

Market Failure

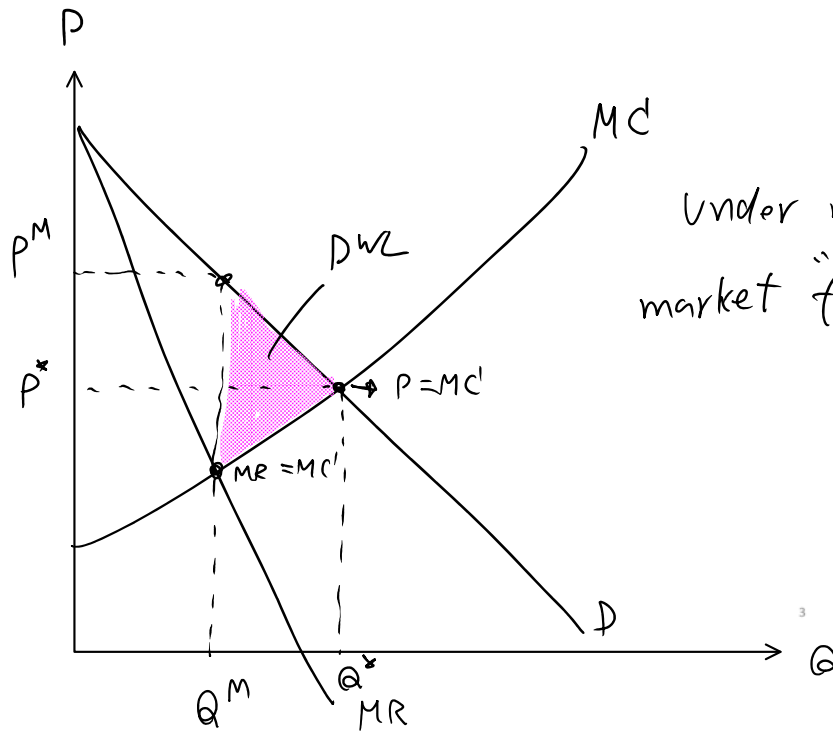
Monopoly ✓

Externalities

Public Goods

Asymmetric Information

Monopoly



Under monopoly,
market "fails" to deliver Q^* .

Externalities

“sic utere tuo ut alienum
non laedas”

“do not use your property in such a way as
to injure another”

Externality Defined

- An externality is present when the activity of one entity (person or firm) directly affects the welfare of another entity in a way that is outside the market mechanism.
 - **Negative externality:** These activities impose damages on others.
 - **Positive externality:** These activities benefits on others.

Examples of Externalities

• Negative Externalities

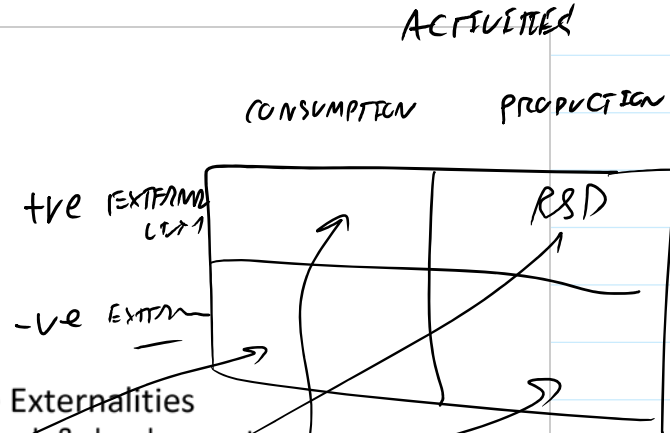
- Pollution
- Cell phones in a movie theater
- Congestion on the internet
- Drinking and driving
- Student cheating that changes the grade curve
- The "Club" anti-theft device for automobiles

• Positive Externalities

- Research & development
- Vaccinations
- A neighbor's nice landscape
- Students asking good questions in class
- The "LoJack" anti-theft device for automobiles

• Not Considered Externalities

- Land prices rising in urban area
- Known as "pecuniary" externalities



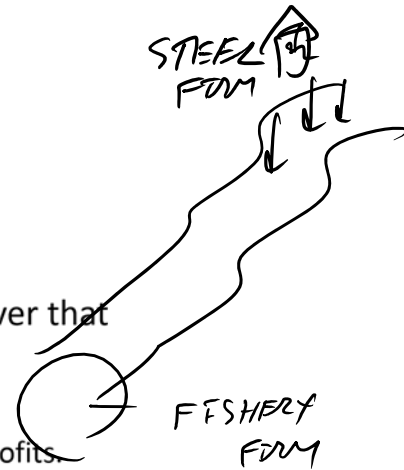
Nature of Externalities

A GUY IS SMOKING AT THE
COMMON AREA...

- Arise because there is no market price attached to the activity
- Can be produced by people or firms
- Can be positive or negative
- Public goods are special case
 - Positive externality's full effects are felt by everyone in the economy — LATER ...

