# Market Failure and Government

## AP Microeconomics ▪ Unit 6

AP Microeconomics

# Start with the decision and whose costs it includes

**A profitable factory and its neighbours**

Buyers value a chemical. Producing it uses labour and materials, but the smoke also harms people who did not buy it.

We will compare private and social choices, then test a policy's incentives and consequences.

# Start with the decision and whose costs it includes

**A profitable factory and its neighbours**

Buyers value a chemical. Producing it uses labour and materials, but the smoke also harms people who did not buy it.

A private profit calculation can leave out a real cost. Ask whether another unit benefits society more than it costs.

> We will compare private and social choices, then test a policy's incentives and consequences.

1

# Efficiency

# Should society produce another unit?

| Proposed extra unit | MSB | MSC | Decision |
|---|---|---|---|
| Unit A | \$70 | \$50 | Produce: net gain \$20 |
| Unit B | \$60 | \$60 | At the margin: net gain \$0 |
| Unit C | \$50 | \$70 | Do not add: net loss \$20 |

**Socially efficient** 社会有效率 means maximizing total net benefits, including effects on third parties.

> In the standard smooth model, the optimum is where MSB=MSC. Efficiency does not establish that the distribution is fair.

# Competition needs the right private incentives

**All costs and benefits included** Private benefit = social benefit. Private cost = social cost. The competitive equilibrium can maximize total surplus.

**Pollution left out** The supply price excludes a cost imposed on residents. Even competitive buyers and sellers can choose too much output.

> **Market failure** 市场失灵 concerns an inefficient allocation from private incentives. A change from yesterday's quantity is not enough to establish it.

# 2 Externalities

# Find the affected person and the missing marginal value

**Externality** 外部性: an uncompensated effect on a third party outside the transaction.

| Situation | Missing value | Social curve |
|---|---|---|
| Factory smoke harms neighbours | **Negative externality** 负外部性 in production | MSC above MPC |
| Vaccination protects others | **Positive externality** 正外部性 in consumption | MSB above MPB |
| Smoker's own health loss | Private effect on the user | Not automatically external |

Identify the affected side. Do not automatically put every externality on a cost curve.

# Pollution: calculate the market's private choice

**Known values: dollars per unit; Q per period**

MPB=MSB=$100 - Q$; MPC=$20 + Q$. External harm is \$20 per unit. Find the private equilibrium.

The private supply curve does not include the harm imposed on residents.

# Pollution: calculate the market's private choice

**Known values: dollars per unit; Q per period**

MPB=MSB=$100 - Q$; MPC=$20 + Q$. External harm is \$20 per unit. Find the private equilibrium.

Buyers and sellers equate their private marginal values:

$$MPB = MPC \qquad 100 - Q = 20 + Q$$

$$Q_m = (100 - 20)/2 = 40 \text{ units per period}$$

$$P_m = 100 - Q_m = 100 - 40 = \$60 \text{ per unit}$$

The private supply curve does not include the harm imposed on residents.

# Pollution: include the cost to residents

**Same market, social decision**

MSC=MPC+external cost=$40 + Q$; MSB=$100 - Q$. Which quantity maximizes total net benefit?

The market produces 10 units too many. The inefficient units are Q30 to Q40.

# Pollution: include the cost to residents

## Same market, social decision

MSC=MPC+external cost=$40 + Q$; MSB=$100 - Q$. Which quantity maximizes total net benefit?

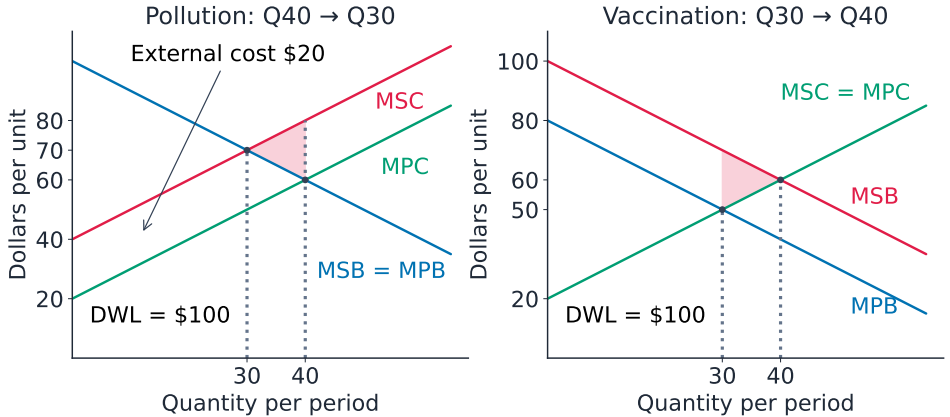
$$MSB = MSC \qquad 100 - Q = 40 + Q$$

$$Q^* = (100 - 40)/2 = 30 \text{ units per period}$$

At Q30, both social marginal values are \$70. At private Q40, MSC is \$80 but MSB only \$60.

