N. GREGORY MANKIW

PRINCIPLES OF

ECONOMICS

Eight Edition

CHAPTER

12

The Design of the Tax System

Modified by Joseph Tao-yi Wang

Premium PowerPoint Slides by:
V. Andreea CHIRITESCU
Eastern Illinois University

Ten Principles of Taiwanese Economics

- No, I will NOT teach Mankiw's Chapter 12.
  - You need not know the US tax system. But,
- You should understand how normal people in Taiwan (鄉民@PTT) see economic issues
- So, several professors and I came up with the Ten Principles of Taiwanese Economics
- See if you can you figure out:
  1. Why Taiwanese people believe in them, and
  2. Why they are misleading.

Ten Principles of Taiwanese Economics

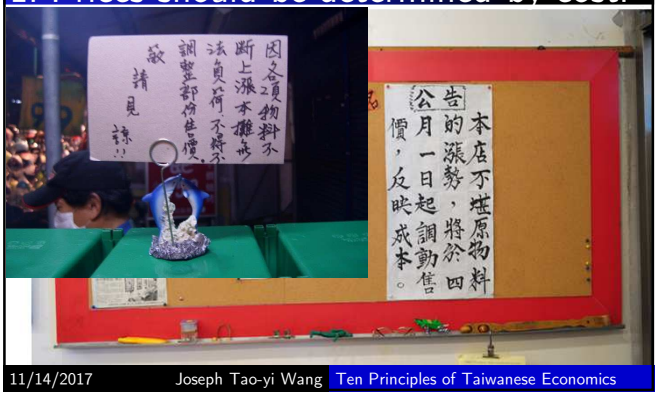
1. Prices should be determined by cost.
2. Wages should be determined by effort.
3. The Taiwanese government is financed by Mars.
4. When market failures occur, blame the government.
5. Economists are to be blamed for government failures.

Ten Principles of Taiwanese Economics

6. The government should provide generous pensions to all (starting from its own employees).
7. Many industries are too sacred to be commercialized.
8. Education is just a signal, not human capital.
9. A weak currency is the driving force of economic growth.
10. Information should be withheld to prevent panics.

1. Prices should be determined by cost.

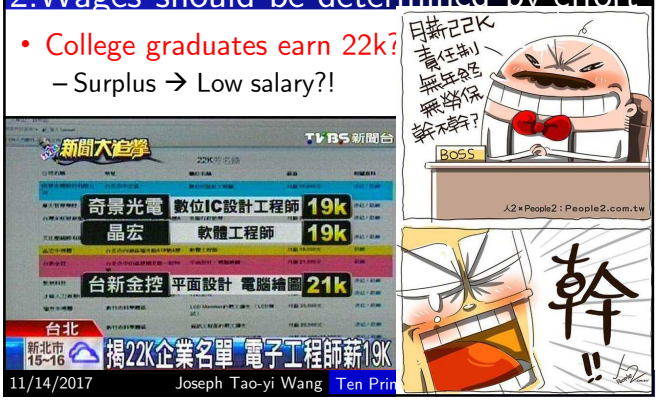
1. Prices should be determined by cost.



1. Prices should be determined by cost.

2.Wages should be determined by effort

- College graduates earn 22k?
  - Surplus → Low salary?!



2.Wages should be determined by effort

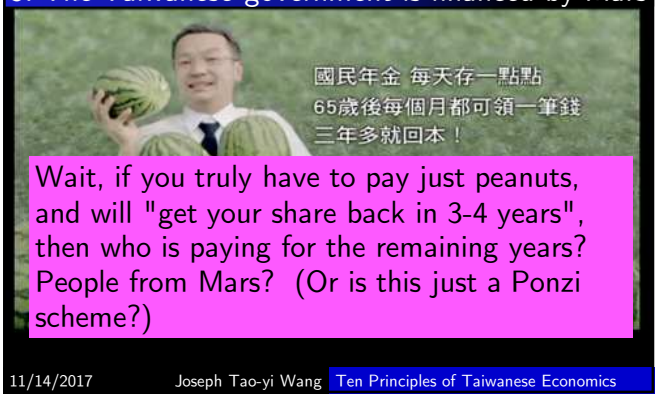
- But US Companies in Taiwan still can't find enough high-skilled workers!
  - 華視新聞：薪資遠勝22k 台灣技術人才短缺
  - Restatement of Principle #1, but for labor

3. The Taiwanese government is financed by Mars

3. The Taiwanese government is financed by Mars

勞保局 國民年金理財篇 (國台語版)

3. The Taiwanese government is financed by Mars



Wait, if you truly have to pay just peanuts, and will "get your share back in 3-4 years", then who is paying for the remaining years? People from Mars? (Or is this just a Ponzi scheme?)