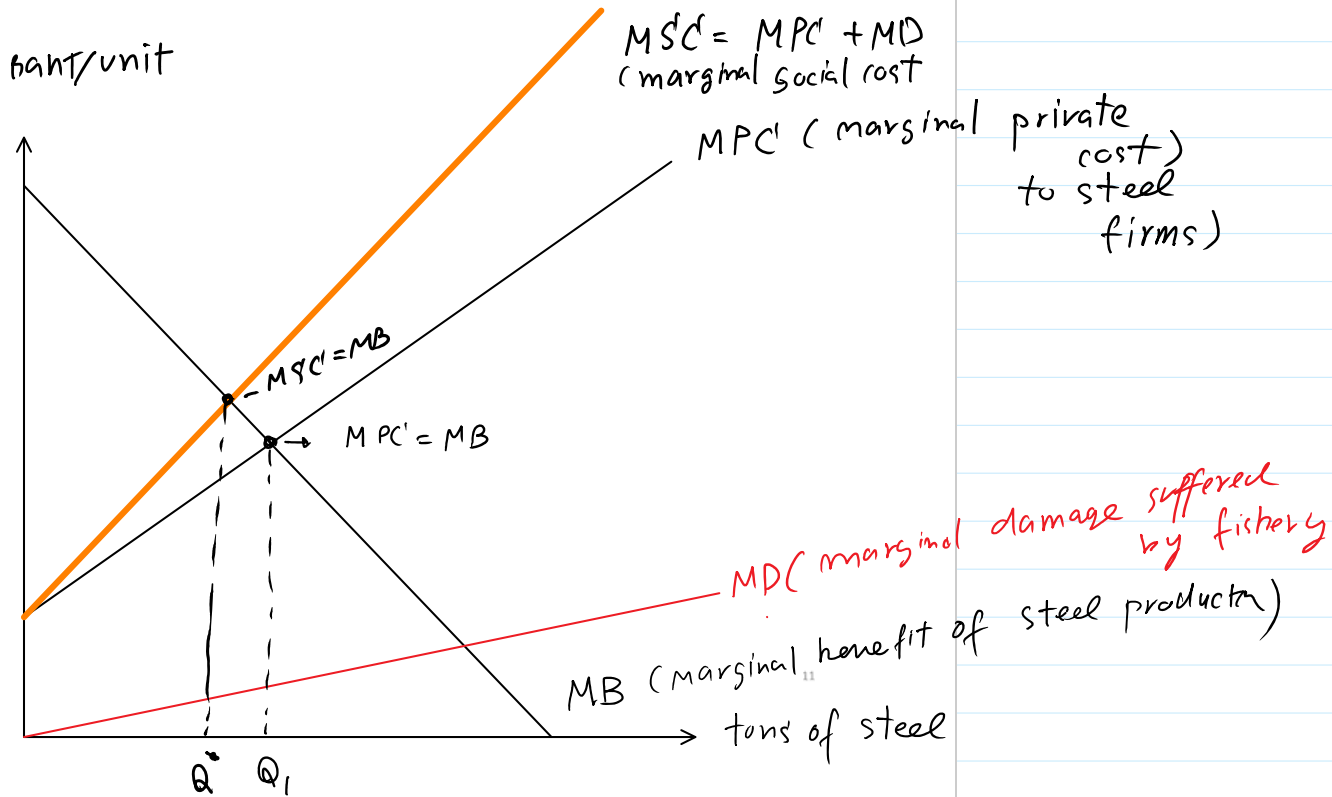
Graphical Analysis: Negative Externalities

- For simplicity, assume that a steel firm dumps pollution into a river that harms a fishery downstream.
- Competitive markets, firms maximize profits
 - Note that steel firm only cares about its own profits, not the fishery's profits.
 - Fishery only cares about its profits, not the steel firm's profits.



Graphical Analysis, continued

- MB = marginal benefit to steel firm
- MPC = marginal *private* cost to steel firm
- MD = marginal damage to fishery
- MSC = MPC+MD = marginal *social* cost



Result #1

Steel firm produces $Q = Q_1$, which is more than Q^* , a socially desirable level where $MSC = MB$.

In short, steel firm produces "too much".

Graphical Analysis, continued

- From Figure 1, as usual, the steel firm maximizes profits at **$MB=MPC$** . This quantity is denoted as Q_1 in the figure.
- Social welfare is maximized at **$MB=MSC$** , which is denoted as Q^* in the figure.

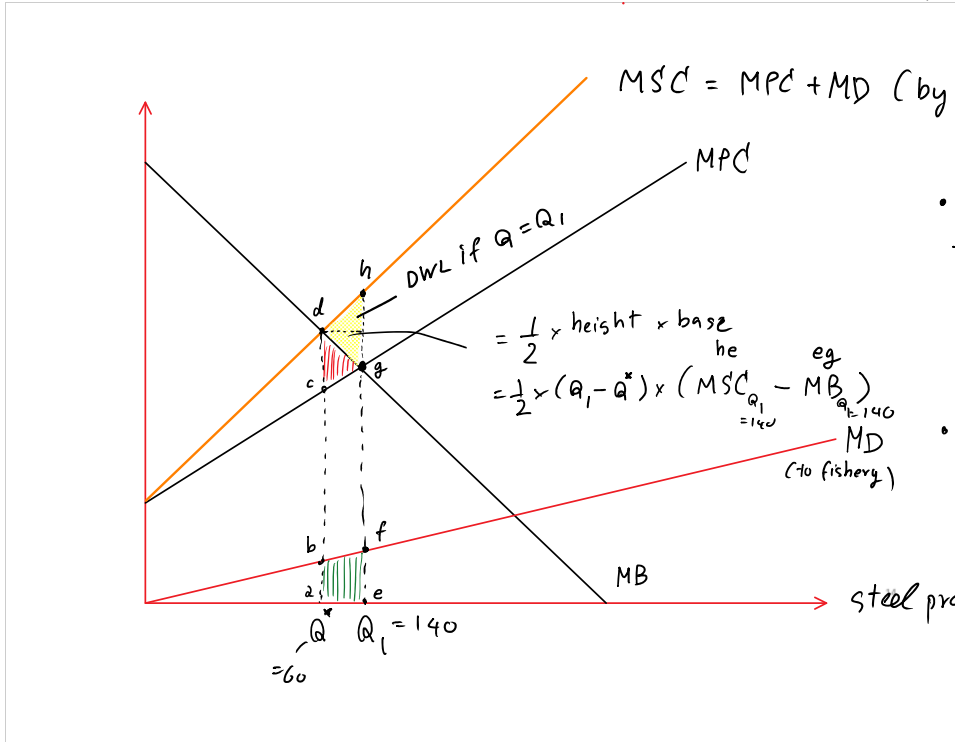
Graphical Analysis, Implications

- **Result 1:** $Q_1 > Q^*$
 - Steel firm privately produces “*too much*” steel, because it does not account for the damages to the fishery.
- **Result 2:** Fishery’s preferred amount is 0.
 - Fishery’s damages are minimized at $MD=0$.
- **Result 3:** Q^* is not the preferred quantity for either party, but is the best (where
- **Result 4:** Socially efficient level entails some pollution.
 - Zero pollution is not socially desirable.

$$= MPC' + MD$$

↑

$$MSC' = MB$$



- If steel firm is forced to move from Q_1 to Q^* , it would lose dce and fishery would gain $abfe$
- Since Gains to fishery $>$ losses to Steel firm, (= $abfe$) (= dce) or = $cdhg$) then moving from Q_1 to Q^* steel production improves "EFFICIENCY" OR reduces $DWL (= d h g)$

Graphical Analysis, Intuition

- In Figure 2, loss to steel firm of moving to Q^* is shaded triangle ***dcg***.
 - This is the area between the MB and MPC curve going from Q_1 to Q^* .
- Fishery gains by an amount ***abfe***.
 - This is the area under the MD curve going from Q_1 to Q^* . By construction, this equals area ***cdhg***.
- Difference between fishery's gain and steel firm's loss is the efficiency loss from producing Q_1 instead of Q^* .