> The market produces 10 units too many. The inefficient units are Q30 to Q40.

# Two externalities, two different social wedges




Pollution raises **MSC** 边际社会成本; vaccination raises **MSB** 边际社会收益. Shading marks lost net benefits.

# Deadweight loss is not the entire pollution bill

**Pollution case: private Q40, efficient Q30**

At Q40, social cost is \$80 and social benefit is \$60. Calculate the loss from the extra units.

Total external harm at Q40 is \$800. That is a different measure from the \$100 loss caused by overproduction.

# Deadweight loss is not the entire pollution bill

**Pollution case: private Q40, efficient Q30**

At Q40, social cost is \$80 and social benefit is \$60. Calculate the loss from the extra units.

$$DWL = \tfrac{1}{2}(Q_m - Q^*)[MSC(Q_m) - MSB(Q_m)]$$
$$DWL = \tfrac{1}{2}(40 - 30)(80 - 60) = \$100 \text{ per period}$$

Total external harm at Q40 is \$800. That is a different measure from the \$100 loss caused by overproduction.

# A corrective tax changes the private decision

A **Pigovian tax** 庇古税 matches marginal external harm at the efficient quantity. Here harm is constant at \$20 per unit.

**Attempt the policy calculation**

Effective supply becomes $20 + Q + 20$. Find quantity, buyer price and net seller price.

# A corrective tax changes the private decision

A **Pigovian tax** 庇古税 matches marginal external harm at the efficient quantity. Here harm is constant at \$20 per unit.

## Attempt the policy calculation

Effective supply becomes $20 + Q + 20$. Find quantity, buyer price and net seller price.

$$MPB = MPC + t \qquad 100 - Q = 20 + Q + 20$$

$$Q_t = (100 - 40)/2 = 30 \text{ units per period}$$

$$P_b = 100 - Q_t = 100 - 30 = \$70 \text{ per unit}$$

$$P_s = P_b - t = 70 - 20 = \$50 \text{ per unit}$$

# Track government revenue and remaining harm

**Government revenue**

$$R = tQ_t$$
$$R = 20(30) = \$600$$

**External harm remains**

$$H = 20Q_t$$
$$H = 20(30) = \$600$$

Efficient output is not zero pollution. The tax removes units whose social cost exceeds social benefit; it does not remove every harmful unit.

# Count transfers once when comparing social surplus

| Per period | Before tax | After tax |
|---|---|---|
| Consumer surplus | \$800 | \$450 |
| Producer surplus | \$800 | \$450 |
| Government revenue | \$0 | \$600 |
| External harm | −\$800 | −\$600 |
| Social net benefit | \$800 | \$900 |

The gain is \$100: the DWL removed. Government revenue is a transfer, not an additional resource loss.

# Vaccination: identify the missing benefit

**Separate market; Q per period, dollars per unit**

MPB=$80 - Q$; MPC=MSC=$20 + Q$; external benefit 20. Thus MSB=$100 - Q$.

Underproduction loses benefits to others. MSC=MPC in this case.

# Vaccination: identify the missing benefit

**Separate market; Q per period, dollars per unit**

MPB=$80 - Q$; MPC=MSC=$20 + Q$; external benefit 20. Thus MSB=$100 - Q$.

**Private equilibrium**

$$MPB = MPC$$
$$80 - Q = 20 + Q$$
$$Q_m = (80 - 20)/2 = 30$$

**Efficient quantity**

$$MSB = MSC$$
$$100 - Q = 20 + Q$$
$$Q^* = (100 - 20)/2 = 40$$

Underproduction loses benefits to others. MSC=MPC in this case.

# Calculate the loss from missing vaccinations

**Known: private Q30, efficient Q40**

Marginal external benefit is 20 dollars per unit. Use the social curves to calculate the loss over the ten missing units.

Count the net social benefit of the missing units, not all external benefits of the good.