N. GREGORY MANKIW

PRINCIPLES OF
ECONOMICS
Eight Edition

CHAPTER
13

The Costs of Production

Premium PowerPoint Slides by:
V. Andreea CHIRITESCU
Eastern Illinois University

Modified by Joseph Tao-yi Wang

Active Learning 1 — Brainstorming costs

You run Foxconn Electronics Inc.(鴻海富士康).

- List three different costs you have.
- List three different business decisions that are affected by your costs
- How would your answers change if you run 台北農產運銷公司 instead?

Look for the answers to these questions:

- What is a production function? What is marginal product? How are they related?
- What are the various costs? How are they related to each other and to output?
- How are costs different in the short run vs. the long run?
- What are "economies of scale"?

Total Revenue, Total Cost, Profit

- We assume that the firm's goal is to maximize profit.

Profit = Total revenue – Total cost

Total revenue: the amount a firm receives from the sale of its output
TR = P×Q

Total cost: the market value of the inputs a firm uses in production

Costs: Explicit vs. Implicit

- 'The cost of something is what you give up to get it.'
- Explicit costs
  - Require an outlay of money
    - E.g., paying wages to workers.
- Implicit costs
  - Do not require a cash outlay
    - E.g., the opportunity cost of the owner's time.
- Total cost = Explicit + Implicit costs

Explicit vs. Implicit Costs: An Example

You need $1,000,000 to start your business. The interest rate is 5%.

- Case 1: borrow $1,000,000
  - explicit cost = $50,000 interest on loan
- Case 2: use $400,000 of your savings, borrow the other $600,000
  - explicit cost = $30,000 (5%) interest on the loan
  - implicit cost = $20,000 (5%) foregone interest you could have earned on your $400,000.

In both cases, total (exp + imp) costs are $50,000

Economic Profit vs. Accounting Profit

- Accounting profit
  =total revenue minus total explicit costs
- Economic profit
  =total revenue minus total costs (including explicit and implicit costs)
- Accounting profit ignores implicit costs, so it's higher than economic profit.

Active Learning 2
Economic profit vs. accounting profit

The equilibrium rent on office space has just increased by $5,000/month.

Determine the effects on accounting profit and economic profit if:

a. you rent your office space

b. you own your office space

Active Learning 2 Answers

The rent on office space increases $5,000/month.

a. You rent your office space.
- Explicit costs increase $5,000/month.
- Accounting profit & economic profit each fall $5,000/month.

b. You own your office space.
- Explicit costs do not change, so accounting profit does not change.
- Implicit costs increase $5,000/month (opp. cost of using your space instead of renting it) so economic profit falls by $5,000/month.

Production Function

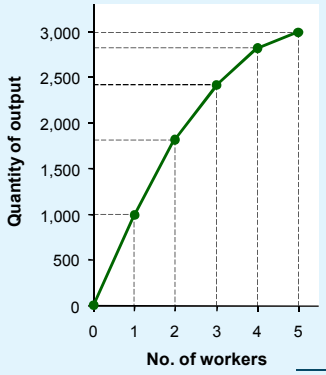
- Production function
  - Relationship between
    - Quantity of inputs used to make a good
    - And the quantity of output of that good
  - Gets flatter as production rises

EXAMPLE 1: Farmer Jack

Example 1:
- Farmer Jack grows vegetables.
- He has 5 acres of land (fixed resource).
- He can hire as many workers as he wants.
  - The quantity of output produced varies with the number of workers hired

EXAMPLE 1: Farmer Jack's Production Function

L (no. of workers)	*Q* (bushels of veggie)
0	0
1	1000
2	1800
3	2400
4	2800
5	3000



Marginal Product

- Marginal product
  - Increase in output that arises from an additional unit of input
    - Other inputs constant
  - Slope of the production function
- Marginal product of labor, MPL
  - MPL = ΔQ/ΔL
  - If Jack hires one more worker, his output rises by the marginal product of labor.

