Public Finance (First part)

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Lecture 6:
Market failures II

2. Public goods

Definition of public good

Definition

Pure public goods: Goods whose consumption is perfectly **non-rival** and are **non-excludable**

- **Non-rivalry**: One individual's consumption of a good does not affect another's opportunity to consume the good.
- **Non-excludability**: Individuals cannot deny each other the opportunity to consume a good.

Definition

Impure public goods: Goods that satisfy the two public good conditions (non-rival in consumption and non-excludable) to some extent, but not fully.

Types of goods

		RIVAL	
		YES	NO
EXCLUDABLE	YES	PRIVATE GOODS Ice-cream	CLUB GOODS Netflix
	NO	COMMON RESOURCES Fisheries	PUBLIC GOODS Defense

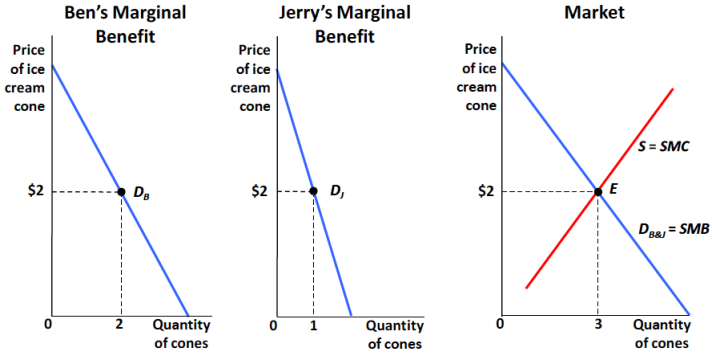
Public goods: some considerations

- **Classification as a public good is not absolute**: it depends on market conditions and the state of technology
- **Private goods are not always provided only by the private sector** (and viceversa)
  - **Publicly provided private goods**: rival and excludable goods provided by government
  - **Definition of public good does not necessarily mean that it is also produced by the public sector** (e.g. garbage collection)
- Even though everyone consumes the same quantity of the good, its value for different individuals might be (and usually is) varying

Provision of private goods (recap)

- Two goods: ic (ice-cream) and c (cookies) with prices P_{ic}, P_c
- Two individuals B and J demand different quantities of the good at the same market price.
- # cookies the consumer is willing to give up for 1 ice-cream determined by $MRS_{ic,c} = MU_{ic}/MU_c$
- Optimality condition for the consumption of private goods is written as: $MRS^B_{ic,c} = MRS^J_{ic,c} = P_{ic}/P_c$
- Equilibrium supply requires: $MC_{ic} = P_{ic}$, $MC_c = P_c$ and $MC_{ic}/MC_c = P_{ic}/P_c$
- In equilibrium, therefore: $MRS^B_{ic,c} = MRS^J_{ic,c} = MC_{ic}/MC_c$

Social (aggregate) demand of private goods



- To find social demand curve, add quantity at each price—sum horizontally.

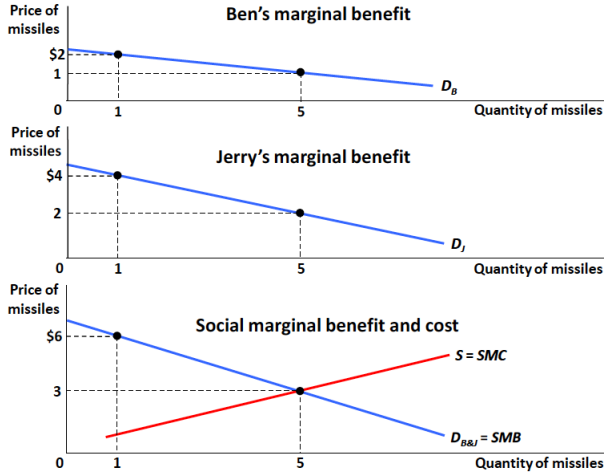
Optimal provision of public goods

- Replace private good ice-cream *ic* by a public good missiles *m*
- $MRS^B_{m,c} = \#$ cookies B is willing to give up for 1 missile
- $MRS^J_{m,c} = \#$ cookies J is willing to give up for 1 missile
- In net, society is willing to give up $MRS^B_{m,c} + MRS^J_{m,c}$ cookies for 1 missile
- Social-efficiency-maximizing condition for the public good is:

$$MRS^B_{m,c} + MRS^J_{m,c} = MC_m$$

- Social efficiency is maximized when the marginal cost is set equal to the *sum of the MRSs, rather than being set equal to each individual MRS*.
- This is a two-individuals application of the **Samuelson rule** (Samuelson, 1954)