# Calculate the loss from missing vaccinations

**Known: private Q30, efficient Q40**

Marginal external benefit is 20 dollars per unit. Use the social curves to calculate the loss over the ten missing units.

$$DWL = \frac{1}{2}(Q^* - Q_m)(MSB - MPB)$$
$$DWL = \frac{1}{2}(40 - 30)(20) = \$100 \text{ per period}$$

Count the net social benefit of the missing units, not all external benefits of the good.

# A subsidy changes the quantity exchanged

**Vaccination market; consumer subsidy 20 dollars per unit**

MPB$=80-Q$; MPC$=20+Q$. Find Q after a consumer subsidy 20.

Subsidy 20 reaches efficient Q40 here. Next, identify buyer and seller prices.

# A subsidy changes the quantity exchanged

**Vaccination market; consumer subsidy 20 dollars per unit**

MPB=$80 - Q$; MPC=$20 + Q$. Find Q after a consumer subsidy 20.

$$
\begin{aligned}
MPB + s &= MPC \\
80 - Q + 20 &= 20 + Q \\
Q_{sub} &= (100 - 20)/2 = 40 \text{ units per period}
\end{aligned}
$$

Subsidy 20 reaches efficient Q40 here. Next, identify buyer and seller prices.

# Keep buyer price, seller price and fiscal cost separate

Known: Q40, subsidy 20; supply $20 + Q$. The seller receives 20 more per unit than the buyer pays.

$$P_s = 20 + Q_{sub} = 20 + 40 = \$60 \text{ per unit}$$
$$P_b = P_s - s = 60 - 20 = \$40 \text{ per unit}$$

$$G = sQ_{sub} = 20(40) = \$800$$

fiscal cost per period

Fiscal cost 800 is a different measure from the DWL100 removed. Do not call both prices simply "the price".

# Does a price ceiling achieve the same result?

**Same vaccination market; ceiling \$40 instead**

MPB$=80-Q$; supply$=20+Q$. Find quantity demanded and quantity supplied at the ceiling.

A lower legal price alone does not create the sellers' incentive provided by the subsidy.

# Does a price ceiling achieve the same result?

**Same vaccination market; ceiling $40 instead**

MPB$=80-Q$; supply$=20+Q$. Find quantity demanded and quantity supplied at the ceiling.

$$Q_d = 80 - P = 80 - 40 = 40 \text{ units per period}$$
$$Q_s = P - 20 = 40 - 20 = 20 \text{ units per period}$$

Without another source of supply, only 20 units can be exchanged, below efficient Q40.

A lower legal price alone does not create the sellers' incentive provided by the subsidy.

# Choose a policy by the incentive it changes

| Tool | What changes? | What needs checking? |
|---|---|---|
| Emissions charge | Makes pollution costly; rewards cleaner methods | Marginal harm, monitoring |
| Regulation | Restricts activity or requires a method | Compliance and real costs |
| Tradable permits | Caps emissions; allows trading | Cap, enforcement, trading conditions |
| Public provision | Expands access or supplies a service | Benefits, resource cost, funding |

An output tax and an emissions charge are different tools when the firm can change pollution per unit.

# Bargaining: who has the right, and can agreement work?

**A factory and nearby households**

The parties might agree on compensation or cleaner production. What could prevent a mutually beneficial agreement?

Rights affect who pays whom. Under the theorem's assumptions, bargaining can reach an efficient activity level; it does not promise costless agreement in every real case.

# Bargaining: who has the right, and can agreement work?

**A factory and nearby households**

The parties might agree on compensation or cleaner production. What could prevent a mutually beneficial agreement?

The **Coase theorem** 科斯定理 relies on clear rights and sufficiently low transaction costs. Many affected households, costly information or weak enforcement can obstruct agreement.

> Rights affect who pays whom. Under the theorem's assumptions, bargaining can reach an efficient activity level; it does not promise costless agreement in every real case.

# 3 Public and private goods

# Classify the service using both properties

**Rivalry** 竞争性: does one person's use reduce availability to others?
**Excludability** 排他性: can non-payers be kept out?

| Service | Rival? | Excludable? |
|---|---|---|
| Sandwich | Yes | Yes |
| Noncongested paid stream | No | Yes |
| Open-access ocean fish | Yes | No |
| Nonexcludable warning signal | No | No |

A **private good** 私人物品 has both properties; a **public good** 公共物品 has neither. Public funding is a different question.

