

Review Session Handout #8

Chapter 10: Perfect Competition

Introduction to Microeconomics: Markets, Strategy, and Real-World Cases

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Exercise R8.1. A competitive wheat farmer has the following total cost of producing 0 to 7 truckloads of wheat per week.

Truckloads	0	1	2	3	4	5	6	7
Total cost	\$90	\$130	\$160	\$180	\$210	\$250	\$310	\$390

Part (a). Find the fixed cost. Then compute the variable cost, marginal cost, average variable cost, and average total cost at each output. What are the lowest values of average variable cost and average total cost?

The fixed cost is the cost the farmer pays even when she produces nothing, \$90. Variable cost is total cost minus the \$90 fixed cost; marginal cost is the extra cost of one more truckload (for example, the fourth truckload raises total cost from \$180 to \$210, so its marginal cost is \$30); average variable cost is variable cost divided by output; and average total cost is total cost divided by output. Rounding to the nearest cent, the complete table is as follows (all figures in dollars).

Truckloads	1	2	3	4	5	6	7
Variable cost	40	70	90	120	160	220	300
Marginal cost	40	30	20	30	40	60	80
Average variable cost	40.00	35.00	30.00	30.00	32.00	36.67	42.86
Average total cost	130.00	80.00	60.00	52.50	50.00	51.67	55.71

Average variable cost reaches its lowest value, \$30, at 3 and 4 truckloads. Average total cost reaches its lowest value, \$50, at 5 truckloads.

Part (b). If the market price is \$70 per truckload, find the profit-maximizing output.

A competitive firm produces the quantity at which price equals marginal cost, provided the price covers average variable cost. The \$70 price is above the \$30 lowest average variable cost, so the farmer operates. Reading the marginal cost column, she produces every truckload whose marginal cost is at or below \$70: the sixth truckload costs \$60 to produce, below the price, but the seventh would cost \$80, above it. The profit-maximizing output is 6 truckloads.

Part (c). Compute the farmer's profit at that output.

Revenue is $6 \times \$70 = \$420$ and total cost is \$310, so profit is

$$\$420 - \$310 = \$110.$$

Average total cost at 6 truckloads is about \$51.67, so the farmer earns about $\$70 - \$51.67 = \$18.33$ on each truckload.

Part (d). If the price falls to \$45, should the farmer operate or shut down in the short run? Compare her loss from operating with her loss from shutting down.

The \$45 price is above the \$30 lowest average variable cost, so the farmer should keep operating. She produces every truckload whose marginal cost is at or below \$45: the fifth truckload costs \$40, but the sixth would cost \$60, so she produces 5 truckloads. Revenue is $5 \times \$45 = \$225$ and total cost is \$250, so she makes a loss of

$$\$225 - \$250 = -\$25.$$

If she shut down, she would still owe the \$90 fixed cost, a loss of \$90. Operating is better: revenue (\$225) exceeds variable cost (\$160), so she covers all of her variable cost and \$65 of her fixed cost.

Remark. In the short run, the farmer operates whenever the price covers average variable cost, even at a loss, because she must pay the fixed cost anyway. She shuts down only if the price falls below \$30, the lowest average variable cost, where revenue would not cover even her variable cost.

Exercise R8.2. A competitive market for pumpkins has 100 identical farms. The following table shows the number of crates each farm supplies per week at each price (each farm's marginal cost curve above its lowest average variable cost of \$20) and the number of crates buyers demand.

Price per crate	\$20	\$25	\$30	\$35	\$40	\$45
Crates supplied by each farm	0	5	10	15	20	25
Crates demanded in the market	4,000	3,500	3,000	2,500	2,000	1,500

Part (a). Construct the market supply schedule.

Market supply adds up the quantities of all farms at each price. With 100 identical farms, the market supplies 100 times the quantity of each farm:

Price per crate	\$20	\$25	\$30	\$35	\$40	\$45
Crates supplied in the market	0	500	1,000	1,500	2,000	2,500

Part (b). Find the market equilibrium price and quantity.

At \$40, farms supply 2,000 crates and buyers demand 2,000 crates, so the equilibrium price is \$40 and the equilibrium quantity is 2,000 crates. At any lower price there is a shortage (at \$35, buyers demand 2,500 crates but farms supply only 1,500), and at any higher price there is a surplus.

Part (c). How many crates does each farm produce?

At \$40, each farm supplies 20 crates. As a check, $100 \times 20 = 2,000$ crates, the equilibrium quantity.