EXAMPLE 1: Total & Marginal Product

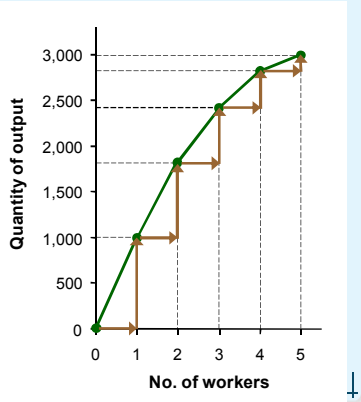
	L (no. of workers)	*Q* (bushels of veggie)		*MPL*
	0	0		
Δ*L* = 1	1	1000	Δ*Q* = 1000	1000
Δ*L* = 1	2	1800	Δ*Q* = 800	800
Δ*L* = 1	3	2400	Δ*Q* = 600	600
Δ*L* = 1	4	2800	Δ*Q* = 400	400
Δ*L* = 1	5	3000	Δ*Q* = 200	200

Diminishing MPL

- Diminishing marginal product
  - Marginal product of an input declines as the quantity of the input increases
  - Production function gets flatter as more inputs are being used:
    - The slope of the production function decreases

EXAMPLE 1: MPL = Slope of Prod Function

L (no. of workers)	*Q* (bushels of veggie)	*MPL*
0	0	
1	1000	1000
2	1800	800
3	2400	600
4	2800	400
5	3000	200



Why MPL Is Important

- 'Rational people think at the margin'
- When Farmer Jack hires an extra worker
  - His costs rise by the wage he pays the worker
  - His output rises by MPL
  - Comparing them helps Jack decide whether he should hire the worker.

Why MPL Diminishes

- Farmer Jack's output rises by a smaller and smaller amount for each additional worker. Why?
  - As Jack adds workers, the average worker has less land to work with and will be less productive.
  - In general, MPL diminishes as L rises whether the fixed input is land or capital (equipment, machines, etc.).

EXAMPLE 1: Farmer Jack's Costs

Farmer Jack must pay $10,000 per month for the land, regardless of how much veggie he grows.

The market wage for a farm worker is $20,000 per month.

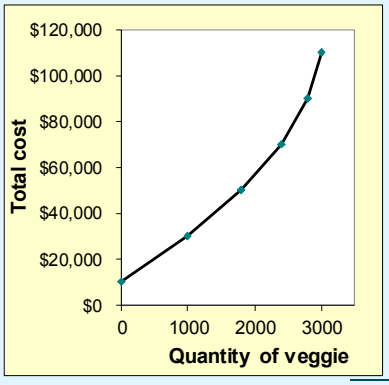
- So Farmer Jack's costs are related to how much veggie he produces….

EXAMPLE 1: Farmer Jack's Costs

L (no. of workers)	*Q* (bushels of veggie)	Cost of land	Cost of labor	Total cost
0	0	$10,000	$0	$10,000
1	1000	$10,000	$20,000	$30,000
2	1800	$10,000	$40,000	$50,000
3	2400	$10,000	$60,000	$70,000
4	2800	$10,000	$80,000	$90,000
5	3000	$10,000	$100,000	$110,000

EXAMPLE 1: Farmer Jack's Total Cost Curve

Q (bushels of veggie)	Total Cost
0	$10,000
1000	$30,000
1800	$50,000
2400	$70,000
2800	$90,000
3000	$110,000



Marginal Cost

- Marginal cost, MC
  - Increase in total cost arising from an extra unit of production
  - Marginal cost = Change in total cost / Change in quantity

$$MC = \Delta TC / \Delta Q$$

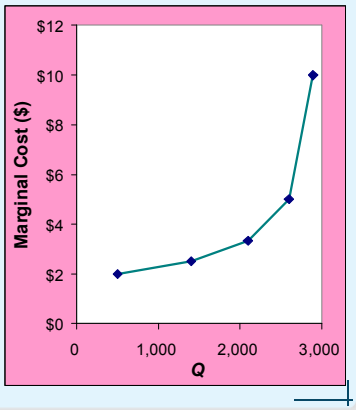
  - Increase in total cost
    - From producing an additional unit of output