# Why a valuable public project may lack finance

**One neighbourhood warning project**

Cost \$50. Three households value the single project at \$30, \$20 and \$10. Is the project worthwhile? Would one household want to pay the full cost alone?

Collective financing may provide a worthwhile project. Donations can sometimes work; "nobody ever pays" is not a definition of public goods.

# Why a valuable public project may lack finance

**One neighbourhood warning project**

Cost \$50. Three households value the single project at \$30, \$20 and \$10. Is the project worthwhile? Would one household want to pay the full cost alone?

Total benefit is \$60, exceeding cost by \$10. Each household values it less than paying \$50 alone. Non-payers can enjoy the signal and **free-ride** 搭便车.

> Collective financing may provide a worthwhile project. Donations can sometimes work; "nobody ever pays" is not a definition of public goods.

# Shared resources and free public services are different

**Open-access fishing Common resources** 公共资源 are rival and non-excludable. An extra catch can leave less stock for others. The **tragedy of the commons** 公地悲剧 is inefficient overuse under these incentives.

**A publicly funded school place** It uses limited classroom capacity, and access can be controlled. Government finance does not make the service non-rival and non-excludable.

> Access rights, quotas and community rules can change common-resource incentives. Classification depends on the actual service and access rules.

# 4 Government intervention

# Can the same tax help one market and harm another?

Both cases have demand $100 - Q$ and private supply $20 + Q$. A **per-unit tax** 从量税 of \$20 lowers private output from Q40 to Q30.

| Starting conditions | Efficient Q | Tax Q | Welfare effect |
|---|---|---|---|
| Pollution cost \$20/unit | 30 | 30 | Removes DWL \$100 |
| No external effects | 40 | 30 | Creates DWL \$100 |

Identify the social curves first. A tax does not universally create an additional efficiency loss.

# A fixed charge and a marginal charge affect different choices

**Lump-sum tax** 定额税 A fixed charge lowers profit but leaves MC and MR unchanged. A continuing firm's interior short-run operating choice can stay the same.

**Lump-sum subsidy** 定额补贴 A fixed payment raises profit without directly changing marginal incentives. Participation, entry and exit can still change.

> Do not extend a conditional short-run firm result into a promise of unchanged industry output forever. Demand and MR changes also matter.

# Natural monopoly: reuse the Unit 4 network model

**Given values per period**

Demand $P = 100 - Q$; $MR = 100 - 2Q$; $TC = 1200 + 20Q$; $MC = 20$.

ATC$=1200/Q + 20$ declines over the demand range: splitting output can sacrifice economies of scale.

# Natural monopoly: reuse the Unit 4 network model

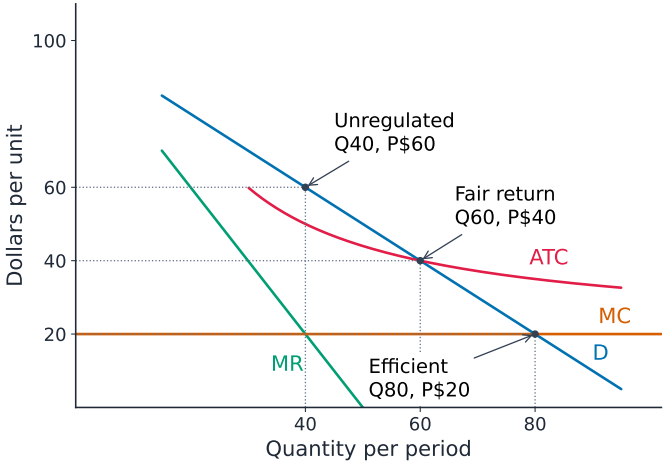
## Given values per period

Demand $P = 100 - Q$; $MR = 100 - 2Q$; $TC = 1200 + 20Q$; $MC = 20$.

$$MR = MC: \quad 100 - 2Q = 20 \;\Rightarrow\; Q_m = 40$$
$$P_m = 100 - Q_m = 100 - 40 = \$60 \text{ per unit}$$
$$\pi = P_m Q_m - TC(Q_m) = 60(40) - [1200 + 20(40)] = \$400$$

ATC$=1200/Q + 20$ declines over the demand range: splitting output can sacrifice economies of scale.

# Regulation changes price, output and the funding question




Unregulated: Q40/P60.

Fair return: Q60/P40.

