Econ 101: Principles of Microeconomics

Chapter 13 - Perfect Competition and the Supply Curve

Fall 2010

Outline

Overview

- In the previous chapter, we characterized the production function for the firm and the implications for the firm's typical cost structure.
- In this chapter, we use that information to infer the firm's supply function in a perfectly competitive market.
- We will see
  - what factors determine the profitability of the firm and why unprofitable firms may choose to operate in the short-run
  - why industries behave differently in the short run versus the long run.
- First, however, we will need to more carefully define what is meant by a perfectly competitive market.
- In chapter 3, we introduced the notion of a competitive market, characterizing as one in which there are *many buyers and sellers* of the *same good or service*.
- This is the essence of what is meant by a competitive market, but we want highlight what is important about this basic definition.

Perfect Competition

A perfectly competitive market has two *necessary* characteristics:

1. All market participants (consumers and producers) must be price-takers.
   - A price-taking producer is one who views their actions as having no-effect on the market price of the good.
     - This is usually due to the fact the none of the producers have a large market share
     - The firm's market share is the fraction of total industry output
     - Examples of price-taking producers would include grain farmers and local gasoline stations
     - There are, of course, many examples of industries in which producers are not *price-taking*
   - A price-taking consumer is one who views their actions as having no-effect on the market price of the good or service.
     - This is typically the case.
     - However, in some markets, firms are the "consumers" of the good produced and far from price-takers.
2. The industry output is a standardized product; i.e., a product that consumers view as the same good regardless of which firm produces it.

Free Entry and Exit

- While not necessary, most perfectly competitive markets are also characterized by free entry and exit
- An industry has free entry and exit when new producers can easily enter into the industry and existing producers can easily leave.
- While a new seller must always incur some start-up
  - A perfectly competitive market has no *significant* barriers to discourage new entrants
  - Any firm wishing to enter can do business on the same terms as firms that are already there
- In some markets there are significant barriers to entry, including
  - Legal barriers (e.g., e.g., taxi medallions in New York City)
  - patents
  - significant economies of scale, which may give existing firms a cost advantage over new entrants
- In some markets there are significant barriers to exit, including
  - plant closing laws
  - union agreements

The Firm's Profit

- The firm's profit is defined as:

$$\textit{Profit} = \text{Total Revenues} - \text{Total Costs} = TR - TC \tag{1}$$

where

$$TR = \text{Price} \times \text{quantity} = P \times Q \tag{2}$$

- Keep in mind that we are still talking about *economic profit* here, so that the cost include all of the *opportunity costs* for the firm.

Jennifer and Jason's Organic Tomato Farm

The text considers an tomato farm, that can sell its tomatoes at \$18 per bushel, TR and TC given by

Output (bushels)	Total Revenue (TR)	Total Cost (TC)	Profit (TR-TC)
0	\$0	\$14	-\$14
1	\$18	\$30	-\$12
2	\$36	\$36	\$0
3	\$54	\$44	\$10
4	\$72	\$56	\$16
5	\$90	\$72	\$18
6	\$108	\$92	\$16
7	\$126	\$116	\$10

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Using Marginal Analysis

- The firm's profit maximizing output level can also be found by using the *principle of marginal analysis*
  - The optimal amount of an activity is the level at which marginal benefit (MB) equals marginal cost (MC)
- The MB to the firm of producing one more unit of their good is the increased revenue they receive; i.e., their marginal revenue.
  - The marginal revenue (MR) is the change in total revenue generated by one additional unit of output; i.e.,

$$MR = \frac{\text{Change in Total Revenue}}{\text{Change in quantity of output}} = \frac{\Delta TR}{\Delta Q} \tag{3}$$