EXAMPLE 1: Total and Marginal Cost

	Q (bushels of veggie)	Total Cost		Marginal Cost (*MC*)
	0	$10,000		
ΔQ = 1000			ΔTC = $20,000	$20.0
	1000	$30,000		
ΔQ = 800			ΔTC = $20,000	$25.0
	1800	$50,000		
ΔQ = 600			ΔTC = $20,000	$33.3
	2400	$70,000		
ΔQ = 400			ΔTC = $20,000	$50.0
	2800	$90,000		
ΔQ = 200			ΔTC = $20,000	$100.0
	3000	$110,000		

EXAMPLE 1: The Marginal Cost Curve

Q (bushels of veggie)	*TC*	*MC*
0	$10,000	
		$20.0
1000	$30,000	
		$25.0
1800	$50,000	
		$33.3
2400	$70,000	
		$50.0
2800	$90,000	
		$100.0
3000	$110,000	



Why MC Is Important

- Farmer Jack is rational and wants to maximize his profit
  - To increase profit, should he produce more or less vegetables?
    - Farmer Jack needs to "think at the margin"
  - If the cost of additional vegetables (MC) is less than the revenue he would get from selling it, then Jack's profits rise if he produces more.

Fixed and Variable Costs

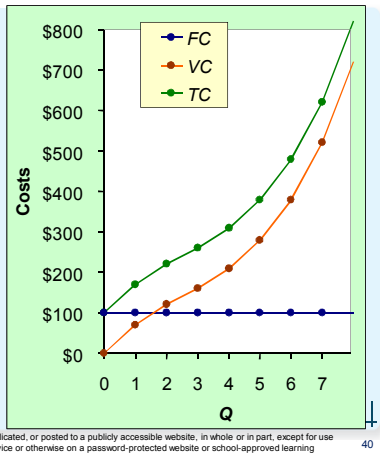
- Fixed costs, FC, do not vary with the quantity of output produced
  - For Farmer Jack, FC = $10,000 for his land
  - Other examples: cost of equipment, loan payments, rent
- Variable costs, VC, vary with the quantity of output produced
  - For Farmer Jack, VC = wages he pays workers
  - Other example: cost of materials
- Total cost = Fixed cost + Variable cost

EXAMPLE 2: Production Costs

- Our second example is more general, applies to any type of firm producing any good with any types of inputs.
  - Calculate and graph TC knowing FC and VC
  - Calculate and graph marginal and average costs
  - Understand the relationship between marginal cost and average cost

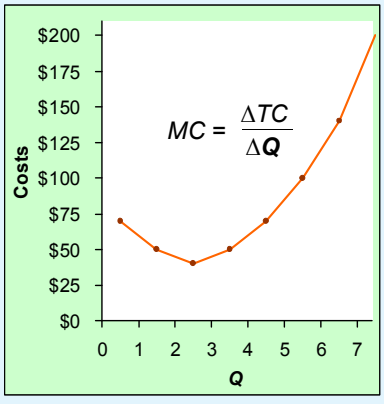
EXAMPLE 2: Costs: TC = FC + VC

Q	FC	VC	TC
0	$100	$0	$100
1	100	70	170
2	100	120	220
3	100	160	260
4	100	210	310
5	100	280	380
6	100	380	480
7	100	520	620



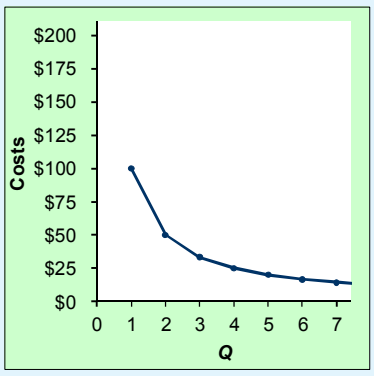
EXAMPLE 2: Marginal Cost

Q	TC	MC
0	$100	
1	170	$70
2	220	50
3	260	40
4	310	50
5	380	70
6	480	100
7	620	140



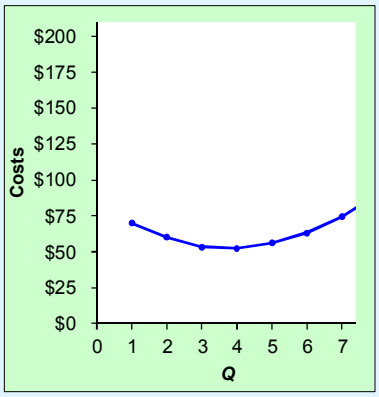
EXAMPLE 2: Average Fixed Cost, AFC

Q	FC	AFC
0	$100	n/a
1	100	$100
2	100	50
3	100	33.33
4	100	25
5	100	20
6	100	16.67
7	100	14.29



