 10 cents per kilowatt-hour. The utility currently produces 2000 kilowatt-hours each day.

How much does it cost to serve a house that happens to be hooked up to the hydro generator?

If a house that is currently hooked to the hydro generator were to be disappear, some other house that is now hooked up to the steam generator could be switched to hydro, for a savings of 10 cents per kilowatt-hour.

Thus the opportunity cost of all power is the cost of the most expensive source currently in use, namely 10 cents/kwh.

Draw the marginal cost curve for this utility.



Does demand ever affect supply?

Example 12.8. Is the cost of a ticket to the NBA finals so high because the salaries of NBA players is so high?

Partly. But then why are the wages of NBA players so high? Because so many people are willing to pay so much to be able to watch them.

But a starving person would be willing to pay even more for food than for watching an NBA game. Food is cheap and NBA games are expensive because many people can produce food, but only few have the skills to play in the NBA.
Joe Durso: 8-time national handball champion. Earnings from handball related activities during last championship season: $0.
Shaquille O'Neal: NBA star extraordinaire. Earnings from basketball-related activities during last championship season: $25,000,000.
Supply depends on costs and costs always depend on demand.
In many (perhaps most) cases the prices of the inputs required to produce a product will not be much affected by the demand for that product.
For example, the demand for bicycles will have no significant affect on the price of steel, an input for making bicycles, because the steel used in making bicycles is only a tiny fraction of the total amount of steel sold.
So for most markets, we can assume that a shift in the demand curve will not lead to a shift in the supply curve. Assume this independence, unless otherwise stated.