Social (aggregate) demand for public goods



- To find social (aggregate) demand for missiles we have to sum vertically (i.e., summing price paid by each individual for a given quantity)

Private provision of public goods

- 2 individuals with identical utility functions defined on X private good (cookies) and F public good (fireworks)
- $F = F_1 + F_2$ where F_i is contribution of individual i is aggregate number of fireworks
- Utility of individual i is $U_i = 2\log(X_i) + \log(F_1 + F_2)$ with budget $X_i + F_i = 100$
- Individual 1 chooses F_1 to maximize $2\log(100 - F_1) + \log(F_1 + F_2)$ taking F_2 as given (and viceversa)

Private prosion of public goods

- First order condition: $-\frac{2}{100-F_1} + \frac{1}{F_1+F_2} = 0 \Rightarrow F_1 = (100 - 2F_2)/3$
- We have expressed F_1 as a function of F_2, this is called the **reaction curve** or **response function**. It puts into relation the optimal choice of an agent given the choice of the others.
- Symmetrically, we have $F_2 = (100 - 2F_1)/3$
  - Free-rider problem: $\frac{\partial F_1}{\partial F_2} < 0$; $\frac{\partial F_2}{\partial F_1} < 0$

Private provision of public goods

Definition

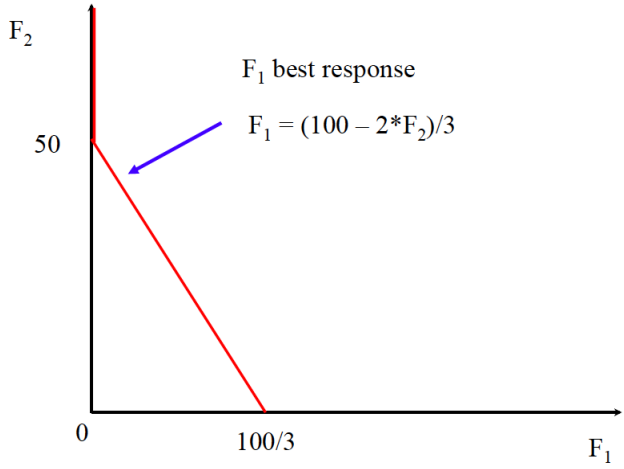
Nash equilibrium: No agent can improve her payoff by changing her action given the actions of the other players

- At the Nash equilibrium, the two reaction curves intersect
- System of two equations:

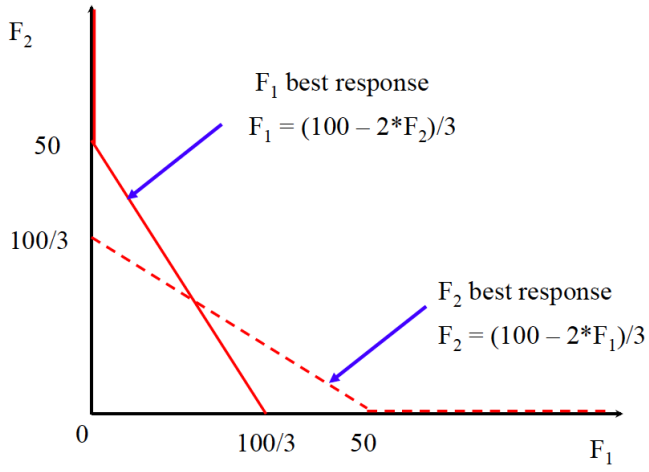
$$\begin{cases} F_1 = (100 - 2F_2)/3 \\ F_2 = (100 - 2F_1)/3 \end{cases}$$

- $\Rightarrow F_1 + F_2 = (200 - 2(F_1 + F_2))/3 \Rightarrow F = F_1 + F_2 = 200/5 = 40 \Rightarrow F_1 = F_2 = 20$

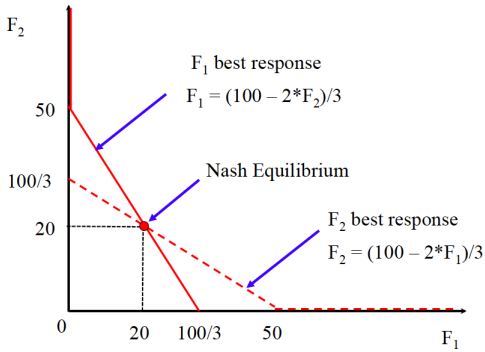
Private provision of public goods: illustration