EXAMPLE 2: Average Variable Cost, AVC

Q	VC	AVC
0	$0	n/a
1	70	$70
2	120	60
3	160	53.33
4	210	52.50
5	280	56.00
6	380	63.33
7	520	74.29



EXAMPLE 2: Average Total Cost

Q	TC	ATC	AFC	AVC
0	$100	n/a	n/a	n/a
1	170	$170	$100	$70
2	220	110	50	60
3	260	86.67	33.33	53.33
4	310	77.50	25	52.50
5	380	76	20	56.00
6	480	80	16.67	63.33
7	620	88.57	14.29	74.29

Average total cost (ATC) equals total cost divided by the quantity of output:

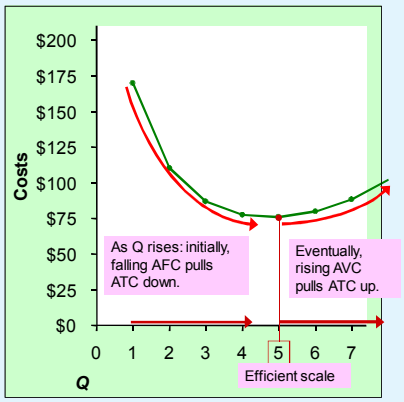
ATC = TC/Q

Also,

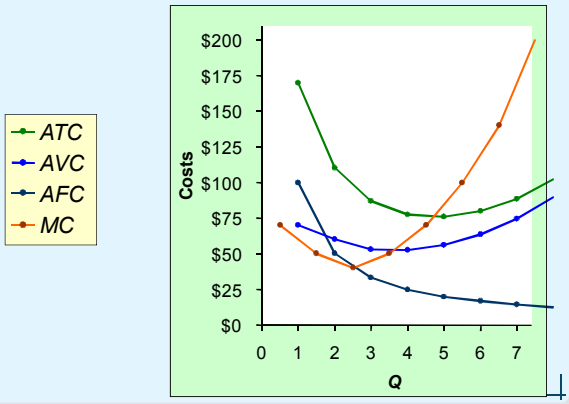
ATC = AFC + AVC

EXAMPLE 2: Average Total Cost, usually U-shaped

Q	TC	ATC
0	$100	n/a
1	170	$170
2	220	110
3	260	86.67
4	310	77.50
5	380	76
6	480	80
7	620	88.57



EXAMPLE 2: The Various Cost Curves Together

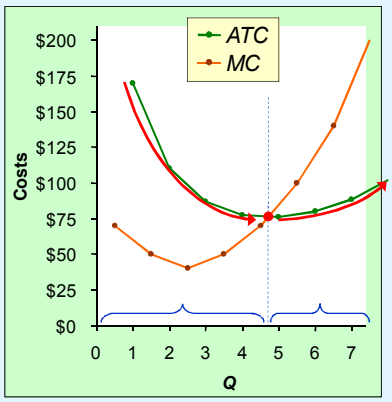


EXAMPLE 2: ATC and MC

When MC < ATC, ATC is falling.

When MC > ATC, ATC is rising.

The MC curve crosses the ATC curve at the ATC curve's minimum.



Active Learning 3 — Calculating costs

Fill in the blank spaces of this table.

Q	VC	TC	AFC	AVC	ATC	MC
0		$50	*n/a*	*n/a*	*n/a*	
1	10			$10	$60.00	$10
2	30	80				
3			16.67	20	36.67	30
4	100	150	12.50		37.50	
5	150			30		
6	210	260	8.33	35	43.33	60

Active Learning 3 — Answers

First, deduce *FC* = \$50 and use *FC* + *VC* = *TC*.

Q	*VC*	*TC*	*AFC*	*AVC*	*ATC*	*MC*
0	\$0	\$50	*n/a*	*n/a*	*n/a*	
1	10	60	\$50.00	\$10	\$60.00	\$10
2	30	80	25.00	15	40.00	20
3	60	110	16.67	20	36.67	30
4	100	150	12.50	25	37.50	40
5	150	200	10.00	30	40.00	50
6	210	260	8.33	35	43.33	60