Numerical Example: Negative Externalities

- Assume the steel firm faces the following MB and MPC curves:

$$MB = 300 - Q$$

$$MPC = 20 + Q$$

Assume the fishery faces the following MD curve:

$$MD = 40 + 2Q$$

For steel firm, profit maximizing output level arises at Q where

$$MB = MPC :$$

$$300 - Q_1 = 20 + Q_1$$

$$2Q_1 = 280$$

$$Q_1 = 140$$

However, socially desirable output level occurs at Q where

$$MB = MSC'$$

$$\downarrow$$

$$MPC + MD$$

$$300 - Q = \underbrace{20 + Q}_{MPC} + \underbrace{(40 + 2Q)}_{MD}$$

$$Q^* = 60$$

If producing Q_1 , $DWL = ?$

$$DWL = \frac{1}{2} \times (Q_1 - Q^*) \times (MSC'_{Q_1=140} - MB_{Q_1=140})$$

$$= \frac{1}{2} (140 - 60) \times (480 - 160)$$

$$= 12,800 \$ \text{ (size of DWL)}$$

Numerical Example, continued

- The steel firm therefore chooses Q_1 :

- The socially efficient amount is instead Q^* :

$$MB = MSC = MPC + MD$$

Numerical Example, continued

- The deadweight loss of steel firm choosing $Q_1=140$ is calculated as the triangle between the MB and MSC curves from Q_1 to Q^* .

In Figure 2, this corresponds to area *dhg*.

Numerical Example, continued

By moving to Q^* the fishery reduces its damages by an amount equal to the trapezoid under the MD curve from Q_1 to Q^* .

By moving to Q^* the steel firm loses profits equal to the triangle between the MB and MPC curve from Q_1 to Q^* .

Private Responses

- Coase Theorem
- Mergers
- Social conventions

Externalities and Property Rights



Ronald H. Coase
United Kingdom
University of Chicago
Chicago, IL, USA
b. 1910

Ronald Coase is an emeritus professor at the University of Chicago Law School.

“The Problem of Social Cost,” *Journal of Law & Economics*, 3, (October 1960)



The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 1991

"for his discovery and clarification of the significance of transaction costs and property rights for the institutional structure and functioning of the economy"

http://nobelprize.org/nobel_prizes/economics/laureates/1991/

Coase Theorem

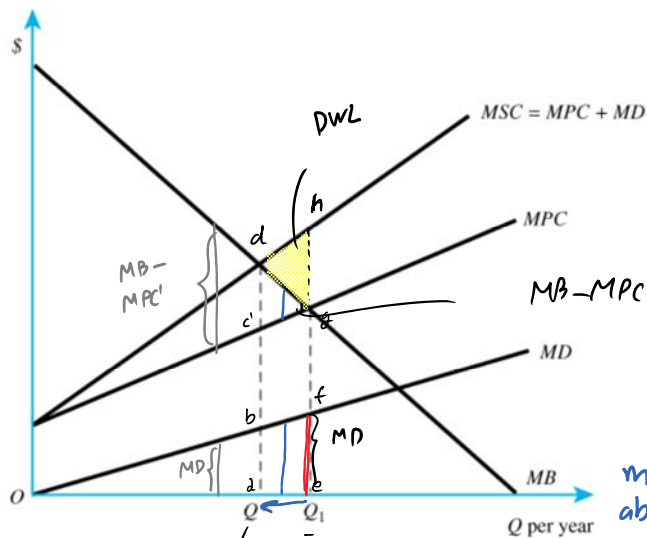
- Insight: root of the inefficiencies from externalities is the absence of property rights.
- The **Coase Theorem** states that once property rights are established and transaction costs are small, then one of the parties will bribe the other to attain the socially efficient quantity. * *
- The socially efficient quantity is attained *regardless* of to whom the property rights were initially assigned.

Illustration of the Coase Theorem

- Recall the steel firm/fishery example. If the steel firm were assigned property rights, it would **initially produce Q_1** , which maximizes its profits.
- If the fishery were assigned property rights, it would **initially mandate zero production**, which minimizes its damages.

Figure 3

CASE 1: STEEL FIRM OWNS THE RIVER.



when $MD = (MB - MPC')$ bargaining stops,

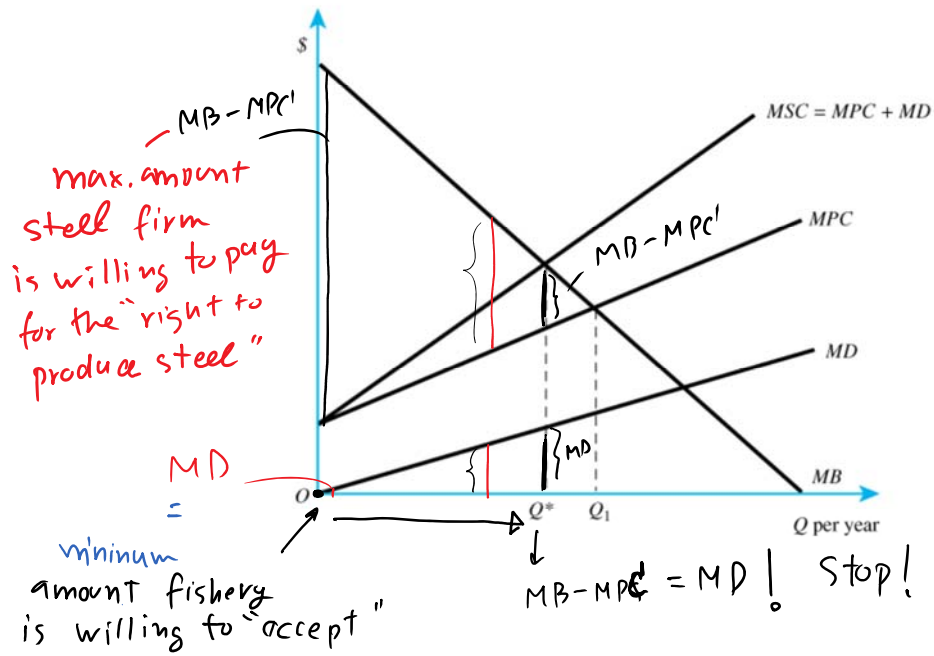
As long as $MD > MB - MPC'$

maximum amount of money fishery is willing to pay to steel firm

minimum payment steel firm would accept

the bribery process continues

Figure 3 CASE 2 FISHERY OWNS RIVER . . .