Private provision of public goods: illustration



Private provision of public goods: illustration



Private provision of public goods

- What is the socially optimal provision of F?
- $MRS^i_{FX} = \frac{MU^i_F}{MU^i_X} = \frac{1}{F_1+F_2}\frac{X_i}{2} = \frac{X_i}{2F}$
- $MRS^i_{FX} + MRS^{-i}_{FX} = \frac{X_1+X_2}{2F} = \frac{200-F}{2F}$
- Samuelson rule requires $sumMRS_{FX} = MC \Rightarrow \frac{200-F}{2F} = 1 \Rightarrow F = \frac{200}{3} \approx 66.6 > 40$
  Public good is under-provided by the market w.r.t. social optimum
- Voluntary (private) provision of public good is an example of prisoner's dilemma: rational agents who aim to maximize their payoff fail to achieve an efficient equilibrium that would result from cooperating

Samuelson's rule

- We can easily prove Samuelson's rule by solving the aggregate problem

$$\max_{X,F} 2log(X) + log(F)$$
$$s.t. X + F = 200$$

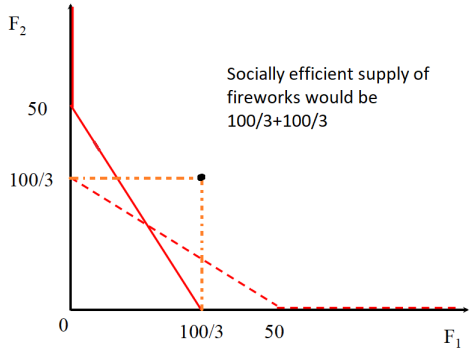
- Which is equivalent to

$$\max_{F} 2log(200 - F) + log(F)$$

- With first-order condition

$$-\frac{2}{200 - F} + \frac{1}{F} = 0 \rightarrow F = \frac{200}{3}$$

Private provision of public goods: illustration



Preferences and Lindhal pricing

- Private sector provision is such that $MRS_{mc} = MC_m$ for each individual so that $\sum MRS_{mc} > MC_m$
  - Outcome is not efficient, society could improve the welfare of everybody by having more fireworks (and less cookies)
- One problem is that **marginal valuation of the public good is potentially different** across agents
  - Differentiated price system "ad personam" would allow an efficient supply of the public good (Lindhal pricing 1919)
  - Efficiency if **preferences are revealed voluntarily** and prices for public good set equal to sum of valuations
- **Fundamental information problem**
  - Finding the efficient allocation/production would simply be an exercise of logic if all relevant information was known (Von Hayek - Nobel 1974)
  - **Preferences are private information**

Preferences and Lindhal pricing

- Three fundamental problems to set-up Lindhal pricing in practice
  1. **Preference Revelation Problem**
     - ⋆ Individuals have an incentive to lie about their willingness to pay, since the amount of money they pay to finance the public good is tied to their stated willingness to pay
  2. **Preference Knowledge Problem**
     - ⋆ Even if individuals are willing to be honest about their valuation of a public good, they may have no idea of what that valuation actually is.
  3. **Preference Aggregation Problem**
     - ⋆ Even if individuals are willing to be honest and even if they know their valuation of the public good, there is a final problem: How can the government aggregate individual values into a social value?

Private sector underprovision: free-riding

- When assumptions of the 1st fundamental theorem of WE are met:
  - **Market prices** are a signal that provides all the information about the value of a given good for both production and consumption
  - Prices attain **preference revelation/knowledge** and provide **incentives** guiding the economic system towards **efficiency**
- **In case of market failure and private information about preferences**
  - If a good has private cost but common benefits, **individuals have incentive to understate** their valuation and **Free Ride** on others' contributions
  - Same for everybody, private market **underinvestment** relative to social optimum

Another way to see it: **private provision of a public good creates a positive externality** (as everybody else benefits)

$\Rightarrow$ Goods causing positive externalities are under-supplied by the market. Analogous and opposite story compared to the Tragedy of the Commons.

Can private provision overcome free-rider problem?