Efficient: Q80/P20.

P=ATC covers costs. P=MC reaches efficient output here, but leaves a loss.

# Test whether the proposed ceiling actually binds

**Same network: unregulated price 60, quantity 40**

A ceiling 80 is legal. Must the firm charge 80? Now compare a ceiling 40.

D and ATC also meet at Q20/P80, but a ceiling 80 does not force that choice. Test the firm's incentives.

# Test whether the proposed ceiling actually binds

**Same network: unregulated price 60, quantity 40**

A ceiling 80 is legal. Must the firm charge 80? Now compare a ceiling 40.

| Ceiling | Binds? | Resulting choice |
|---|---|---|
| 80 | No | Existing P60/Q40 remains legal |
| 40 | Yes | Sell up to Q60 at price 40 |

At price 40, another unit adds revenue 40 and costs 20 up to Q60. Expanding to Q60 covers total cost.

D and ATC also meet at Q20/P80, but a ceiling 80 does not force that choice. Test the firm's incentives.

# Zero profit does not eliminate deadweight loss

| Policy | Q | P | Profit | DWL |
|---|---|---|---|---|
| Unregulated | 40 | \$60 | \$400 | \$800 |
| Fair-return price | 60 | \$40 | \$0 | \$200 |
| Marginal-cost price | 80 | \$20 | $-\$1200$ | \$0 |

At Q80: revenue$=20(80) = 1600$ and cost$=1200 + 20(80) = 2800$. A fixed subsidy 1200 covers the loss if efficient service is provided.

Fair return still underproduces. Efficient pricing requires a funding decision; evaluate its real and administrative costs.

# Test a per-unit policy against the fixed-charge result

**Same unregulated network firm**

A fixed tax 400 lowers profit from 400 to 0 at Q40/P60. Instead impose a tax 10 on each unit. Find the new operating choice.

Subsidy 10 instead gives Q45/P55, still below efficient Q80.

# Test a per-unit policy against the fixed-charge result

## Same unregulated network firm

A fixed tax 400 lowers profit from 400 to 0 at Q40/P60. Instead impose a tax 10 on each unit. Find the new operating choice.

$$MR = MC + t \qquad 100 - 2Q = 20 + 10$$

$Q_t = (100 - 30)/2 = 35$ units per period

$P_t = 100 - Q_t = 100 - 35 = \$65$ per unit

Subsidy 10 instead gives Q45/P55, still below efficient Q80.

# Choose the comparison before recommending policy

**A proposed merger or regulated price**

What market failure does it address? What incentive changes? What real costs or funding needs follow?

**Antitrust laws** 反垄断法 aim to limit anticompetitive mergers and collusion. More competition can help, but economies of scale also matter.

Under a price ceiling the firm's revenue schedule changes. Derive the constrained choice; do not keep the old monopoly MR curve unchanged.

# 5 Inequality

# Income, wealth, inequality and poverty answer different questions

**Two households**

A earns $100,000 this year and has net assets $50,000. B earns $80,000 and has net assets $1,000,000. Which has greater income? Which has greater wealth?

Inequality compares shares. Poverty concerns a living-standard threshold. Neither current income nor inequality alone establishes the others.

# Income, wealth, inequality and poverty answer different questions

**Two households**

A earns $100,000 this year and has net assets $50,000. B earns $80,000 and has net assets $1,000,000. Which has greater income? Which has greater wealth?

A has the greater current income flow. B has the greater wealth stock. The **income distribution** 收入分配 describes income shares over a stated period.

> Inequality compares shares. Poverty concerns a living-standard threshold. Neither current income nor inequality alone establishes the others.

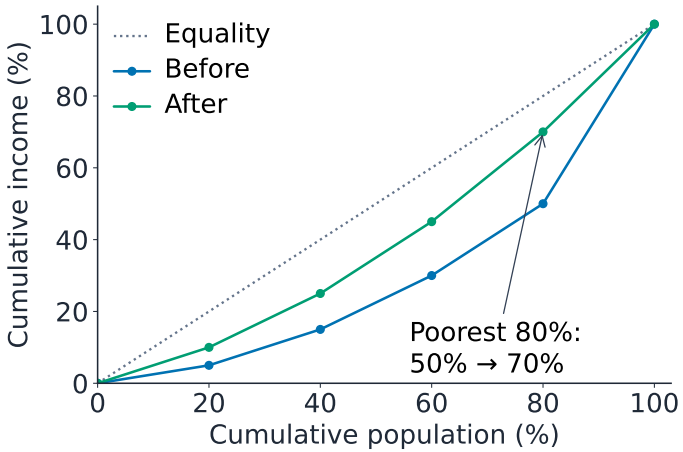
# Read all five groups before comparing distributions