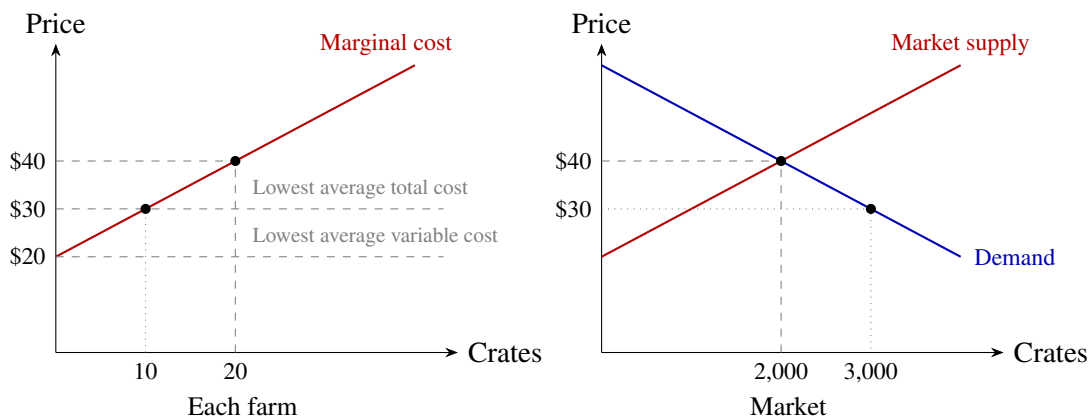
Part (d). Each farm's lowest average total cost is \$30, reached at 10 crates per week. Is the industry in long-run equilibrium? If not, describe what happens, and find the long-run price, the output of each farm, the total quantity sold, and the number of farms.

The \$40 market price exceeds the \$30 lowest average total cost, so each farm earns a positive economic profit, and the industry is not in long-run equilibrium. Profit attracts new farms. Entry shifts the market

supply curve to the right, increasing the quantity supplied at every price, and the price falls. Entry continues until the price reaches the lowest average total cost, \$30, where economic profit is zero. At the long-run price of \$30:

- Each farm produces 10 crates.
- Buyers demand 3,000 crates.
- The market needs $\frac{3,000}{10} = 300$ farms, so 200 new farms enter.

The following figure shows each farm (left panel) and the market (right panel) before entry, with the long-run price of \$30 marked by dotted lines.



Exercise R8.3. Consider a competitive industry in long-run equilibrium in which all firms, old and new, have the same costs. Demand for the industry's product permanently increases.

Part (a). In the short run, describe what happens to the price, the quantity, and each firm's profit.

The increase in demand shifts the demand curve to the right. With a fixed number of firms, the market supply curve does not move, so the new demand curve crosses it at a higher price and a larger quantity. Each firm responds to the higher price by moving up its marginal cost curve and producing more. Because the new price exceeds the lowest average total cost, each firm earns a positive economic profit.

Part (b). In the long run, describe entry, the shift in supply, and the new equilibrium.

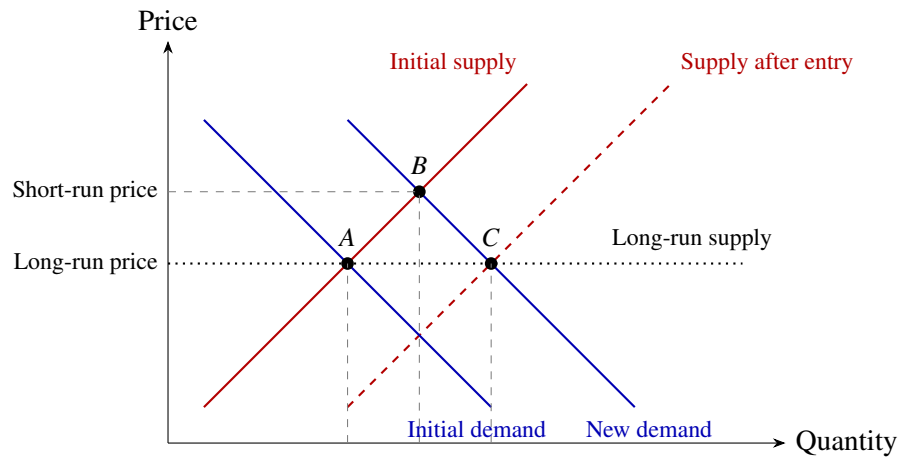
Positive economic profit attracts new firms. As they enter, the market supply curve shifts to the right, which pushes the price down and reduces each firm's profit. Entry continues until economic profit returns to zero, which happens when the price falls back to the lowest average total cost. In the new long-run equilibrium, the market sells more than before, produced by a larger number of firms.

Part (c). At what price does the industry settle in the new long-run equilibrium?

Because every firm, old and new, has the same costs, entry continues until the price is back at the lowest average total cost, the same price as in the original long-run equilibrium. The long-run supply curve of the industry is flat at that price: demand determines the quantity sold in the long run, but not the price.

Part (d). Draw a figure showing the short-run and long-run adjustments (the demand shift, the short-run equilibrium, the shift in supply from entry, and the new long-run equilibrium).

The following figure illustrates the adjustment.



- Point A is the initial long-run equilibrium, where the initial demand curve crosses the initial supply curve at the long-run price, the lowest average total cost.
- The increase in demand moves the market from point A to point B, the short-run equilibrium, where the new demand curve crosses the initial supply curve at a higher short-run price. Firms earn a positive economic profit.
- Entry shifts supply to the supply curve after entry.
- Point C is the new long-run equilibrium, where the new demand curve crosses the supply curve after entry. The price returns to the long-run price, and the quantity is larger than at point A.
- The flat long-run supply curve passes through points A and C: in the long run, the industry supplies any quantity buyers demand at the same price.