- Thus, for the profit maximizing firm, the optimal output rule *if it produces at all* is to produce additional output level as long as

$$MR \geq MC \tag{4}$$

- If possible, production should stop at the point where $MR = MC$

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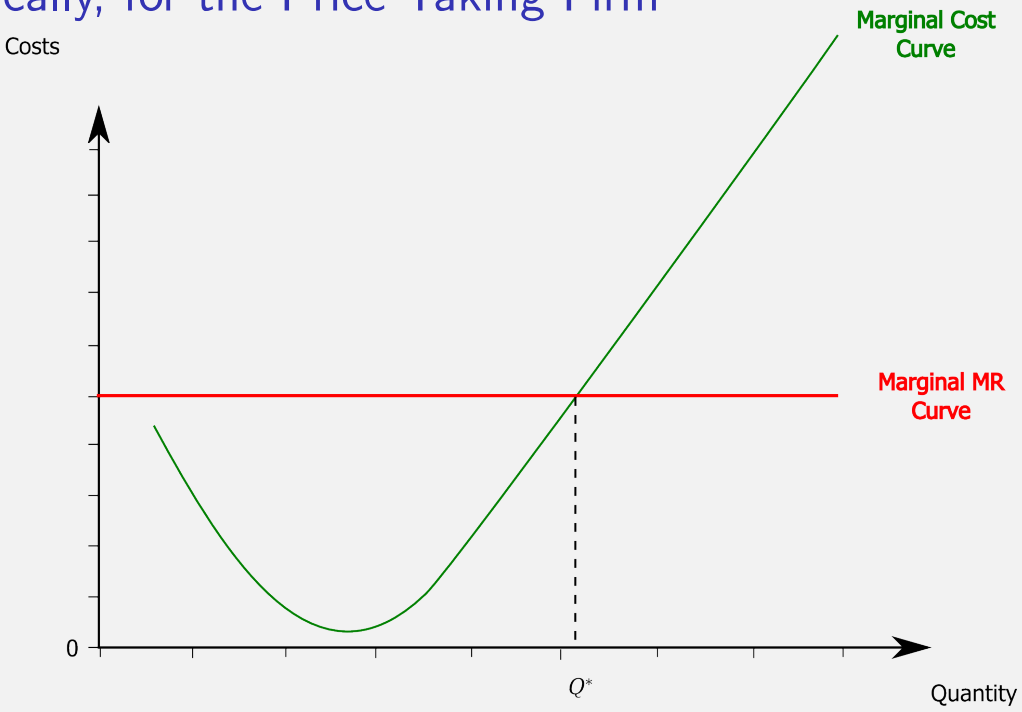
The text considers an tomato farm, that can sell its tomatoes at \$18 per bushel, TR and TC given by

Output (bushels)	TR	TC	Profit (TR-TC)	Marginal Rev. (MR)	Marginal Cost (MC)	Net Gain MR - MC
0	\$0	\$14	-\$14			
1	\$18	\$30	-\$12	\$18	\$16	\$2
2	\$36	\$36	\$0	\$18	\$6	\$12
3	\$54	\$44	\$10	\$18	\$8	\$10
4	\$72	\$56	\$16	\$18	\$12	\$6
5	\$90	\$72	\$18	\$18	\$16	\$2
6	\$108	\$92	\$16	\$18	\$20	-\$2
7	\$126	\$116	\$10	\$18	\$24	-\$6

Graphically, for the Price Taking Firm



Notes on the Optimal Output

- Notice that, for Jennifer and Jason's Farm, their production levels are discrete, so there is not a point at which $MR = MC$.
  - In this case, they should continue to produce as long as $MR \geq MC$.
  - In most cases we will consider, however, firms can adjust output, stopping production when $MR = MC$
- Also, since Jennifer and Jason are *price-taking* producers, $MR = P$.
  - As we will see later, the optimal output rule $MR = MC$ applies even to markets that are not perfectly competitive.
  - For the competitive market, this general rule has the form $P = MC$
- Notice earlier that the optimal output rule had a caveat.
  - The rule specified the optimal output *assuming the firm was producing*.
  - We still need to decide whether the firm should produce at all.
  - It might be the case that the optimal output still results in the firm loosing money.

When is Production Profitable?