Coase Theorem: Assign Property Rights to Steel Firm

- Consider the effects of the steel firm reducing production in the direction of the socially efficient level, Q^* . This entails a cost to the steel firm and a benefit to the fishery:
 - The steel firm (and its customers) would lose surplus between the MB and MPC curves between Q_1 and Q_1-1 , while the fishery's damages are reduced by the area under the MD curve between Q_1 and Q_1-1 .
 - Note that the marginal loss in profits is extremely small, because the steel firm was profit maximizing, while the reduction in damages to the fishery is substantial.
 - A bribe from the fishery to the steel firm could therefore make all parties better off.

Coase Theorem: Assign Property Rights to Steel Firm

- When would the process of bribes (and pollution reduction) stop?
 - When the parties no longer find it beneficial to bribe.
 - The fishery will not offer a bribe larger than its MD for a given quantity, and the steel firm will not accept a bribe smaller than its loss in profits (MB-MPC) for a given quantity.
 - Thus, the quantity where $MD=(MB-MPC)$ will be where the parties stop bribing and reducing output.
 - Rearranging, $MC+MPC=MB$, or $MSC=MB$, which is equal at Q^* , the socially efficient level.

Coase Theorem: Assign Property Rights to Fishery

- Similar reasoning follows when the fishery has property rights, and initially allows zero production.
 - The fishery's damages are increased by the area under the MD curve by moving from 0 to 1. On the other hand, the steel firm's surplus is increased.
 - The increase in damages to the fishery is initially very small, while the gain in surplus to the steel firm is large.
 - A bribe from the steel firm to the fishery could therefore make all parties better off.

Coase Theorem: Assign Property Rights to Fishery

- When would the process of bribes now stop?
 - Again, when the parties no longer find it beneficial to bribe.
 - The fishery will not accept a bribe smaller than its MD for a given quantity, and the steel firm will not offer a bribe larger than its gain in profits (MB-MPC) for a given quantity.
 - Again, the quantity where $MD=(MB-MPC)$ will be where the parties stop bribing and reducing output. This still occurs at Q^* .

When Is the Coase Theorem Relevant?

- Low transaction costs
 - Few parties involved
- Source of externality well defined
- Example: Several firms with pollution
- Not relevant with high transaction costs or ill-defined externality
- Example: Air pollution

Public Responses

- Taxes
- Emission Fee
- Emission Standard
- Cap and Trade

As

A.C' Pigou

↓

TAX

Vs. Coase

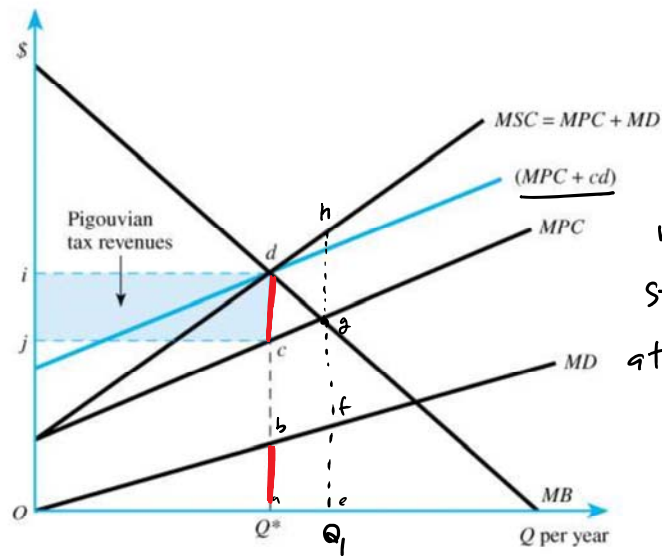
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NO NEED

Taxes

- Again, return to the steel firm/fishery example.
- Steel firm produces inefficiently because the prices for inputs incorrectly signal social costs. Input prices are too low. Natural solution is to levy a tax on a polluter.
- A **Pigouvian tax** is a tax levied on each unit of a polluter's output in an amount just equal to the marginal damage it inflicts at the efficient level of output.

Figure 5.4



W/ TAX,
 Steel firm produces
 at Q where
 $MPC' + TAX = MB!$
 $= cd$ baht/unit

cd must be equal to \sim MD evaluated at Q^* !
 Then, Q^* will be achieved. #

Numerical Example: Pigouvian Taxes

- Returning to the numerical example:

$$MB = 300 - Q$$

$$MPC = 20 + Q$$

$$MD = 40 + 2Q$$

Recall that $Q_1=140$ and $Q^*=60$.

$$Q^s = 60$$

Numerical Example: Pigouvian Taxes

- Setting $t=MD(60)$ gives $t=160$. The firm now sets $MB=MPC+t$, which then yields Q^* .

$$MB = MPC + t$$

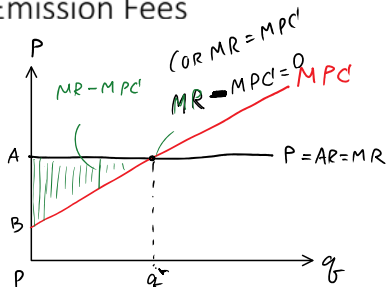
$$\Rightarrow 300 - Q = 20 + Q + t$$

$$\Rightarrow 300 - Q = 20 + Q + \underline{160}$$

$$\Rightarrow 120 = 2Q$$

$$\Rightarrow Q = 60$$

Emission Fees



B/f Emission fees are discussed, we have to understand some key terms:

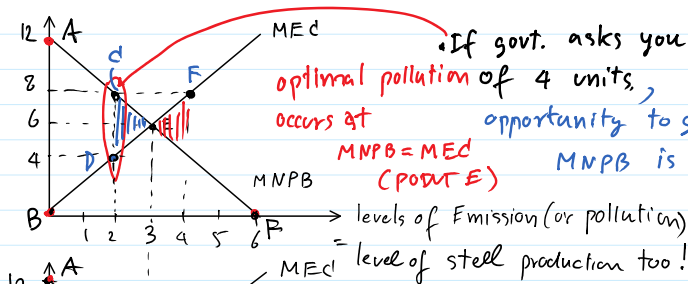
- Marginal Net Private Benefits (MNPB)
- Marginal External Cost (MEC)
- Marginal Abatement Cost (MAC)

Consider a competitive firm who produces and also pollutes...

