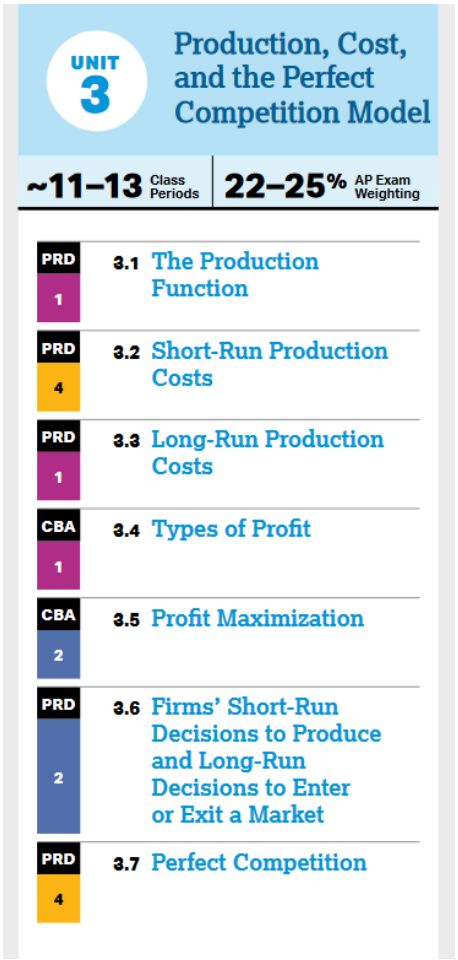
AP Dojo

AP Microeconomics
Unit 3 - Cheat Sheet

Unit 3 - Study Guide - Part 1

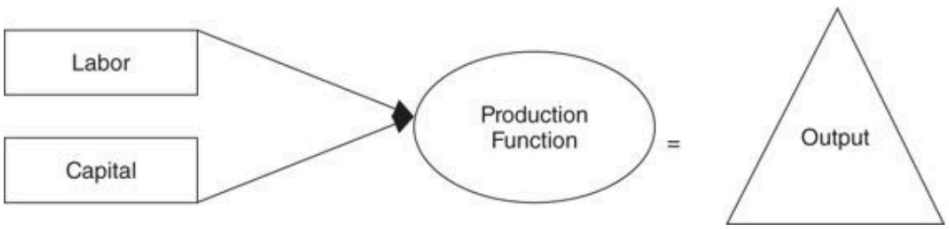
Concepts you need to know for Unit 3 of the AP Micro exam



Topic 1: The Production Function

Production: refers to the process by which a producer takes inputs, or factors of production, and makes outputs (goods and services)

- Input: any resource used by a firm to produce output
- Example: If Smoothie Shack wants to produce mango smoothies, they need mangoes, milk, ice, sugar, a blender, a kitchen, employees, etc.



Fixed Costs and Variable Costs:

- When a company produces output, there are various costs associated with producing

- **Fixed Costs**: costs that do not change regardless of amount produced
- **Variable Costs**: costs that change with the amount produced (as a firm produces more, variable costs increase
- **Example**: Smoothie Shack increases their production of smoothies from 100 smoothies per day to 200 smoothies per day
    - Fixed costs: blender, kitchen equipment, rent
    - Variable costs: mangoes, sugar, ice, milk
- **Total Costs:** the sum of fixed costs and variable costs

Total Costs = Fixed Costs + Variable Costs

Accounting Costs and Economic Costs:

Accounting Costs: the explicit or "out of pocket" payments paid by firms to use resources during the production process

- Example: Smoothie Shacks must buy it's smoothie ingredients from other producers, pay rent to a landlord, etc.

Economic Costs: the sum of both the implicit costs (opportunity costs) and explicit costs of production

- Example: The owner of Smoothie Shack could spend their time working for a salary elsewhere if they weren't running a business. This is an implicit cost of production.

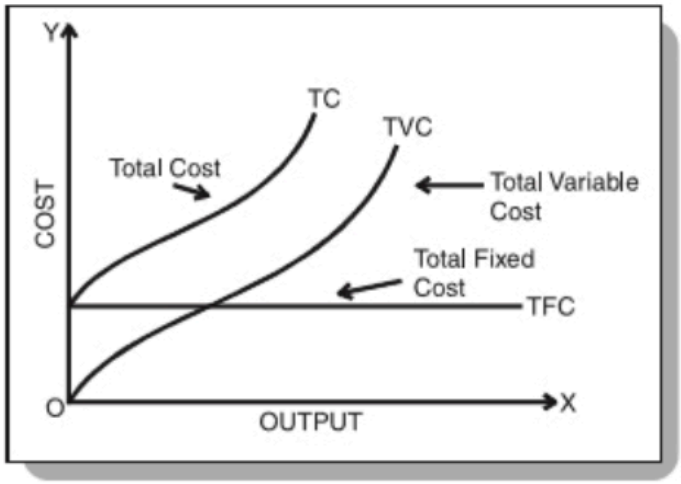


Fig. 5 : Short run Total Cost Curves

TC = TFC + TVC

Revenue and Profits:

Revenue: the total amount of money a firm brings in

- **Revenue = Price * Quantity Sold**

Profit: the amount of revenue left over after accounting for the costs of production

- **Profit = Total Revenue - Total Costs**

Measuring Productivity:

There are three ways of measuring what a firm produces. You need to know all of them

Productivity shows the relationship between the number of inputs added and the output produced

- NOTE: On the AP test, the input is almost always labor (adding an additional employee)