- Private provision works better when:
  1. **Some individuals care more than others**
     - ⋆ Individuals are not identical, and some individuals have an especially high demand for the public good
  2. **Altruism**
     - ⋆ Individuals value the benefits and costs to others in making their consumption choices $\rightarrow$ positive externality is internalized
  3. **Warm Glow**
     - ⋆ Model of public goods provision in which individuals care about both the total amount of the public good and their particular contributions as well.

Experimental evidence on free-riding

- Laboratory experiments are a great device to test economic theories
- Subjects (often college students) sit in front of a computer team game and get paid based on the game outcome
- Many public good lab experiments. Example (Marwell and Ames 1981):
  - 10 repetitions for each game
  - In each game, group of 5 people, each with 10 tokens to allocate between cash and public good.
  - If take token in cash, get \$1 in cash for yourself. If contribute to common good, get \$.5 to each of all five players.

Experimental evidence on free-riding

- Nash equilibrium: get everything in cash
- Pareto-efficient solution: contribute everything to public good
  - Sort of a prisoner's dilemma: if all were to contribute, individual payoff would be \$ 25 instead of \$ 10 ($0.5 \times 5 \times 10$) versus (1×10)
- Results: In the lab, subjects contribute about 50% to public good, but public good contributions fall as game is repeated (Isaac, McCue, and Plott, 1985)
- Explanations: people are willing to cooperate at first but get upset and retaliate if others take advantage of them
- Empirical support for the free-rider (common pool) problem

Crowding out of private provision by govt. intervention

- Consider the example on cookies and fireworks above.
- Suppose government forces each individual to provide 5 so that now $F = F_1 + F_2 + 10$ where F_i is voluntary contribution of individual i
- Utility of individual i is $U_i = 2\log(X_i) + \log(F_1 + F_2 + 10)$ with budget $X_i + F_i = 95$
- Private optimum is $F_1 = F_2 = 15$ (solve as an exercise) so that government forced contribution **crowds out one-to-one private contributions**

Empirical evidence on crowd-out and charitable giving

Two strands of empirical literature

1. Observational studies
2. Lab and field experiments
   - Lab experiments show imperfect crowd-out in public good games (where you compare situation with no forced public goods contributions and with forced public good contributions).
   - Lab experiment may not capture important motives for giving: warm glow, prestige, solicitations from fund raisers

Charitable giving

- Charitable giving is one form of private provision of public good (big in the US, 2% of GDP given to charities)
- Funds (1) religious activities, (2) education, (3) human services, (4) health, (5) arts, (6) various causes (environment, animal protection, etc.)
- Encouraged by government: giving can be deducted from income for income tax purposes
- People give out for (1) warm-glow (name on building), (2) reciprocity (alumni), (3) social pressure (churches), (4) altruism (poverty relief)
  - Those effects are not captured in basic economic model
- Charities have big fundraising operations to induce people to give based on those social/psychological effects

Crowding-out

- Government spending crowds out private donations through two channels: willingness to donate + fundraising
- Andreoni (1993) uses tax return data on arts and social service organizations
- Panel study: follows the same organizations over time
- **Results:** $1000 increase in government grant leads to $250 reduction in fundraising
- Suggests that crowd-out could be non-trivial if fundraising is a powerful source of generating private contributions
- Subsequent study (Andreoni and Payne, 2003) confirms this
  - $1 more of government grant to a charity leads to 56 cents less private contributions
  - 70 percent ($0.40) due to the fundraising channel

Reciprocity

- Falk (2007) conducted a field experiment to investigate the relevance of reciprocity in charitable giving
- In collaboration with a charitable organization, sent 10,000 Christmas solicitation letters for funding schools for street children in Bengladesh to potential donors (in Switzerland) randomized into 3 groups
  1. 1/3 of letters contained no gift (control group)
  2. 1/3 contained a small gift: one post-card (children drawings)+one envelope
  3. 1/3 contained a larger gift: 4 post-cards (children drawings)+4 envelopes (treatment 2)
- Likelihood of giving: 12% in control, 14% in treatment 1, 21% in treatment 2
- "Large gift" was very effective (even relative to cost)

