

## Chapter 4: Firm Behavior

**Instructions:** These are the notes for Chapter 4. Make sure you review the material presented here and read the corresponding chapters on the textbook: **Chapter 12 on Mankiw.**

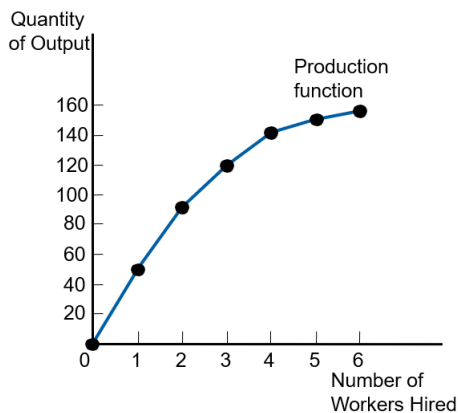
### Industrial Organization

- **Industrial organization.** The study of firms' decisions about prices and quantities depending on the market conditions they face.
- The goal of a firm is to maximize profit
- Profit = Total Revenue – Total Cost
- Total Revenue,  $TR = P \times Q$ 
  - Total amount a firm receives for the sale of its output
  - i.e. quantity of output times the price
- Total cost, TC is the cost of the inputs that firm uses in production.

### Economic Costs

- Two types of costs: explicit costs and implicit costs.
- **Explicit costs.** Input costs that require an outlay of money by the firm.
  - Accountants use only these costs.
- **Implicit costs.** Input costs that do not require an outlay of money by the firm.
  - Economists consider these costs in addition to explicit costs.
- Example: A bakery owner Caroline pays \$2000 for flour is an explicit cost. Her alternative job as a programmer paying her \$100 per hour is included in implicit costs.
- Accounting profit = Revenue – Explicit costs
- Economic profit = Revenue – Explicit costs – Implicit costs
  - = Revenue – Total Cost
- Total Cost includes implicit costs for an economist because it affects decision making.

### Production Function



- **Production function.** Relationship between quantity of inputs used to make a good and the quantity of output of that good.
- **Total product (TP).** Total quantity of output that is produced.
- **Marginal product (MP)** reflects the change in output when one more unit of input is added.
- **Average product (AP).** The output produced per unit of input, i.e.  $\frac{\text{Total Product}}{\text{Units of input}}$

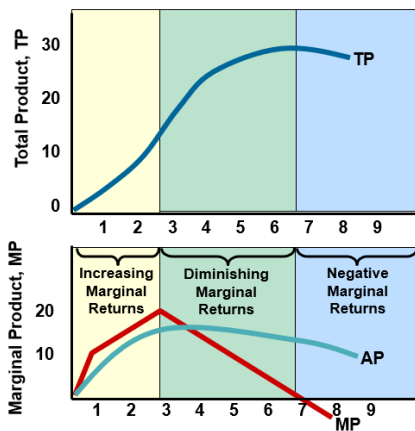
**Total, Marginal, and Average Product: The Law of Diminishing Returns**

(1) Units of the Variable Resource (Labor input)	(2) Total Product (TP)	(3) Marginal Product (MP) Change in (2)/ Change in (1)	(4) Average Product (AP), (2)/(1)
0	0		-
1	10		
2	25		
3	45		
4	60		
5	70		
6	75		
7	75		
8	70		

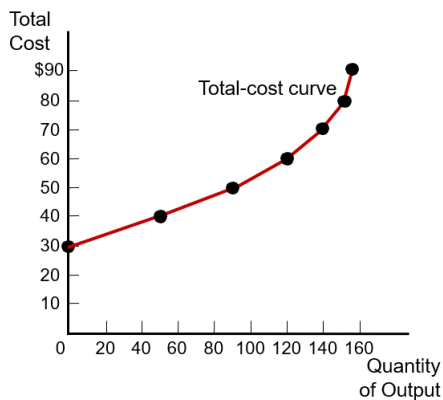
**Total, Marginal, and Average Product: The Law of Diminishing Returns**

(1) Units of the Variable Resource (Labor input)	(2) Total Product (TP)	(3) Marginal Product (MP) Change in (2)/ Change in (1)		(4) Average Product (AP), (2)/(1)
0	0			-
1	10	10	Increasing marginal returns	10.00
2	25	15		12.50
3	45	20		15.00
4	60	15	Diminishing marginal returns	15.00
5	70	10		14.00
6	75	5		12.50
7	75	0		10.71
8	70	-5	Negative marginal returns	8.75

- **Law of Diminishing Returns.** Economic law stating that when the quantity of input in the production is increased, the increase in output becomes smaller.