100 SMOOTHIES (TOTAL PRODUCT)

5 employees

100 / 5 = 20 smoothies

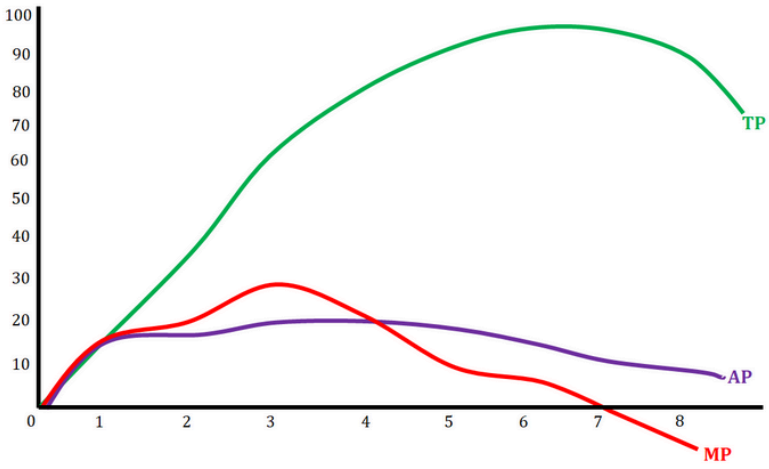
1 employee --> 40 smoothies (Marginal Product: 40)
2 employees --> 85 smoothies (How many extra smoothies can we make with the 2nd employee? 45) Marginal Product: 45
3 employees --> 95 smoothies (Marginal Product: 10)
4 employees --> 98 smoothies (Marginal Product: 3)
5 employees --> 100 smoothies (Marginal Product: 2)
6 employees --> 98 smoothies (Marginal Product: -2)

1) **Total Product (TP)** - the output that is produced by all of the employed workers
2) **Average Product (AP)** - the output per unit of factor inputs
    a) **Average Product = Total Product / Units of Variable Factor Input**
3) **Marginal Product (MP)** - the additional output from adding one more input
    a) **Marginal Product = Change in Output/ Change in Input**
    b) Marginal Product is especially important because it tells firms how many inputs they should use
    c) **IMPORTANT**: If marginal product reaches zero or becomes negative, firms should stop adding inputs

- If $MP_L > AP_L$: AP_L is rising.
- If $MP_L < AP_L$: AP_L is falling.
- If $MP_L = AP_L$: AP_L is at the peak.

Law of Diminishing Marginal Returns: the phenomenon that each additional unit of gain leads to an ever-smaller increase in subjective value

# OF WORKERS	TOTAL PRODUCT	AVERAGE PRODUCT	MARGINAL PRODUCT
0	0	0	-
1	15	15	15
2	34	17	19
3	60	20	26
4	80	20	20
5	90	18	10
6	96	16	6
7	96	13.7	0
8	90	11.25	-6



Topic 2: Short-Run Production Costs

Video: "Jacob Clifford - Short-Run Costs (Part 1)" ← Definitions and Tables

Video: "Jacob Clifford - Short-Run Costs (Part 2)" ← Graphs

- *One of the most important topics in microeconomics*

Short Run Production: the process of utilizing one or more inputs to produce output over a period of time where at least one input is fixed

- In the short run, Smoothie Shack can buy more mangoes, sugar, and even more blenders. In cannot, however, move to a larger kitchen. It's "land" factor of production is fixed.

Long Run Production: the process of utilizing one or more inputs to produce output over a period of time where all factors of production can fluctuate or change

- Over a long enough period of time, Smoothie Shack can rent additional kitchen space. All of its factors of production can change.

Total Costs:

In the short run, there is at least one input that is fixed and so these costs are also fixed. All inputs that are variable incur variable costs.

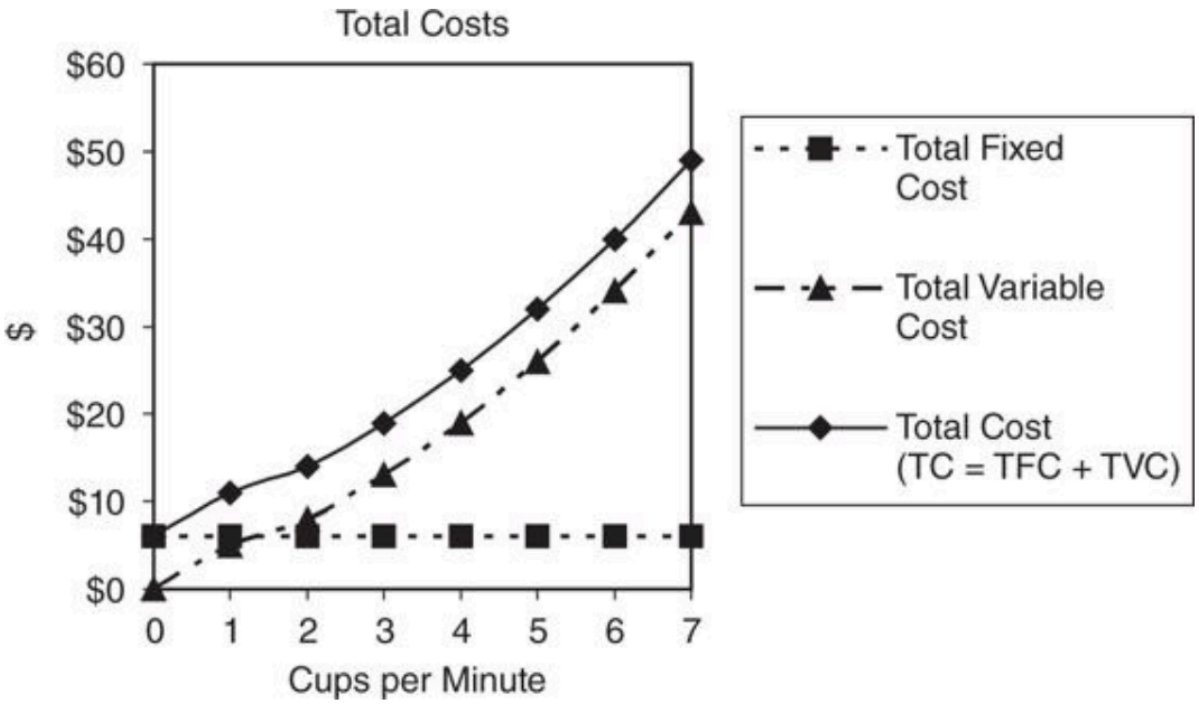
1. **Total fixed costs (TFC)** are those costs that do not vary with changes in short-run output. They must be paid even when output is zero. These include rent on building or equipment, insurance, or licenses.
2. **Total variable costs (TVC)** are those costs that change with the level of output. If output is zero, so are total variable costs. They include payment for materials, fuel, power, transportation services, most labor, and similar costs.
3. **Total cost (TC)** is the sum of total fixed and total variable costs at each level of output:

$$TC = TVC + TFC$$

Graphing Total Costs:

Table 8.3

TOTAL PRODUCT CUPS PER MINUTE	TOTAL FIXED COST (TFC)	TOTAL VARIABLE COST (TVC)	TOTAL COST (TC = TFC + TVC)
0	$6	$0	$6
1	$6	$5	$11
2	$6	$8	$14
3	$6	$13	$19
4	$6	$19	$25
5	$6	$26	$32
6	$6	$34	$40
7	$6	$43	$49



Per Unit Costs:

- In addition to determining the total cost of production, we can also determine the costs per unit of input
- You must know the following: average total cost, average variable cost, average fixed cost, marginal cost

Average Total Cost (ATC) = TC / Q

Average Variable Cost (AVC) = VC / Q

Average Fixed Cost (AFC) = FC / Q

Average Total Cost = Average Variable Cost + Average Fixed Cost

Marginal Cost: the additional cost of producing one more unit

- At first, a firm experiences diminishing marginal costs because of specialization
- Eventually see an increase in marginal cost. This leads to an upward sloping marginal cost curve.
- The reason for the upward sloping marginal cost curve is the **law of diminishing marginal returns**

- Look at the graph below and notice a few things:
    - marginal costs end up increasing as production increases
    - average fixed cost decrease as production increases
    - average total cost equals the sum of average variable cost and average fixed cost

NOTE: The most important curves on this graph are Marginal Cost (MC) and Average Total Cost (ATC)

Average Weight: 150 lbs

Marginal Person Weight: 120 lbs

Average Weight: 140 lbs

Marginal Person Weight: 130 lbs

Average Weight: 135 lbs

Marginal Person Weight: 135 lbs

Average Weight: 135 lbs

Marginal Person Weight: 150 lbs

Graphing Average and Marginal Costs:

Table 8.4

TOTAL PRODUCT CUPS PER MINUTE	MARGINAL COST (MC)	AVERAGE FIXED COST (AFC)	AVERAGE VARIABLE COST (AVC)	AVERAGE TOTAL COST (ATC)
0				
1	$5	$6.00	$5	$11.00
2	$3	$3.00	$4	$7.00
3	$5	$2.00	$4.33	$6.33
4	$6	$1.50	$4.75	$6.25
5	$7	$1.20	$5.20	$6.40
6	$8	$1.00	$5.67	$6.67
7	$9	$0.86	$6.14	$7.00