Social pressure

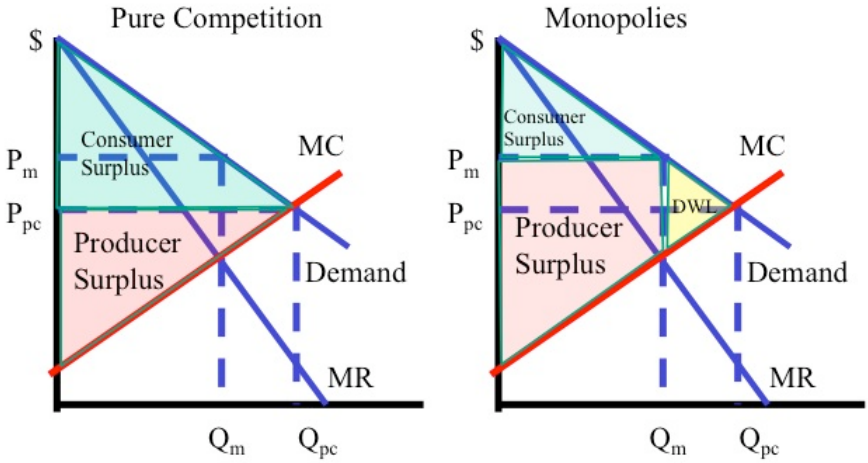
- Dellavigna-List-Malmendier (2012) design a door-to-door fundraiser randomized experiment:
  - Control: no advance warning of fund-raiser visit
  - Treatment group 1: flyer at doorknob informs about the exact time of solicitation (hence can seek/avoid fund-raiser)
  - Treatment group 2: same as treatment 1 but flyer has a check box "Do not disturb"
- Treatment group 1: 10% less likely than control to open door for fund-raiser, same (unconditional) giving
- Treatment group 2: 25% less likely to open door, (unconditional) giving is 28-42% lower
- Social pressure is an important determinant of door-to-door giving

Remarks on public good provision

- Public goods are affected by **free-riding** and their private provision entails a fundamental coordination problem
- In some cases, the private sector can provide public goods, but in general it will not achieve the optimal level of provision
- Government intervention can potentially increase efficiency by use of coercive power: imposing mandatory contribution and providing the public good at the socially optimal level
- Empirical evidence shows the importance of psychological and sociological factors in economic choices, private provision of the public good is -in general- higher than predicted by the economic model assuming "simple" agents

3. Natural monopoly

Monopoly (recap)



Natural monopoly

- There are situations in which trying to increase competition by encouraging new entrants into the market creates a potential **loss of efficiency**
- Natural monopoly is typical of production processes characterized by **high fixed costs and economies of scale** (e.g., local transportation)
- Key difference w.r.t. other types of monopoly is that natural monopoly results from efficiency gains as opposed to a firm being the controller of an essential resource or having a patent on a product
- In the situation of natural monopoly there cannot be more than one efficient provider of a good.

Natural monopoly

Definition

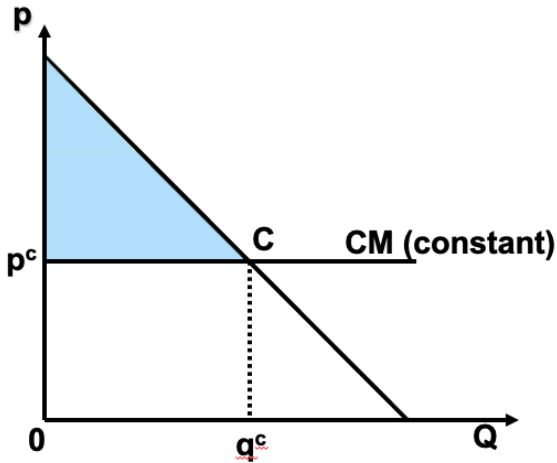
An industry is said to be a natural monopoly if one firm can produce the desired market demand at a lower cost than two (or more) firms can.

- Natural monopoly is defined in terms of a single-firm's efficiency relative to the efficiency of other firms in the industry
  - Existence of **economies of scale** in the production of a product, or **economies of scope** in the production of different goods
  - Decreasing long-run average cost
  - High fixed costs
  - **Cost function subadditivity**