Suppose that 1 unit of steel generates 1 unit of pollution

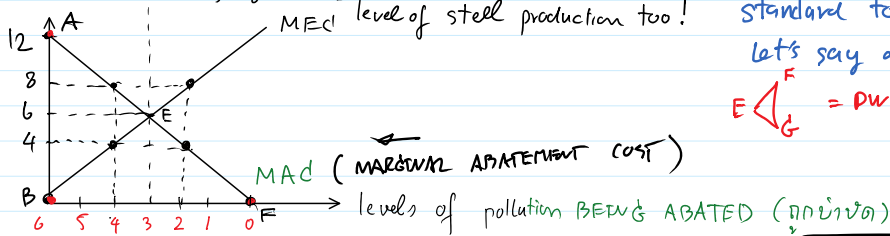
Profit is max when $MNPB$ (or $MR-MPC$) = 0! (1:1)

UMR: x 1000 baht



If govt. asks you to do abatement optimal pollution of 4 units, society will lose opportunity to get more good since MNPB is still higher than MEC (POINT E)

If govt. sets pollution standard too loose, let's say at 4 units, $E \triangle F = DWL$



Conclusion

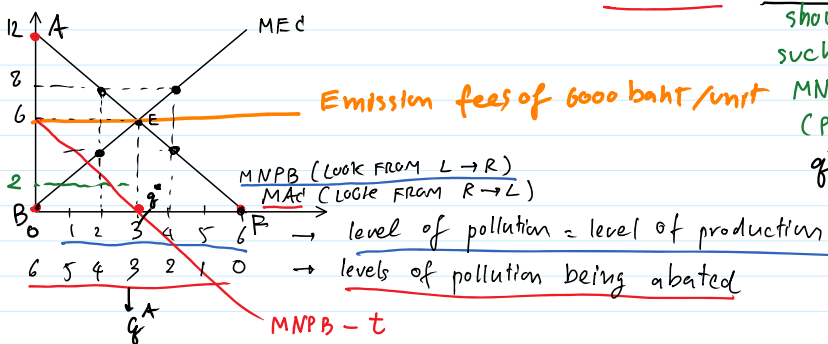
Emission standard

should be set such that $MNPB = MEC$ (POINT E)

$q^* = 3$ units (level of good produced)

= level of pollution allowed)

$q^A = 3$ units. (level of pollution abatement)



How about Emission fees or Emission taxes?

Let's use the diagram above to explain...

When govt imposes $t^* = 6000$ baht/unit of pollution generated,

the producer will take into a/c the Line "MNPB - t"
 instead of Line MNPB when he makes a production decision.

Then he will produce at $q^* = 3$ where $MNPB - t^* = 0$

he produces $q^* = 3$ units and do abatement $q^A = 3$ units

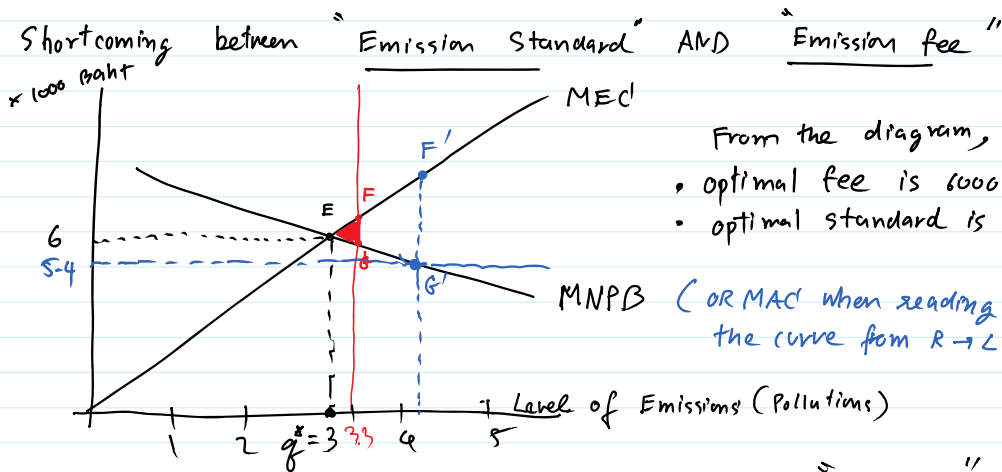
Look at MAC line above ... It is not a good idea for him to do abatement less than 3 units (Why?)

When $MAC < t$, the producer would abate the pollution instead of being charged emission tax (here $t = 6000$ baht/unit)

Emission fee: suppose fees = 6000 baht/unit
 (orange line is created)

When $MAC < fees$, firm will abate more
 (Go to the Left)

firm stops abatement where $MAC = fee$. So $q^A = 3$.



- From the diagram,
- optimal fee is 6000 baht
 - optimal standard is $q^* = 3$ units

- Suppose the govt. sets the standard "too low" by 10%. ($3 \rightarrow 3.3$)

DWL from this error = $\triangle EFG$

- Suppose the govt. sets the fee "too low" by 10%. ($6 \rightarrow 6(1-0.1) = 5.4$)

DWL from this error = $\triangle EFG'$

high elasticity

low elasticity

or 6000 \rightarrow 5400
 baht/unit baht/unit

So, when MNPB is flat and MEC is steep,
 DWL from the wrong fee $>$ DWL from the wrong standard.

Emission Fees

Emission Standards

Emission Standards

Cap and Trade

Cap and Trade

The Tragedy of the Commons



How many sheep will villagers send onto the commons?



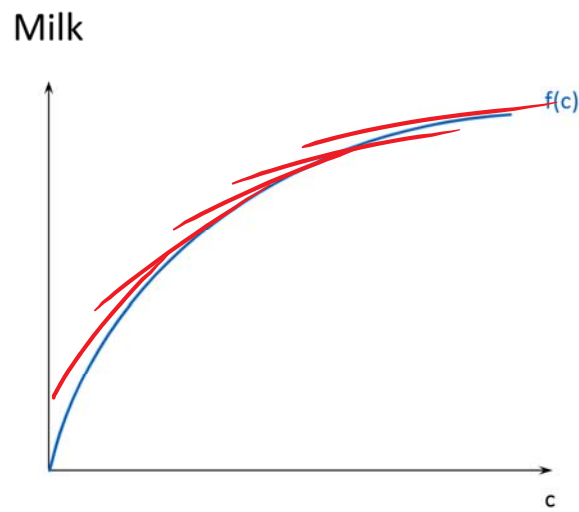
What is the socially optimal number of sheep to send onto the common?



The Tragedy of the Commons

- Consider a grazing area owned “in common” by all members of a village.
- Villagers graze cows on the common.
- When c cows are grazed, total milk production is $f(c)$, where $f' > 0$ and $f'' < 0$.
- How should the villagers graze their cows so as to maximize their overall income?