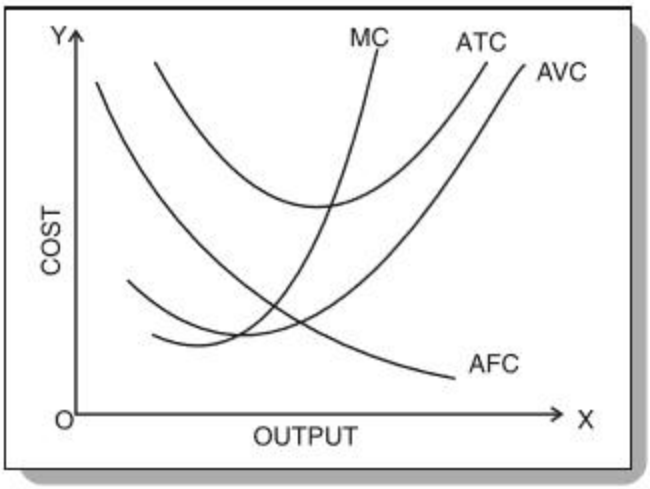


Fig. 1 : Short run Average and Marginal Cost Curves

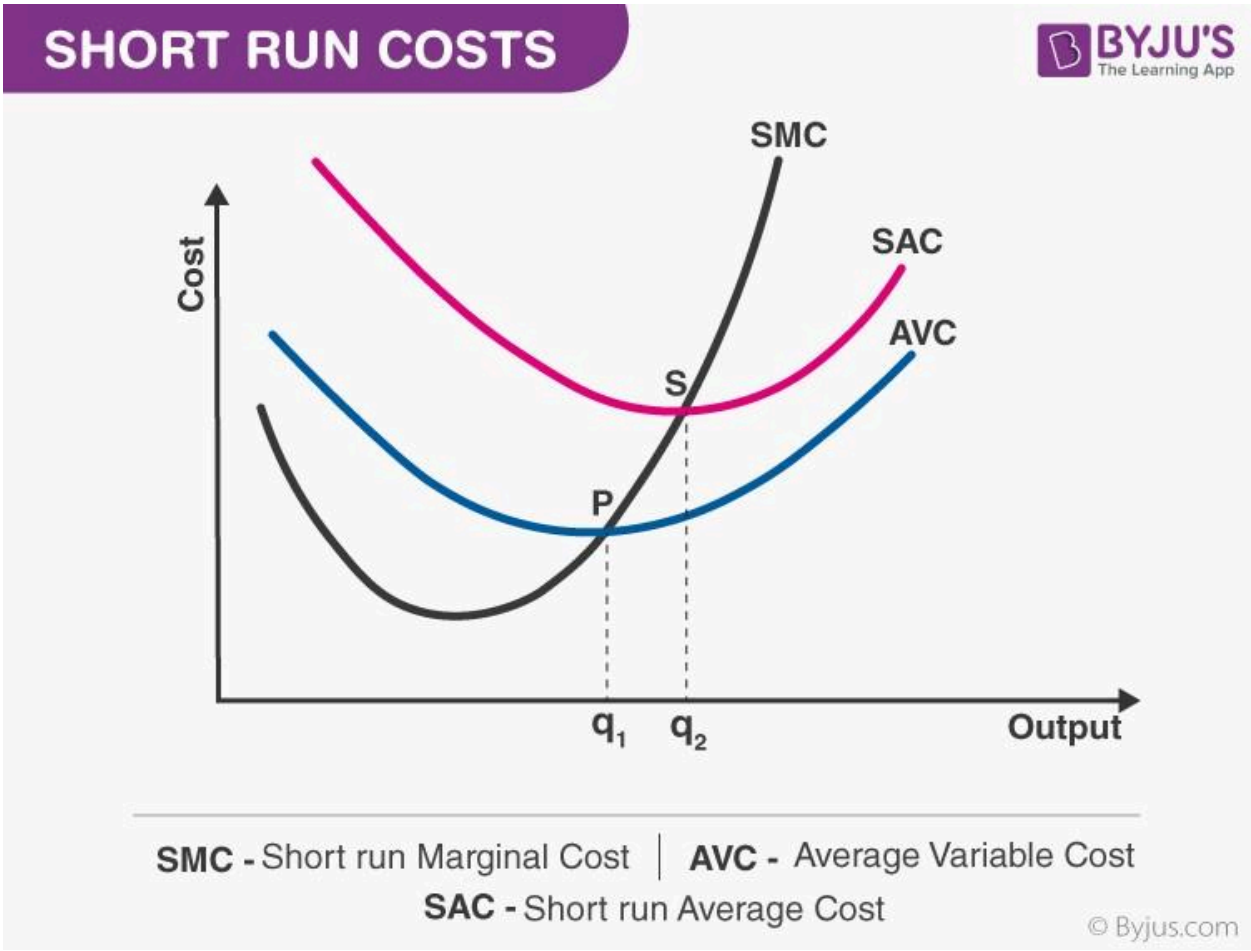
Total Fixed Costs: $1,000

AFC = TFC / Quantity

AFC = 1,000 / 1 = 1,000

AFC = 1,000 / 1,000 = 1

AFC = 1,000 / 2,000 = 0.5



Reasons For the Shapes of the Curves:

Marginal Cost Curve:

- The marginal cost curve is a direct reflection of the marginal product that a producer receives when adding units of input
- For example, if Smoothie Shack hires more employees to make smoothies, at first the additional employees will be beneficial (marginal product increases, marginal costs decrease)
- As more and more employees are hired, Smoothie Shack might not have enough blenders for the employees to use. Or the kitchen might be too small for all the employees to work effectively.
- As inputs are adding, the marginal costs of each additional input increases

Average Total Cost Curve:

- Average total costs start high, as a company must spend lots of money to begin producing. Smoothie Shack needs to buy machinery, rent a kitchen, etc.
- As marginal costs decrease, this brings down the average total costs as well (**EXAMPLE**: If the average person in a room weighs 100kg, then the next (marginal) person enters the room and weighs 50kg, it will bring the average total weight down)
- Eventually, marginal costs start to increase. This means the MC curve starts to move upwards. But if the marginal cost is still less than total average cost, it will still brings the total average cost down (**EXAMPLE**: The 50kg person already entered the room. This brought the total average weight down to 90kg. The next person to enter the room is 70kg.
    - In this scenario, the marginal weight increased
    - But 70kg is still less than the total average weight of 90kg, so when this person enters the room, it will bring down the average total weight
- When marginal costs become GREATER than average total costs, the average total costs start increasing and the curve heads upwards
    - (**EXAMPLE**: If the average weight is 85 kg and the next person to enter the room is 90kg, the marginal weight is greater than the average total weight, and the average total weight will increase)
- ***Once you understand this, you know that the MARGINAL COST CURVE will always intersect with the AVERAGE TOTAL COST curve at the low-point of the AVERAGE TOTAL COST CURVE***

Average Variable Cost Curve:

- Average Variable Costs decline when Marginal Costs is below it
- Average Variable Costs increase when Margial Costs are above it

- Once again, that means that ***MARGINAL COST CURVE will always intersect with the AVERAGE VARIRABLE COST curve at the low-point of the AVERAGE VARIABLE COST CURVE***