Costs in the Short Run & Long Run

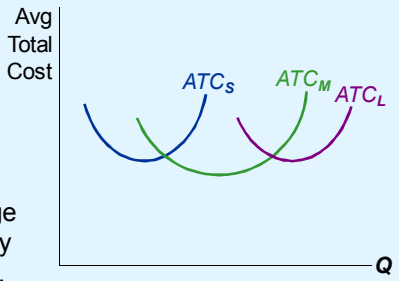
- Short run:
  - Some inputs are fixed (e.g., factories, land)
  - The costs of these inputs are FC
- Long run:
  - All inputs are variable (e.g., firms can build more factories or sell existing ones)
- In the long run
  - ATC at any Q is cost per unit using the most efficient mix of inputs for that Q (e.g., the factory size with the lowest ATC)

EXAMPLE 3: LRATC with 3 factory sizes

Firm can choose from three factory sizes: S, M, L.

Each size has its own SRATC curve.

The firm can change to a different factory size in the long run, but not in the short run.

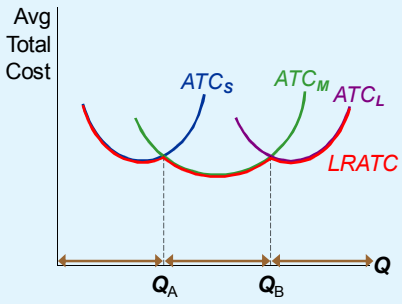


EXAMPLE 3: LRATC with 3 factory sizes

To produce less than Q_A, firm will choose size S in the long run.

To produce between Q_A and Q_B, firm will choose size M in the long run.

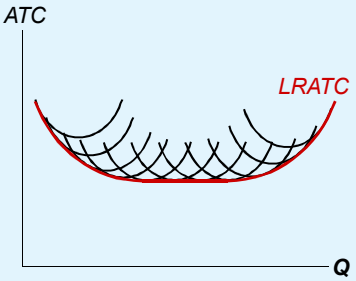
To produce more than Q_B, firm will choose size L in the long run.



A Typical LRATC Curve

In the real world, factories come in many sizes, each with its own SRATC curve.

So a typical LRATC curve looks like this:

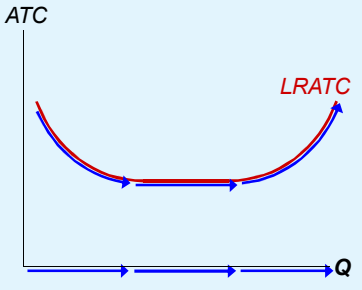


How ATC Changes as the Scale of Production Changes

Economies of scale: ATC falls as Q increases.

Constant returns to scale: ATC stays the same as Q increases.

Diseconomies of scale: ATC rises as Q increases.



Costs in Short and Long Run

- Economies of scale
  - Long-run average total cost falls as the quantity of output increases
    - Increasing specialization among workers
    - More common when Q is low
- Constant returns to scale
  - Long-run average total cost stays the same as the quantity of output changes

Costs in Short and Long Run

- Diseconomies of scale
  - Long-run average total cost rises as the quantity of output increases
  - Increasing coordination problems in large organizations.
    - E.g., management becomes stretched, can't control costs.
    - More common when Q is high.

Summary

- The goal of firms is to maximize profit, which equals total revenue minus total cost.
- When analyzing a firm's behavior, it is important to include all the opportunity costs of production.
  - Explicit: wages a firm pays its workers
  - Implicit: wages the firm owner gives up by working at the firm rather than taking another job
- Economic profit takes both explicit and implicit costs into account, whereas accounting profit considers only explicit costs.

Summary

- A firm's costs reflect its production process.
  - Diminishing marginal product: production function gets flatter as Q of an input increases
  - Total-cost curve gets steeper as the quantity produced rises.
- Firm's total costs = fixed costs + variable costs.
  - Fixed costs: do not change when the firm alters the quantity of output produced.
  - Variable costs: change when the firm alters the quantity of output produced.

Summary

- Average total cost is total cost divided by the quantity of output.
- Marginal cost is the amount by which total cost rises if output increases by 1 unit.
- Graph average total cost and marginal cost.
  - Marginal cost rises with the quantity of output.
  - Average total cost first falls as output increases and then rises as output increases further.
  - The marginal-cost curve always crosses the average total-cost curve at the minimum of average total cost

Summary

- A firm's costs often depend on the time horizon considered.
  - In particular, many costs are fixed in the short run but variable in the long run.
  - As a result, when the firm changes its level of production, average total cost may rise more in the short run than in the long run.