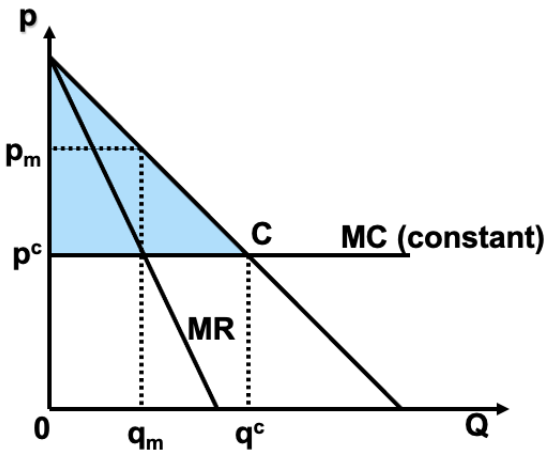
Definition

Subadditivity: It is cheaper for one firm to produce the total output demanded than it would be for several firms to produce proportions of it.
This can be expressed as: $C(Y) < C(\sum y^i)$, where $\sum y^i = Y$

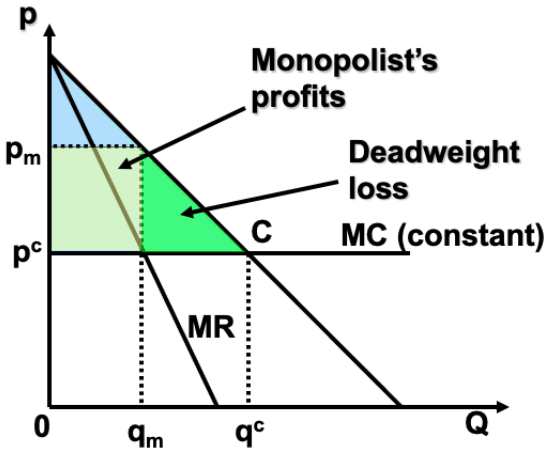
Natural monopoly



Natural monopoly



Natural monopoly



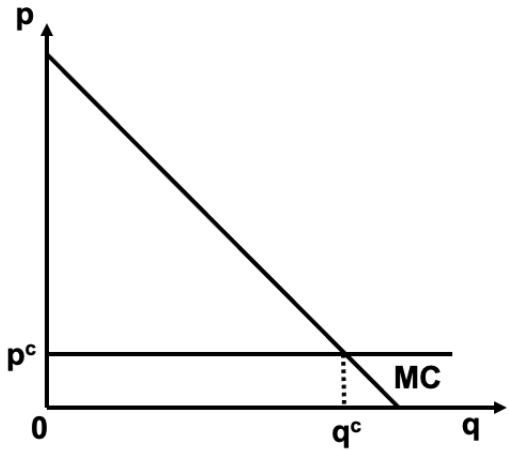
Natural monopoly

- The presence of only one agent on the market does not necessarily imply monopoly behavior (contestable markets)
  - Natural monopolist may be induced to offer competitive q^c at competitive price p^c to avoid losing its market.
  - Instead of competition within the market, we have competition to enter (or survive) in the market
- With barriers to entry, however, the natural monopolist can behave likewise other monopolists, resulting in a loss of efficiency
- It is a cause of market failure due to the parties' difficulty in finding a potentially advantageous agreement (consumers could compensate the monopolist).

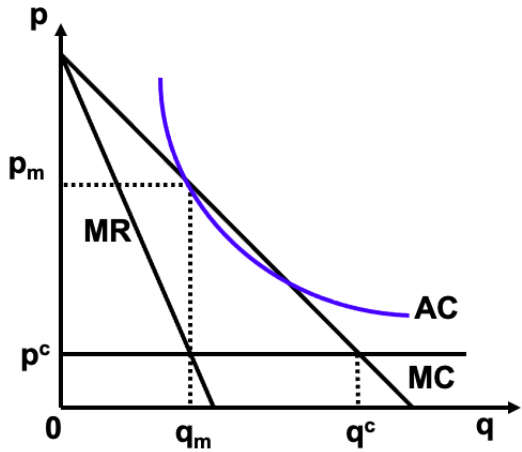
Natural monopoly: possible solutions

1. **Nationalization** of the service: burden on taxpayers
2. **Regulation without compensation**: government imposes $p = MC$ to the monopolist.
   - Information problem: Government could not have all the necessary information to properly set the price
   - Natural monopolies are characterized by increasing returns to scale (decreasing average costs AC), or $AC > MC$. Thus, imposing $p = MC$ imposes a loss on the monopolist
3. **Regulation with compensation**
   - Through taxes: burden on taxpayers
   - Through price: burden on users