Topic 3: Long-Run Production Costs

Short Run: at least one variable is fixed
Long Run: all variables can be changed (no fixed variables)

Long Run Production: the process of utilizing one or more inputs to produce output over a period of time where all factors of production can fluctuate or change

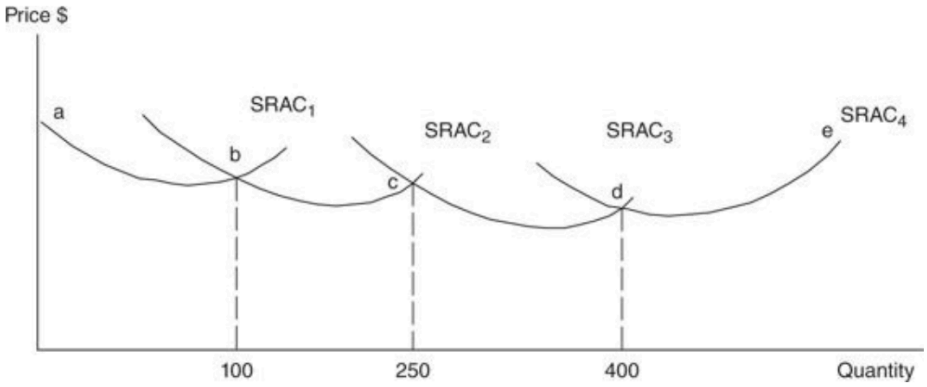
In the long run, all factors of production and inputs are variable

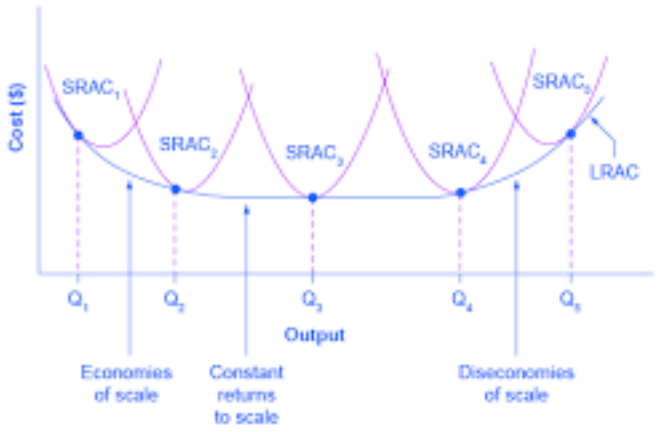
- Example: Given enough time, Smoothie Shack can move to a different kitchen, hire more workers, and buy more blenders.

How Short-Run Production and Long-Run Production Are Related:

- Think of the firm's short-run average costs as a snapshot of the firm's ability to produce efficiently at the fixed plant size. Over time, the firm may grow and expand the plant size and begin to produce efficiently, but at the larger fixed plant size, giving us another snapshot.
- This process repeats itself as the firm expands or contracts and each time we receive another short-run snapshot of average cost.

- If we could put these short-run snapshots together into a kind of motion picture, we would see a more continuous long-run home movie of the firm's average costs





Economies of Scales:

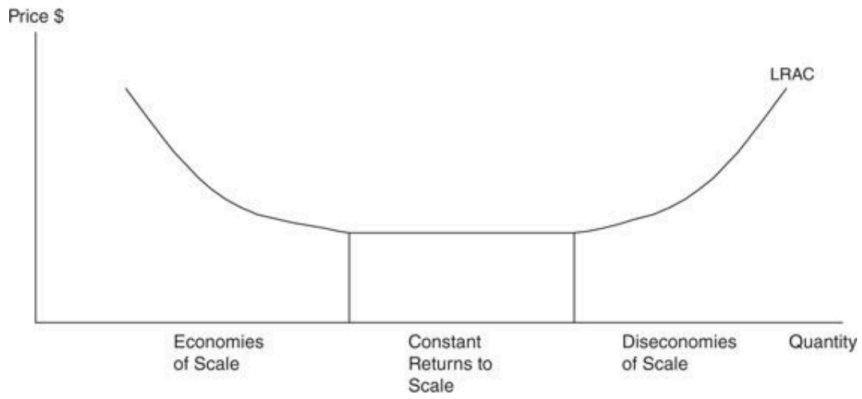
Economies of Scale: reductions in the average cost of production that companies experience as a result of increasing the scale of production

- Example: As Smoothie Shack increases in size, they can buy ingredients in bulk, to reduce the average cost. They could also purchase larger machines that can blend dozens of servings of mango smoothie at once.

- **Specialization** leads to economies of scale. Instead of one Smoothie Shack employee trying to manage ordering supplies, blend smoothies, and advertise, the company can hire specialized employees that increase productivity.
- downward sloping LRATC curve
- average costs are decreasing

Diseconomies of Scale:

- Example: As Smoothie Shack expands its business, they may need to hire managers to manage their growing staff, human resources officers, etc. They might also need expensive software systems to track inventory. These costs that come along with a growing business might drive up their LRATC.
- upward sloping LRATC curve
- average costs are increasing



Impact of Taxes:

"The government takes, efficiency breaks"

From Two Groups to Three:

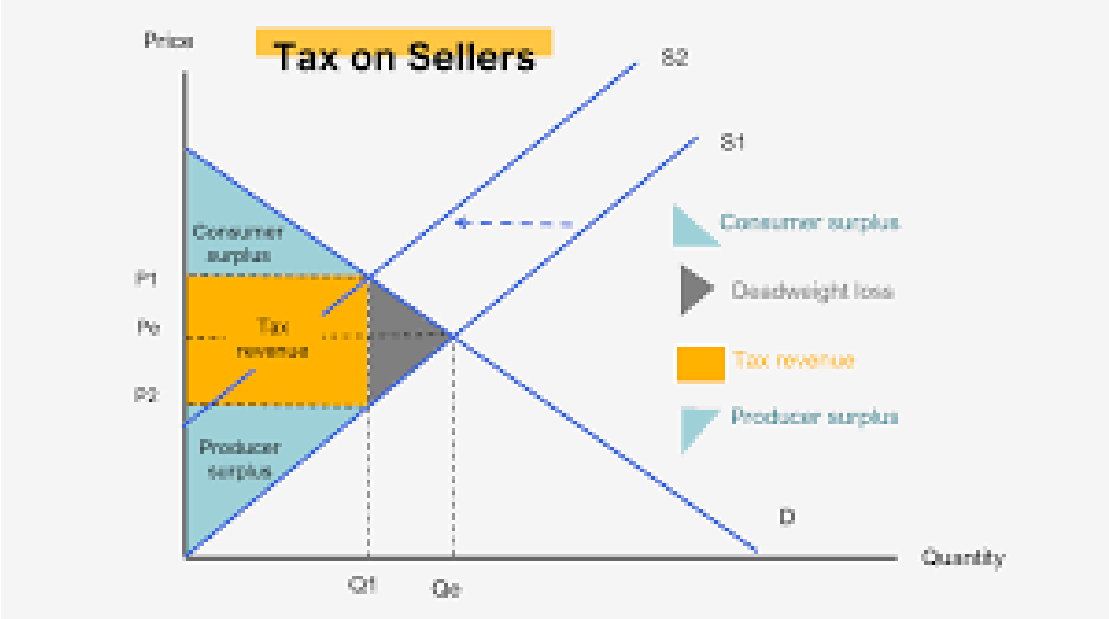
- Originally, when a producer is bought and sold, only two groups are involved: producers and consumers

- The benefit of the transaction if shared between the two. The consumers get some benefit, the producer gets some benefit
- When the government implements a tax, there are three groups involved: producers, consumers, and the government.
- The benefit of the transaction is shared by the three groups. The consumers get some benefit (less than before), the producers get some benefit (less than before), and the government gets some benefit

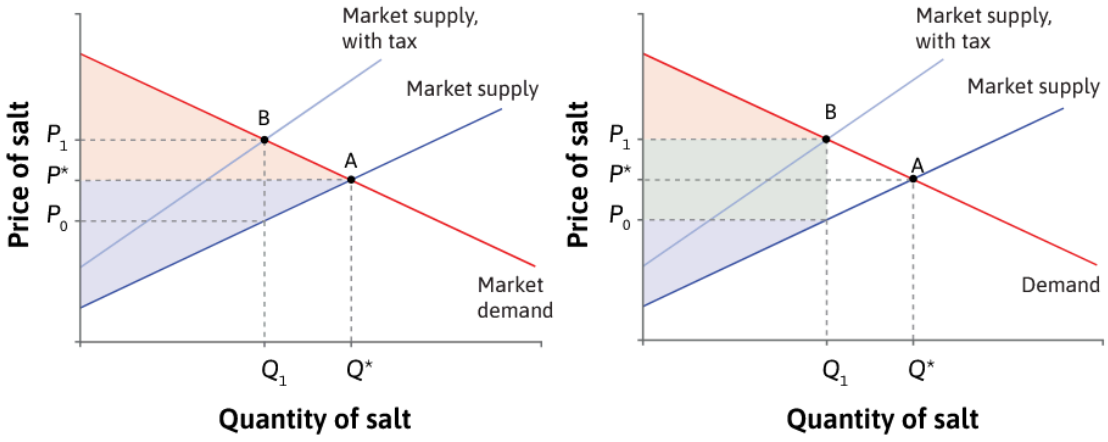
How to Visualize the Impact of a Tax:

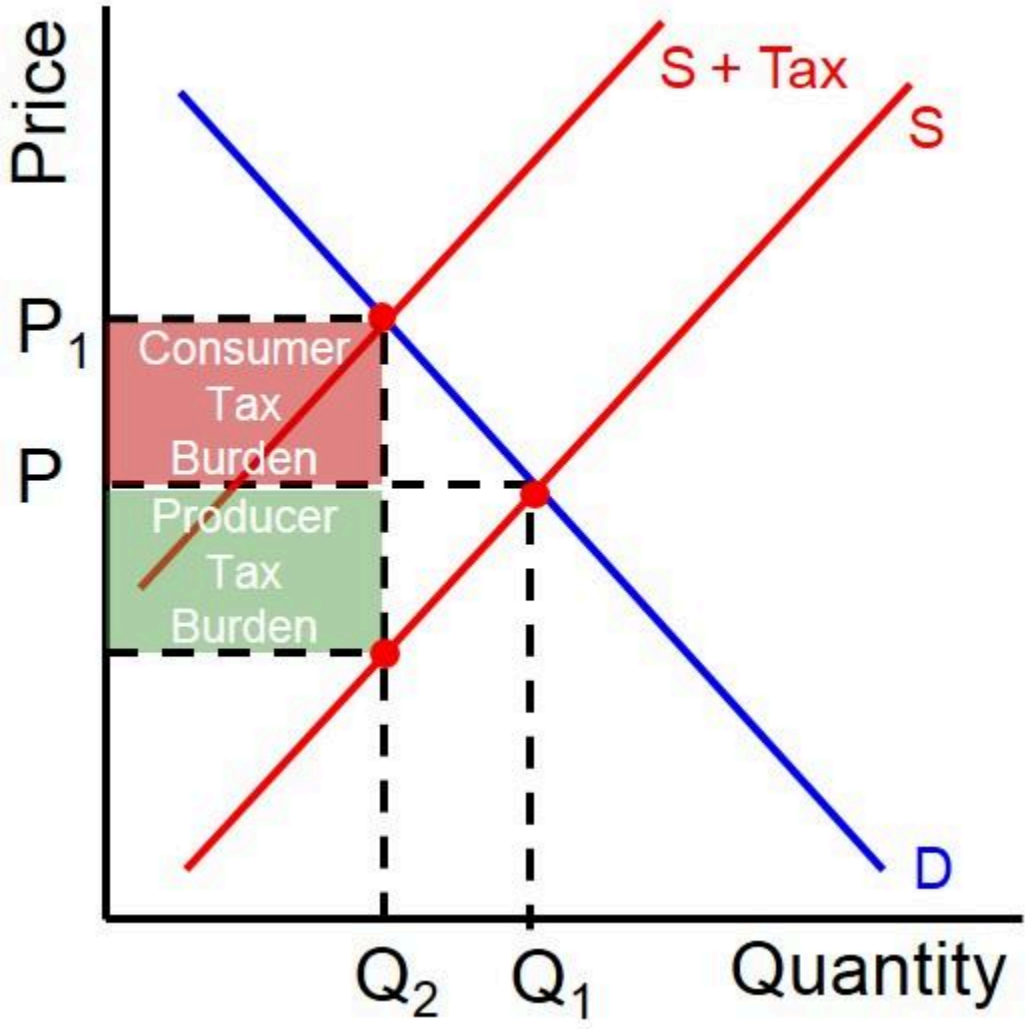
- Anything that increases the cost of production can shift the supply curve to the left
- A tax levied on producers increases the cost of production, shifting the supply curve to the left
- At any given price, fewer producers are willing to supply the product

Deadweight Loss: the difference in production and consumption of any given product or service including government tax



- *Consumer surplus falls*: Consumers pay a higher price, P_1, and buy less salt.
- *Producer surplus falls*: Producers supply less and receive a lower net price, P_0 .
- *Tax revenue:* A tax equal to $(P_1 - P_0)$ is paid to the government on each of the Q_1 units of salt sold (the green-shaded area).
- *Total surplus (including tax revenue) is lower*: The tax causes a deadweight loss equal to the area of the white triangle, which is $1/2 \times (Q^* - Q_1) \times (P_1 - P_0)$.




Price
S + Tax
S
P_1
Consumer Tax Burden
P
Producer Tax Burden
D
Q_2
Q_1
Quantity

Price Floors and Price Ceilings

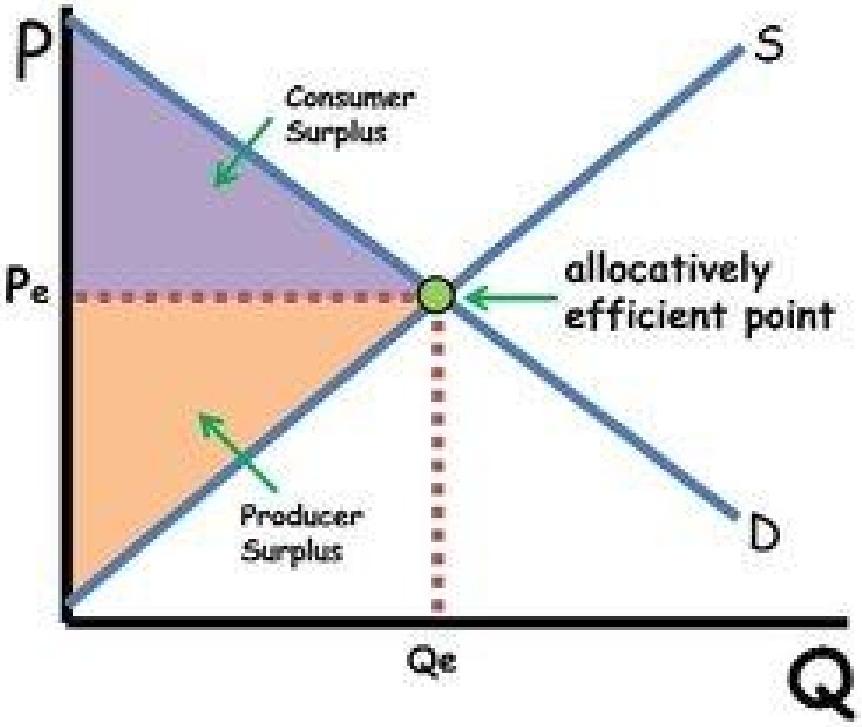
Price Floor: A type of government price control that sets a legal minimum price that a good or service can be sold for (can't go lower than the ceiling)