### Total Cost Function



- **Total Cost function.** Relationship between quantity produced and total costs.
- Implication of the production function
- Total Cost = Fixed cost + Variable cost
- Fixed cost are costs that do not vary with output i.e. cost of building, rent, insurance..
- Variable cost vary with output i.e. input materials, fuel, power, labor..

### Question

- If you owned a small farm, which of the following would be a fixed cost?
  - a. harvest labor
  - b. hail insurance
  - c. fertilizer
  - d. seed

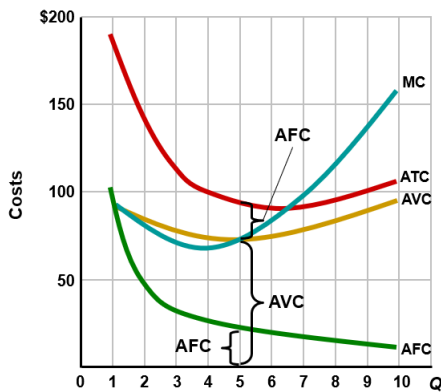
## Per-unit Costs

- Per-unit costs are useful in making comparisons to price
- Average fixed cost,  $AFC = TFC/Q$
- Average variable cost,  $AVC = TVC/Q$
- Average total cost,  $ATC = TC/Q = AFC + AVC$
- Marginal cost,  $MC = \Delta TC/\Delta Q$ 
  - i.e. additional cost of producing 1 more output.

Total, Average, and Marginal Cost Schedules for an Individual Firm in the <b>Short Run</b>							
Total Cost Data				Average Cost Data			Marginal Cost
(1) Total Product (Q)	(2) Total Fixed Cost (TFC)	(3) Total Variable Cost (TVC)	(4) Total Cost (TC) TC = TFC + TVC	(5) Average Fixed Cost (AFC) AFC = TFC/Q	(6) Average Variable Cost (AVC) AVC=TVC/Q	(7) Average Total Cost (ATC) ATC = TC/Q	(8) Marginal Cost (MC) MC = $\Delta$ TC/ $\Delta$ Q
0	\$100	\$0		-	-	-	-
1		90					
2		170					
3		240					
4		300					
5		370					
6		450					
7		540					
8		650					
9		780					
10		930					

Total, Average, and Marginal Cost Schedules for an Individual Firm in the <b>Short Run</b>							
Total Cost Data				Average Cost Data			Marginal Cost
(1) Total Product (Q)	(2) Total Fixed Cost (TFC)	(3) Total Variable Cost (TVC)	(4) Total Cost (TC) TC = TFC + TVC	(5) Average Fixed Cost (AFC) AFC = TFC/Q	(6) Average Variable Cost (AVC) AVC=TVC/Q	(7) Average Total Cost (ATC) ATC = TC/Q	(8) Marginal Cost (MC) MC = $\Delta$ TC/ $\Delta$ Q
0	\$100	\$0	\$100				
1	100	90	190	\$100.00	\$90.00	\$190.00	\$90
2	100	170	270	50.00	85.00	135.00	80
3	100	240	340	33.33	80.00	113.33	70
4	100	300	400	25.00	75.00	100.00	60
5	100	370	470	20.00	74.00	94.00	70
6	100	450	550	16.67	75.00	91.67	80
7	100	540	640	14.29	77.14	91.43	90
8	100	650	750	12.50	81.25	93.75	110
9	100	780	880	11.11	86.67	97.78	130
10	100	930	1030	10.00	93.00	103.00	150