- Recall that the firm's profit is defined as $Profit = TR - TC$.
- Thus, we have three possible case:
  1. Positive Profit: $Profit = TR - TC > 0$
  2. Breaking Even: $Profit = TR - TC = 0$
  3. Negative Profit: $Profit = TR - TC < 0$
- For the competitive firm, profit can equivalently written as $Profit = P \times Q - TC$
- For such firms, the positive profit condition can be rewritten as:

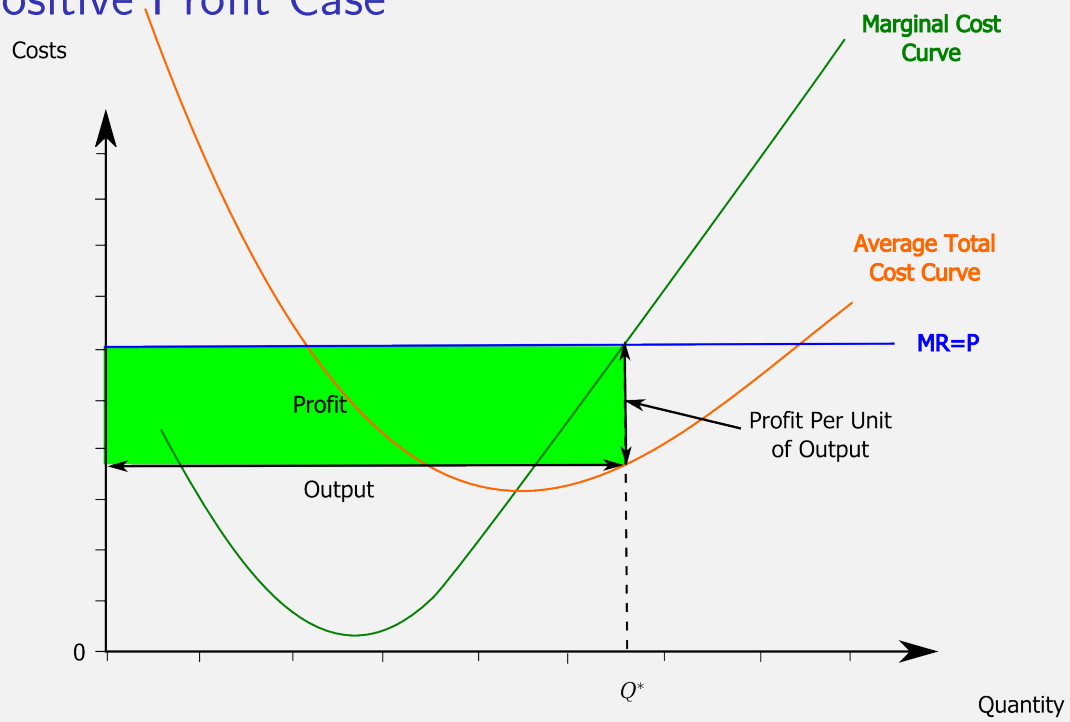
$$\frac{Profit}{Output} = \frac{P \times Q - TC}{Q} = P - \frac{TC}{Q} = P - ATC > 0 \qquad (5)$$

- Using similar steps for the other two cases, we have the following three cases:
  1. Positive Profit: $P > ATC$
  2. Breaking Even: $P = ATC$
  3. Negative Profit: $P < ATC$