The Tragedy of the Commons



$$f'(c) > 0$$
$$f''(c) < 0$$

The Tragedy of the Commons

- Make the price of milk \$1 and let the relative cost of grazing a cow be p_c . Then the profit function for the entire village is

and the village's problem is to

$$\Pi(c) = f(c) - p_c c$$

$$\max_{c \geq 0} \Pi(c) = f(c) - p_c c.$$

The Tragedy of the Commons

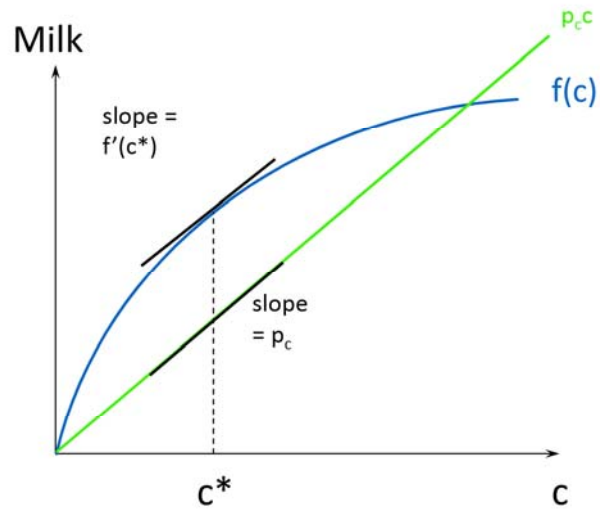
$$\max_{c \geq 0} \Pi(c) = f(c) - p_c c.$$

The income-maximizing number of cows to graze, c^* , satisfies

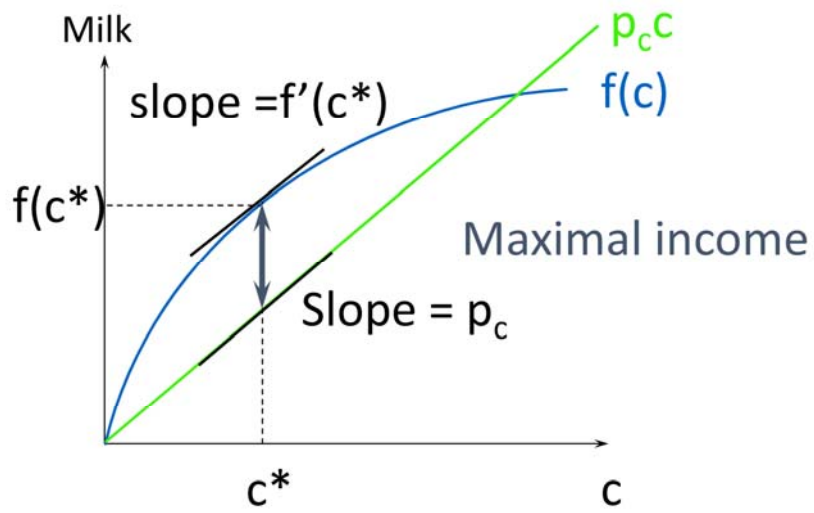
$$f'(c) = p_c$$

i.e. the **marginal** income gain from the last cow grazed must equal the **marginal** cost of grazing it.

The Tragedy of the Commons



The Tragedy of the Commons



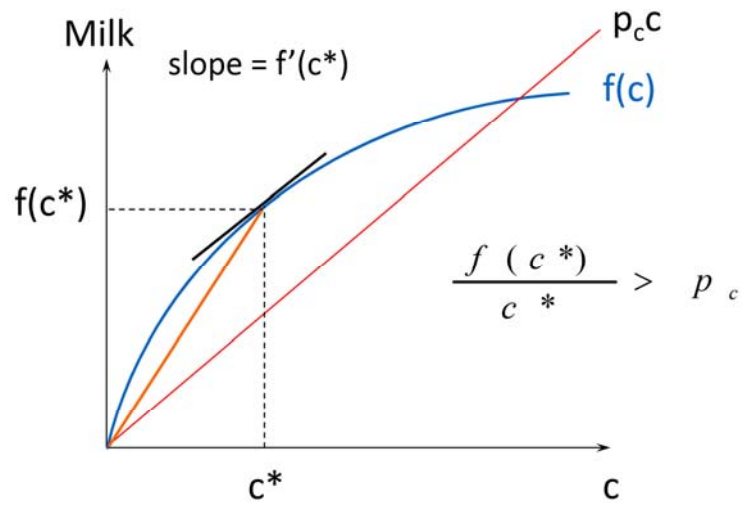
The Tragedy of the Commons

- For $c = c^*$, the average gain per cow grazed is

$$\frac{\Pi(c^*)}{c^*} = \frac{f(c^*) - p_c c^*}{c^*} = \frac{f(c^*)}{c^*} - p_c > 0$$

- because $f' > 0$ and $f'' < 0$.

The Tragedy of the Commons



The Tragedy of the Commons

- For $c = c^*$, the average gain per cow grazed is

$$\frac{\Pi(c^*)}{c^*} = \frac{f(c^*) - p_c c^*}{c^*} = \frac{f(c^*)}{c^*} - p_c > 0$$

because $f' > 0$ and $f'' < 0$. So the economic profit from introducing one more cow is positive.

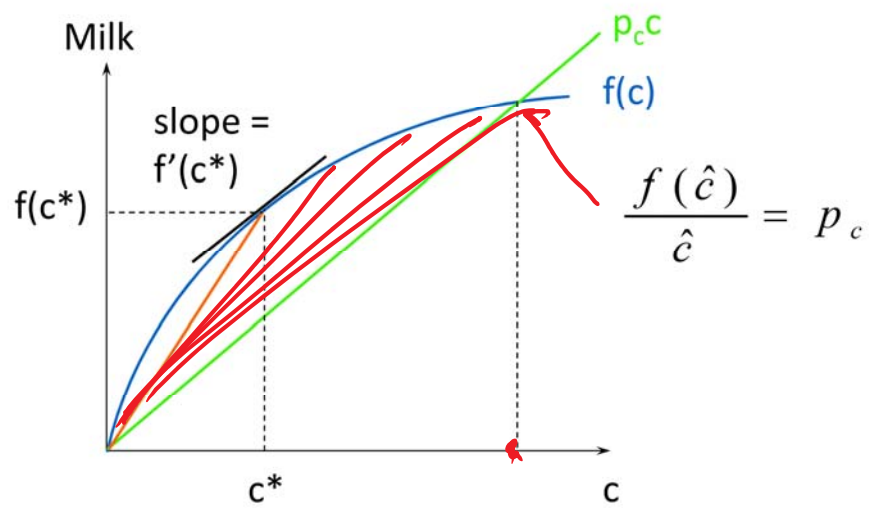
- Since nobody owns the common, entry is not restricted.