Five equally sized groups, ordered from lowest to highest income. These are illustrative shares, not a policy forecast.

| Group | Before | After |
|---|---|---|
| First fifth | 5% | 10% |
| Second fifth | 10% | 15% |
| Third fifth | 15% | 20% |
| Fourth fifth | 20% | 25% |
| Fifth fifth | 50% | 30% |

Before revealing the graph: what shares do the poorest 40% and poorest 80% receive in each distribution?

# Interpret the Lorenz curve; no Gini calculation required




The **Lorenz curve** 洛伦兹曲线 shows cumulative income against cumulative population.
Poorest 40%:15%→25%.

Poorest 80%:50%→70%.
The after curve is closer to

equality and does not cross the before curve.

# What an inequality measure can and cannot establish

**Gini coefficient** 基尼系数: zero represents equality; values closer to one represent more inequality under the usual nonnegative-income convention.

**A claim to evaluate**

"The poorest 20% receive 5% and the richest 20% receive 50%, so the Gini coefficient is exactly 0.6."

Use comparable definitions and populations. AP requires interpreting these measures, not drawing Lorenz curves or calculating Gini coefficients.

# What an inequality measure can and cannot establish

**Gini coefficient** 基尼系数: zero represents equality; values closer to one represent more inequality under the usual nonnegative-income convention.

**A claim to evaluate**

"The poorest 20% receive 5% and the richest 20% receive 50%, so the Gini coefficient is exactly 0.6."

Reject the exact number: these two shares do not specify the entire distribution. A city photograph gives even less numerical evidence.

Use comparable definitions and populations. AP requires interpreting these measures, not drawing Lorenz curves or calculating Gini coefficients.

# Tax progression depends on the average share, not dollars alone

**Calculate average tax rates**

Income \$10,000: tax \$1,000. Income \$40,000: tax \$8,000. Is the tax progressive?

A fixed 1000 levy instead takes 10% and 2.5%: regressive average burdens. Marginal brackets are not rates on every dollar of income.

# Tax progression depends on the average share, not dollars alone

**Calculate average tax rates**

Income \$10,000: tax \$1,000. Income \$40,000: tax \$8,000. Is the tax progressive?

$$ATR_L = (T_L/Y_L)100\% = (1000/10000)100\% = 10\%$$
$$ATR_H = (T_H/Y_H)100\% = (8000/40000)100\% = 20\%$$

**Progressive taxes** 累进税 take a higher average share as income rises.

A fixed 1000 levy instead takes 10% and 2.5%: regressive average burdens. Marginal brackets are not rates on every dollar of income.

# Explain inequality without an unsupported ranking of causes

**Human capital** 人力资本 includes education and skills. Inheritance, discrimination, social networks, access to finance, mobility and bargaining power can also affect outcomes.

## Two possible effects of redistribution

A poorly designed benefit can weaken work incentives. Better access to health care or training can improve participation and productivity.

**Transfer payments** 转移支付 change disposable income without paying for current production.

> The **efficiency–equity trade-off** 效率与公平权衡 is a possible tension. Evaluate a specific design; do not assume every redistribution reduces efficiency.

# 6 Apply and retrieve

# Build a complete externality answer

1. Identify the third-party effect and the relevant private and social curves.
2. Find the private and efficient quantities from the correct intersections.
3. Show the loss over the inefficient units using the social curves.
4. Test a policy: quantity, buyer/seller prices, fiscal effects and remaining harm.

> The tax, subsidy and ceiling cases teach different incentives. Choose the model that matches the question.

# Check yourself

1. Why can a competitive market still overproduce?
2. Does a fixed tax necessarily reduce a continuing firm's short-run output?
3. Does zero economic profit establish efficient monopoly output?

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1. Why can a competitive market still overproduce?
2. Does a fixed tax necessarily reduce a continuing firm's short-run output?
3. Does zero economic profit establish efficient monopoly output?

1. Private supply may omit external harm. 2. No: MR and MC can remain unchanged; check participation. 3. No: fair-return Q60 still falls short of efficient Q80 in our network model.