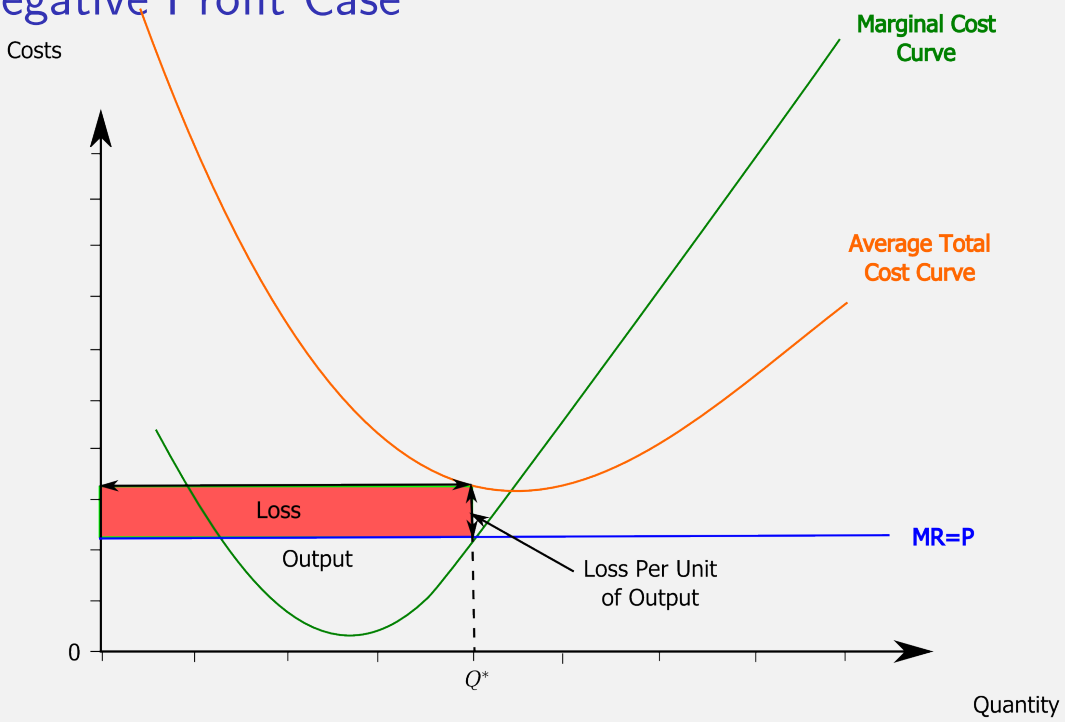
What Does this Mean for the Competitive Firm?

- For the competitive firm, we know that their optimal output (Q^*) occurs where $P = MC$
- The firms will then make a profit if, at Q^*, it is also the case that $P > ATC$.
- If, however, at Q^* it is the case that $P < ATC$, then the firm will have negative profits.
- Finally, if at Q^*, $P = ATC$, then profits will be zero.This is known as the break-even price for the competitive firm.
  - In this special case, since $P = ATC$, and $P = MC$ (by definition at Q^*), we have that $MC = ATC$ at Q^*.
  - But we know from the previous chapter that $MC = ATC$ at the minimum ATC for the firm.

The Positive Profit Case



The Negative Profit Case



To Produce or Not to Produce...

- While production may be unprofitable for the firm, that does not mean the firm should cease to produce.
- Why?Well, the firm may loose even more money by shutting down.
- One way to see this is to consider what is gained by shutting down
  - In the short-run, by shutting down, the firm is able to avoid it's variable costs
  - It cannot, however, avoid its fixed costs. The fixed costs are sunk costs that the firm cannot avoid by shutting down and, hence, should be ignored in consider whether to produce at all.
- Instead, the firm should consider whether, by producing, it can offset its *Total Variable Costs (TVC)*