The Tragedy of the Commons

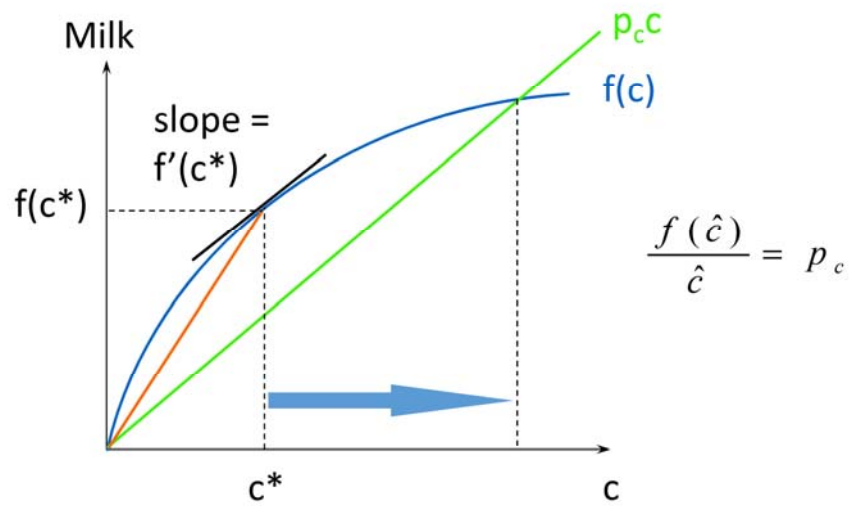
- Entry continues until the economic profit of grazing another cow is zero; that is, until

$$\frac{\Pi(c)}{c} = \frac{f(c) - p_c c}{c} = \frac{f(c)}{c} - p_c = 0.$$

The Tragedy of the Commons



The Tragedy of the Commons



The commons are **over-grazed**, tragically.

The Tragedy of the Commons

- The reason for the tragedy is that when a villager adds one more cow his income rises (by $f(c)/c - p_c$) but every other villager's income falls.
- The villager who adds the extra cow takes no account of the cost inflicted upon the rest of the village.

The Tragedy of the Commons

- Modern-day “tragedies of the commons” include
 - over-fishing the high seas
 - over-logging forests on public lands
 - over-intensive use of public parks; e.g. Yellowstone.
 - urban traffic congestion.

Public Goods

Public Goods

- Pure public goods share two characteristics
 - **Nonrival** – Cost of another person consuming the good is zero
 - **Nonexcludable** – Very expensive to prevent others from consuming the good

Examples of Public and Private Goods

- Public Goods

- National defense
- House cleaning in an apartment with many roommates
- Fireworks display
- Music file sharing
- Uncongested freeway

- Private goods

- Pizza
- Health care
- Congested freeway
- Public housing

Valuation of Public Goods

- Everyone consumes same *quantity* of public good (EX: Firework Display)
- Marginal benefit of public good varies by person
 - In the housecleaning example, different roommates value the clean apartment differently.

FE 4 41

FE 3 40

FE 4 42

Impure Public Goods

- Most goods that are thought of as public goods may not strictly satisfy the *nonrival* or *nonexcludable* assumption.
 - A scenic view is a public good without congestion, but the quality diminishes as more the number of sightseers increases.
 - Thus, a scenic view becomes *rival*.

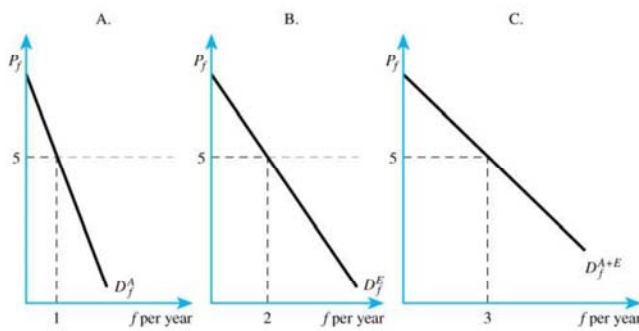
Private Goods can Be Provided by the Public Sector

- These are called “publicly provided private goods.”
- Key criteria: is the good *rival* and *excludable*?
- Public housing is rival (one family consumes one apartment) and excludable (easy to prevent consumption).

Efficient Provision of Private Goods

- Derivation of aggregate demand
- Each person's demand curve represents the willingness-to-pay for an additional unit of a good
- Private good: holding P constant, add together individual quantities to get Q
- Horizontal summation

Figure 4.1



• horizontal summation
 • at the same price,
 individual is allowed to
 consume different quantity.

" SAME P, DIFFERENT Q "
 (FOR PRIVATE GOODS)

Equilibrium in Private Goods Market

- Equilibrium where supply curve intersects aggregate demand curve
- Everyone pays the same price, P
- Individuals consume different quantities, Q
- Pareto efficient

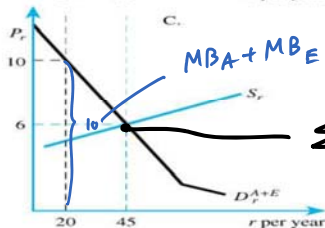
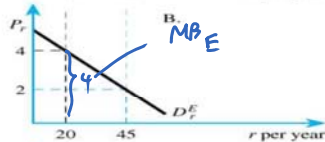
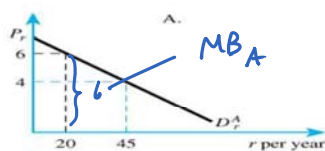
Efficient Provision of Public Goods

- Consider a fireworks display as a public good – it is nonrival and nonexcludable.
- Bigger displays give higher benefit.
- Public good: holding Q constant, add together individual willingness-to-pay to get P .
- Vertical summation.

Figure 4.4

SAME Q
BUT DIFFERENT
P (OR WTP)

PUBLIC GOODS



ROCKET DISPLAY

$$MBA + MBE = \sum_{i=A,E} MB_i$$

$$\sum MB = MD$$

$$Q^* = 45$$

Efficiency in Public Goods Market

- Everyone consumes the same quantity, Q .
- Individual's marginal benefit varies.
- Efficiency requires that the *sum* of individual marginal benefits equals the marginal cost.