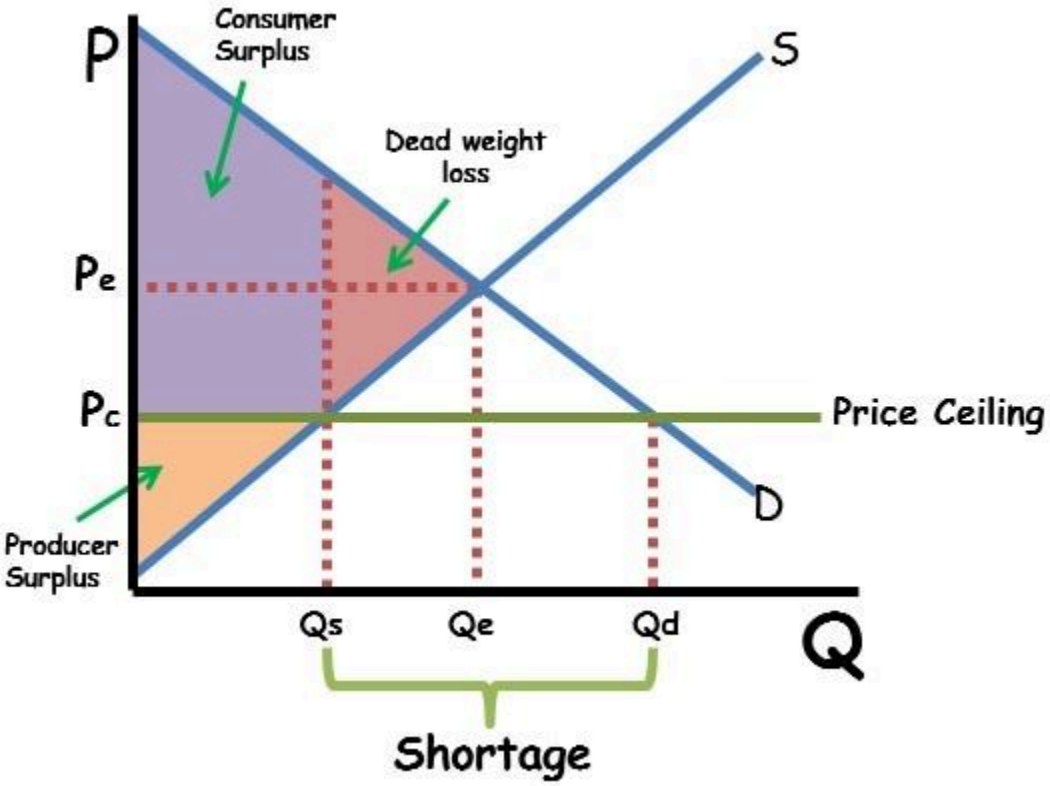
- set ABOVE equilibrium price
- causes a shortage
- increases producer surplus and decreases consumer surplus

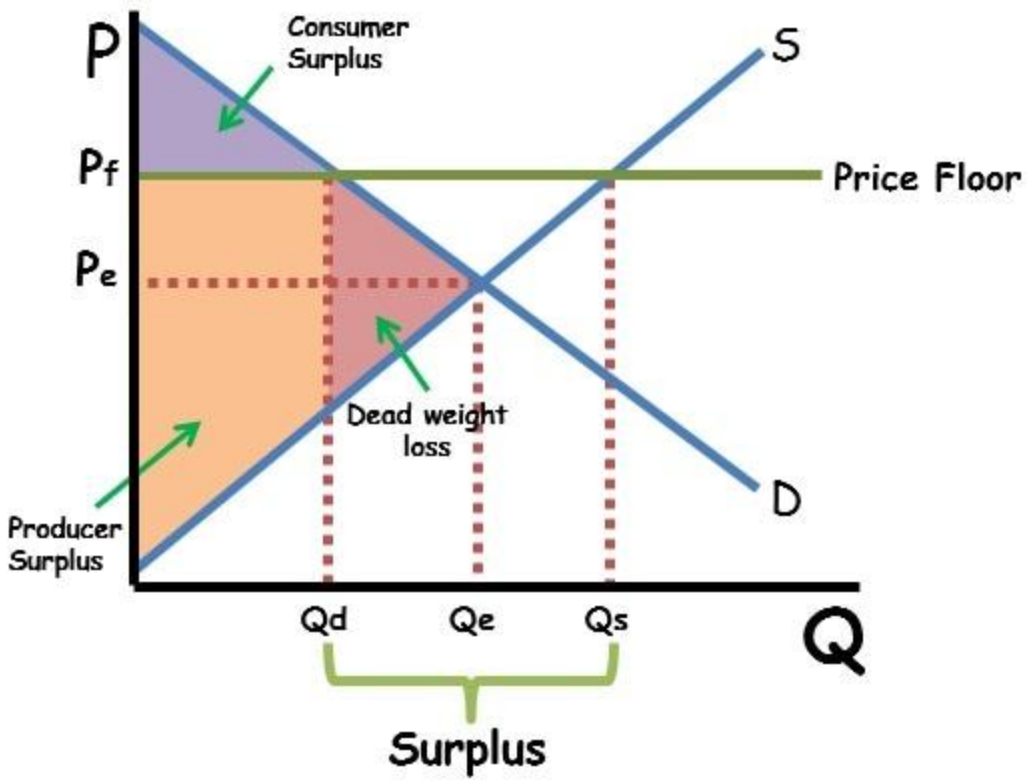
Price Ceiling: A type of government price control that sets a legal maximum price that a good or service can be sold for (can't go higher than the ceiling)

- set BELOW equilibrium price
- causes a surplus
- increases consumer surplus and decreases producer surplus

- Price controls prevent a market from reaching equilibrium and create **deadweight loss**


P
S
Consumer Surplus
Pe
allocatively efficient point
Producer Surplus
D
Qe
Q


P
Consumer Surplus
S
Dead weight loss
Pe
Pc
Price Ceiling
Producer Surplus
D
Qs
Qe
Qd
Q
Shortage


P
Consumer Surplus
S
Pf
Price Floor
Pe
Dead weight loss
D
Producer Surplus
Qd
Qe
Qs
Q
Surplus