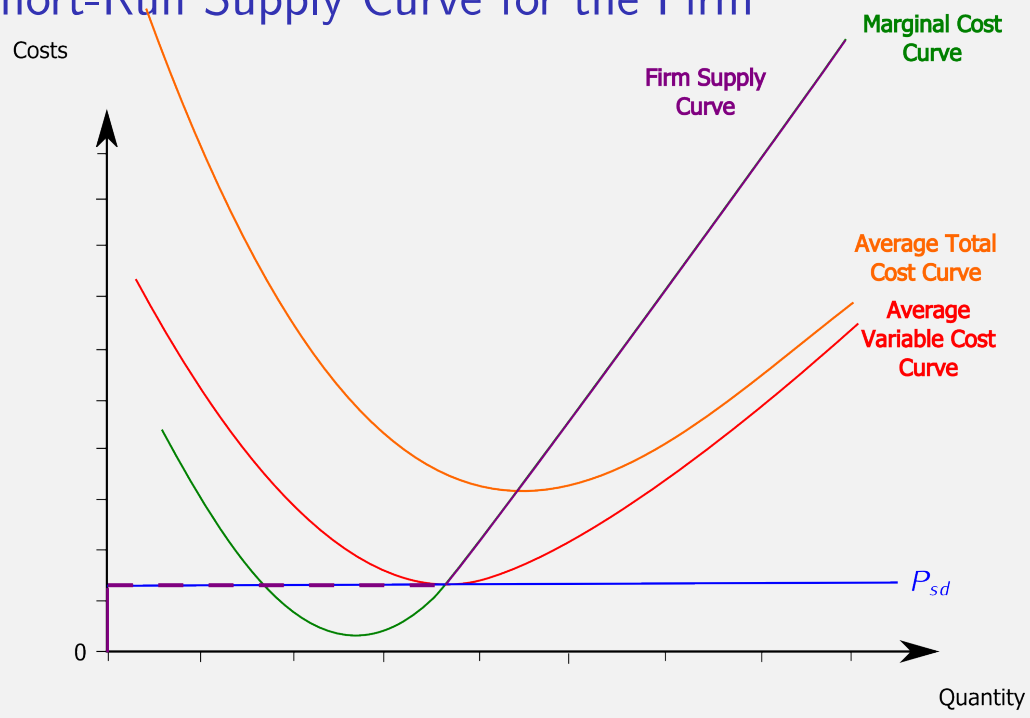
The Shut-Down Rule

- The shutdown decision depends on how $TR = P \times Q$ compares to TVC at the optimal output level (Q^*)
- This leads to three cases:
  1. Operate: If $TR = P \times Q > TVC$; or equivalently if $P > \frac{TVC}{Q} = AVC$
  2. Indifferent: If $P \times Q = TVC$; or equivalently if $P = AVC$
  3. Shut-down: If $TR < TVC$; or equivalently if $P < AVC$
- Since $P = MC$ at Q^*, the critical shut-down price occurs where $MC = P = AVC$.
- But this at the minimum AVC, which we will label as P_{sd} (for *shut-down*)

Deriving the Individual Firm's Short-Run Supply Curve

- These results enable us to draw the individual firm's supply curve.
- Specifically,
  1. As long as $P < P_{sd}$ the firm should shutdown and produce nothing.
  2. With $P = P_{sd}$ the firm should be indifferent between producing or not.
  3. With $P > P_{sd}$ the firm should produce at the point where $P = MC$