Numerical Example

- Consider 2 individuals, Adam and Eve, who have the following inverse demand curves and face a marginal cost curve below.

$$P_A = 100 - \frac{1}{2}Q_A$$

$$P_E = 200 - Q_E$$

$$MC = \frac{2}{3}Q$$

Numerical Example, Private Good

- If the good was a **private good**, then the aggregate demand curve is:

$$Q = Q_A + Q_E = (200 - 2P_A) + (200 - P_E)$$

With a **private good**, everyone pays the same price.

$$P = P_A = P_E$$

$$Q = 400 - 3P$$

Numerical Example, Private Good

- In a competitive market, $P=MC$

$$P = MC \Rightarrow \frac{400}{3} - \frac{Q}{3} = \frac{2}{3}Q$$

$$Q = \frac{400}{3} \approx 133, P = \frac{800}{9} \approx 88$$

Approximately 133 units of the **private good** are provided at a price of \$88.

Adam consumes around 22 units, and Eve consumes around 111 units.

Numerical Example, Public Good

- Suppose instead that the good is a **public good**. The aggregate demand curve is:

$$P = P_A + P_E = (100 - \frac{1}{2} Q_A) + (200 - Q_E)$$

With a **public good**, everyone consumes the same quantity.

$$Q = Q_A = Q_E$$

$$P = 300 - \frac{3}{2} Q$$

Numerical Example, Public Good

- Efficient provision would require: $P=MC$

$$P = MC \Rightarrow 300 - \frac{3}{2}Q = \frac{2}{3}Q$$

$$Q \approx 138.46, P \approx 92.30$$

Efficient provision would imply that Adam & Eve consume 138.46 units of the public good.

Private market may not arrive at this allocation, however.

Efficient Allocations of Public Goods: Problems

- Although a competitive market will provide private goods efficiently, will the same be true for public goods?
- People may have incentives to hide their true preferences for a public good.
- If Adam can get Eve to pay for the public good, he can use his income for other purposes and still enjoy the public good.

Problems, continued

- This incentive to let others pay for the public good while still enjoying the benefits is known as the ***“free rider problem.”***
- The private market may therefore fall short of providing the efficient amount of the public good.

Problems, continued

- This incentive to free ride occurs because the public good is nonrival and nonexcludable. ✓
- A person gets to consume the good even if he does not pay for it. ✓

Problems, continued

- Return to the public goods numerical example. Suppose Adam chooses to free ride, and Eve therefore provides her optimal amount.
- Eve chooses:

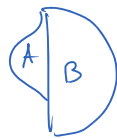
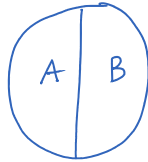
$$P_E = MC \Rightarrow Q_E = Q = 120$$

After Eve contributes 120 units of the public good, Adam does not provide any additional contributions, because the marginal benefit to Adam of the 120th unit is less than the marginal cost.

Asymmetric Information

Adverse Selection

INFORMATION IS SYMMETRICAL



INFORMATION IS NOT SYMMETRICAL

→ second-hand car market,

Sellers have information superiority than buyers

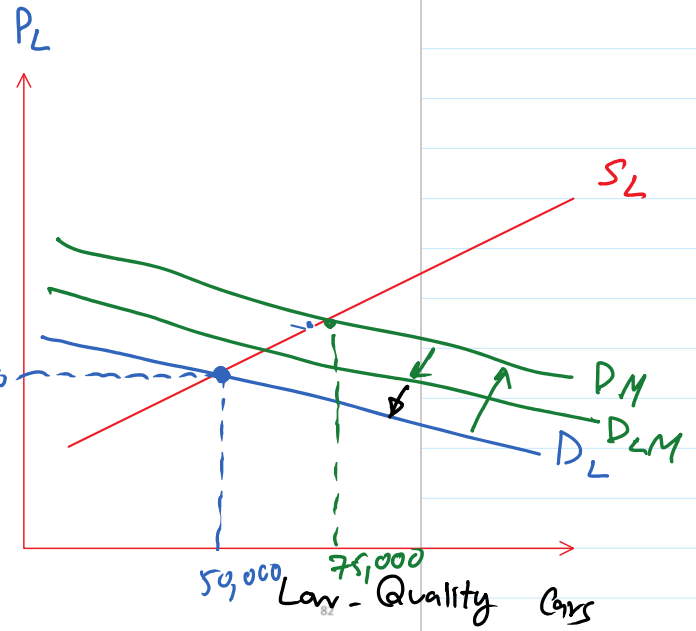
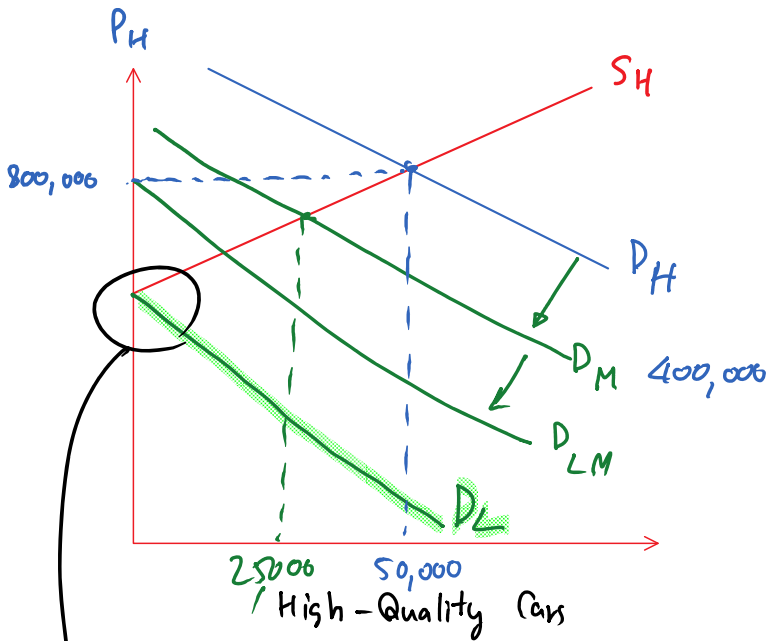
quality of cars

→ health insurance market,

buyers have information superiority than the sellers.

health condition

The Market for Used Cars



Initially $P_H = 800,000$ Baht
 $Q_H = 50,000$ cars

$P_L = 400,000$ Baht
 $Q_L = 50,000$ cars

w/ asymmetric information, avg. price = $0.5(800,000) + 0.5(400,000)$
 $= 600,000$ baht

MKT COLLAPSES!!!

WTP

READ: Pindyck for full details. * * *

Moral Hazard → (hidden action)

Principal - Agent Problem occurs when effort by agent is not observable.

Parents vs. kids
Employer vs. Employees

Solutions : Contract , Signalling

References

- Varian, Hal R. (7th ed.) Intermediate Microeconomics: A Modern Approach, New York: Norton, 2006.
- Rosen, Harvey S. And Gayer, Ted, *Public Finance*, 9th Edition, McGraw-Hill, 2009.