## Marginal Cost Curve

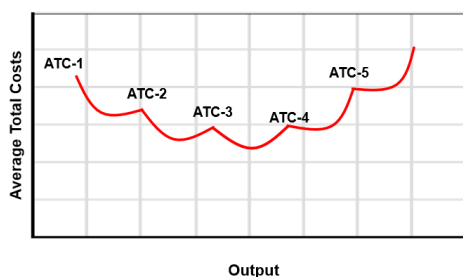


- At first, MC decreases and then increases because of MP assumption: diminishing marginal product.
- Marginal cost intersects AVC where AVC is at its minimum!
- When  $MC < AVC$ , AVC is decreasing because producing one more unit brings the AVC down.
- When  $MC > AVC$ , AVC is increasing because producing one more unit increases the AVC.

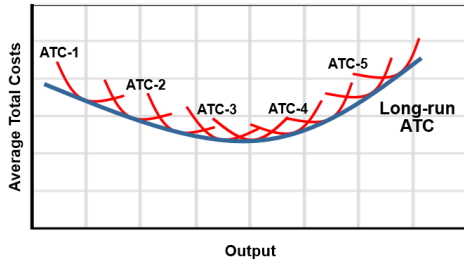
## Short-run vs. Long-run

- **Short run.** A period of time that is too brief for a firm to alter its plant capacity, but the firm can change output somewhat by increasing or decreasing its variable inputs.
  - i.e. can decrease/increase how many to produce, but can't build a new plant.
- **Long run.** A period of time that is long enough for the firm to adjust the plant size as well as enter or leave the industry.
  - i.e. can decrease/increase how many to produce, and can build a new factory, or exit business.
- Note: the length of short run and long run differs across industries.

## Long-run Total Cost Curve

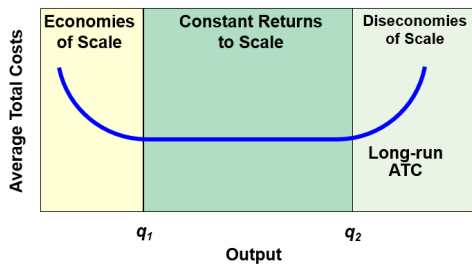


- In the long run, all costs are variable (no TVC or TFC) so there is only long-run ATC.
- ATC-1 to ATC-5 are short-run ATCs at different output levels.

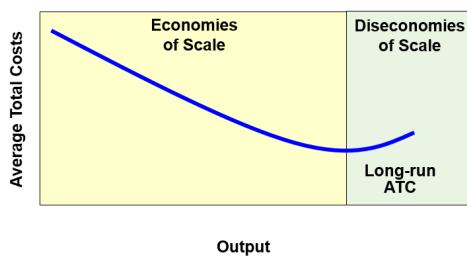


- Long-run ATC is obtained by connecting short-run ATCs at different output levels.
- Long-run ATC is U-shaped because of economies of scale, followed by diseconomies of scale.
- Economies of scale at first because firm uses the advantage of flexibility or benefit learning by doing..
- Diseconomies of scale later on because firm becomes too big to control and coordinate.

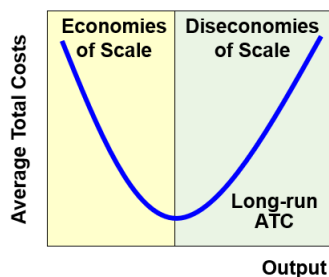
### Different Industry Structures



- Small- and large-scale producers will co-exist and be equally successful.
- Apparel, banking, furniture, food, small appliances..



- A few large- scale firms.
- Automotive, steel, microchips, operating systems..



- a large number of small firms.
- Bakery, hair salon..

**Question**

- The government imposes a \$1,000 per year license fee on all pizza restaurants. As a result, which cost curves shift?
  - a. average total cost and average marginal cost
  - b. average total cost and average fixed cost
  - c. average variable cost and marginal cost
  - d. average variable cost and average fixed cost