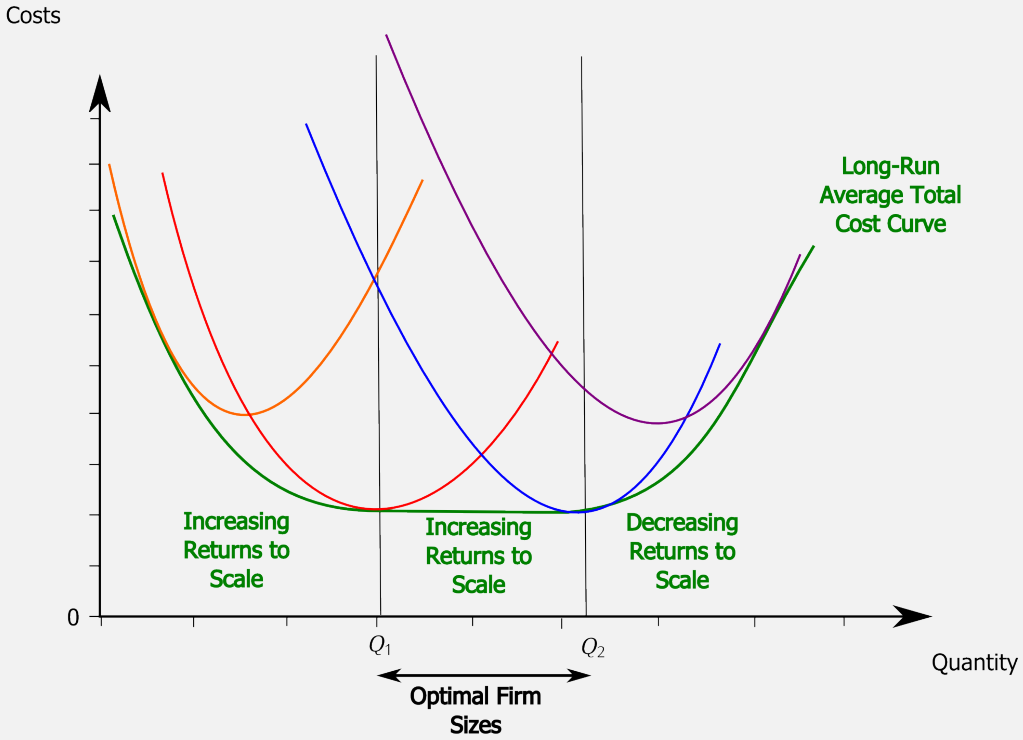
The Short-Run Supply Curve for the Firm



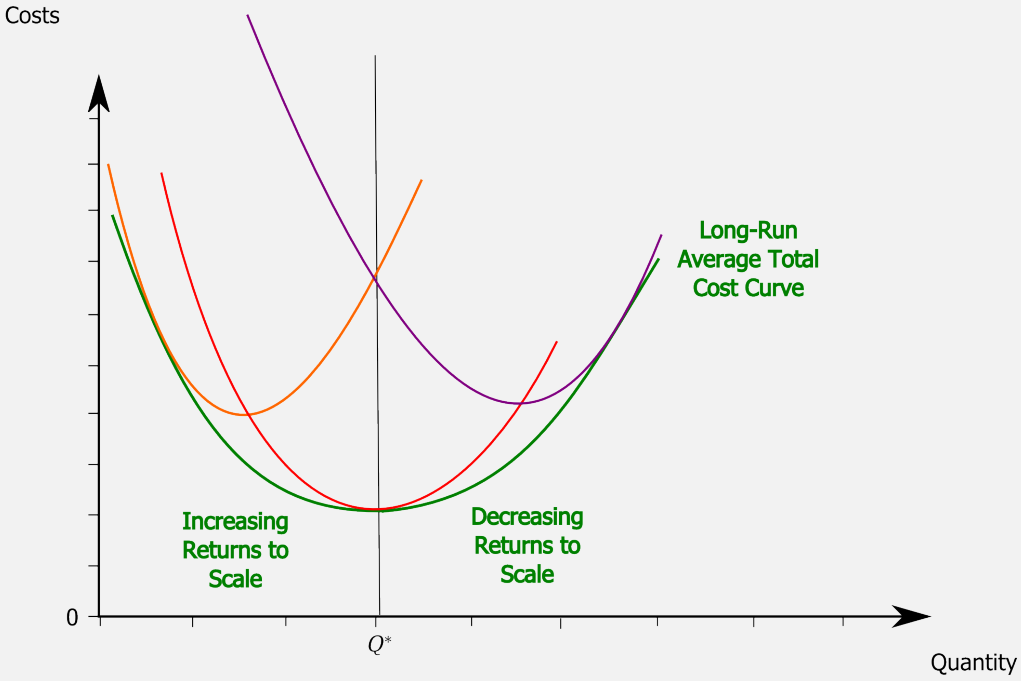
Adjustments in the Long Run

- Of course, in the long-run, firms will adjust their fixed costs in response to the profit situation in the industry.
- Krugman and Wells notes that such adjustments will take place, but to simplify the discussion assume that the firms only have one possible set of fixed costs.
- We can actually say more.
- In a perfectly competitive industry (with *many* producers), there will be an optimal level (or range of levels) for the fixed cost.
- This optimal level corresponds to firm configurations that minimize the Long-Run Average Cost Curve we discussed in Chapter 12.

Optimal Firm Size



Optimal Firm Size with No CRS



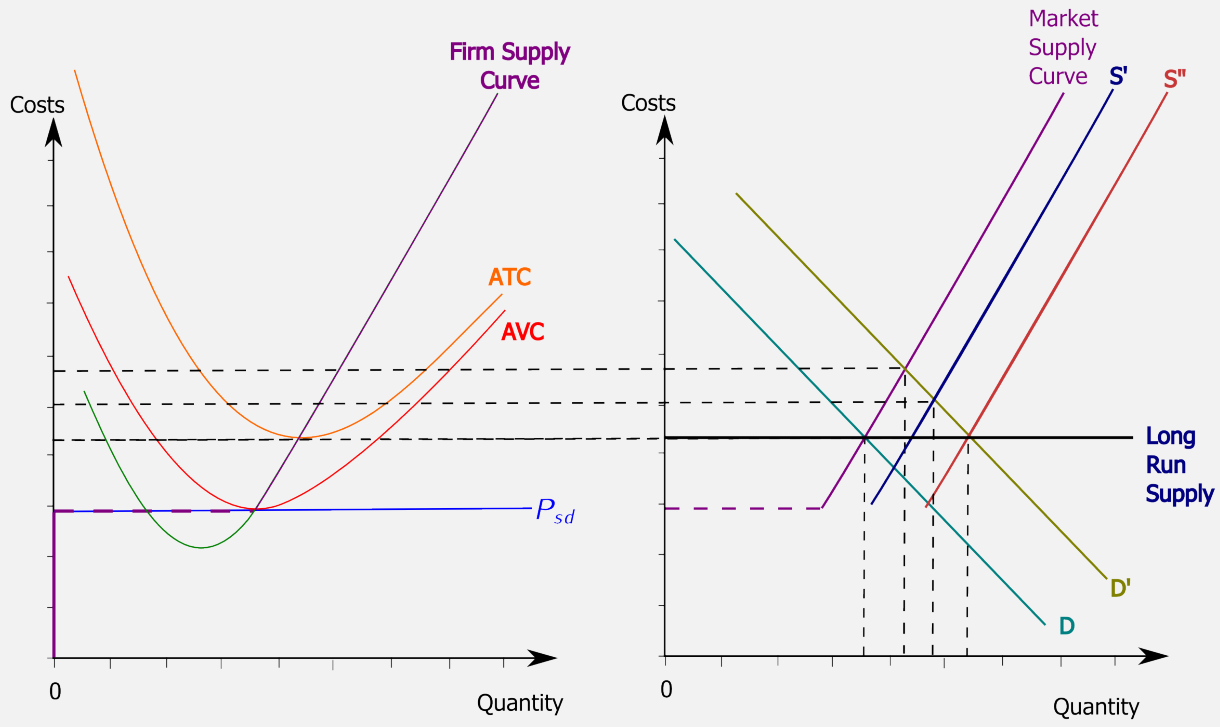
The Industry Supply Curve in the Short Run

- In the short-run, the industry supply curve is simply the sum of the individual firm's supply curves.
- The shape of the short-turn supply curve will look much like the individual firm's short-run supply curve.
- As with the individual firms:
  - there will be a P_{sd} shut-down price, below which firms start to shut down.
  - there will be a *break-even* point which will be the same for all of the firms, above which firms are making profits, and below which firms will incur short-term losses.

The Industry Supply Curve in the Long-Run

- In the long-run, exit from and entry into the industry will cause the industry supply curve to shift.
- Whether exist or entry occurs depends on whether the market price is above or below the *break-even price*
  1. If the price is above the *break-even point*
     - firms in the industry will be making profits, encouraging firms to enter and share in the profits.
     - entry will shift the market supply curve rightward, causing price down.
     - entry will continue (and price will continue to drop) until profits are driven to zero.
  2. If the price is below the *break-even point*
     - firms in the industry will be incurring losses, encouraging firms to exit the industry.
     - exit will shift the market supply curve leftward, causing price up.
     - exit will continue (and price will continue to rise) until profits are driven to zero.

Market Adjustments in the Long-Run



The Long-Run Industry Supply Curve

- In the previous graph, we found that the long-run industry supply curve was flat (i.e., perfectly elastic), at the *break-even* price for the individual firms.
- While this is sometimes the case, it is more common for the long-run supply curve to have a positive slope.
- This is typically the case because new entrants to the market impact the cost curves for existing firms by driving up the price of inputs to the production process that have a limited supply.
- It will still be that case that the long-run supply curve will be flatter (i.e., more elastic) than the short-run supply curve.
- In any case, free entry and exit in the competitive industry will drive firm *economic* profits to zero and those firms that do produce will do so at the minimum long-run costs of production.