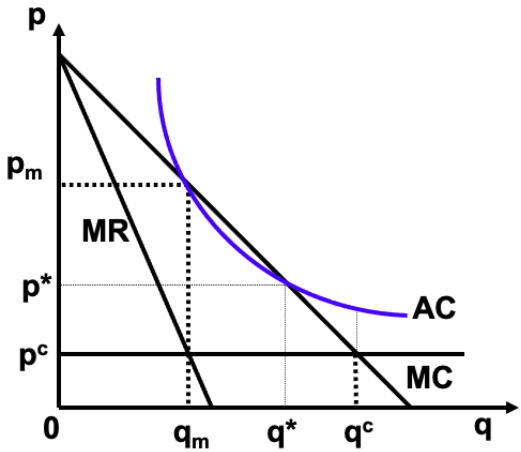
Natural monopoly: regulation with compensation



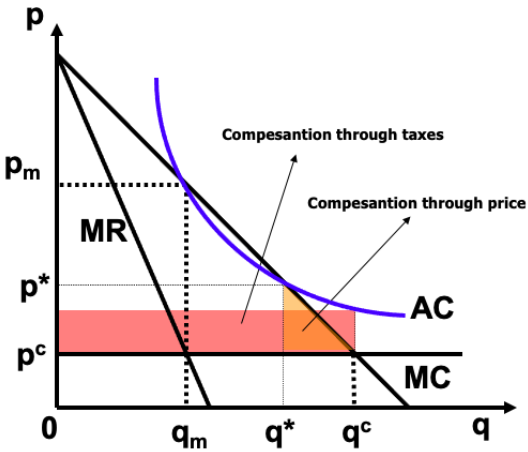
Natural monopoly: regulation with compensation



Natural monopoly: regulation with compensation



Natural monopoly: regulation with compensation



Natural monopoly: regulation with compensation

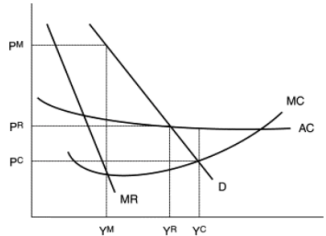
- **Regulation with compensation by taxpayers**: with $p = MC$, the monopolist faces losses that government repays (otherwise the monopolist would be better off out of the market).
  $\rightarrow$ The compensation is paid by the taxpayers. In the absence of lump sum tools, even this solution cannot be considered the *first best* (more on this in the second part of the course).
- **Regulation with compensation by users**: with $p = AC$, the monopolist has zero profits and the state makes no compensation.
  $\rightarrow$ The cost of the service is borne by the users only
  - **Price-cap regulation** imposes a maximum price
  - **Rate of return regulation** limits the profitability of firms

Regulation with compensation by users: the case of electricity

- Electricity is not storable and flows along the path of least resistance
  - High, and largely sunk, required capital investments
  - Well-established presence of economies of scale
  - Vertical integration

  $\rightarrow$ **Clearly a natural monopoly**
- Conventional wisdom held that competition is infeasible and **price regulation** is necessary to ensure that consumers pay a fair price and producers and owners are appropriately compensated for any risks associated with supplying the electricity

Regulation with compensation by users: the case of electricity



- Without price regulation, the consumer would pay the monopoly price (P^M) and the output in the market would be Y^M
- Although allocative efficiency would dictate that price equal marginal cost (P^C), which would yield an industry output of Y^C, this is not feasible since the firm cannot cover its costs.
- The regulator would set the price equal to average cost, which yields a higher level of output (Y^R) than the monopoly output and a lower price would prevail in the marketplace (denoted by P^R)

Regulation with compensation by users: the case of electricity

- Recently, competition has been introduced in the electricity market exploiting the fact that the **supplier** of energy does not need to be the same firm as the owner of the distribution facilities.
- The *real* natural monopolist is the owner of distribution facilities.
  - Free market for energy supplies
  - Distribution facilities are owned by a natural monopolist. One of suppliers can also be the natural monopolist of distribution facilities.
    - ⋆ e-Distribuzione, which is part of Enel, in 90% of Italy
  - Regulator (ARERA, which is an independent public agency) sets the cost of transportation that consumers have to pay to the owner of the distribution facility (through the supplier)
- Similar story applies to natural gas supply and distribution; railways transportation.

4. Asymmetric information

Asymmetric information

Definition

Situation in which the parties in the market have **imperfect knowledge of a tradeable good**.

It occurs when one party has different information with respect to another one

- **Example**: When selling a used car, the owner is likely to have full knowledge about its service history and its likelihood to break-down. The potential buyer, by contrast, will be in the dark and he may not be able to trust the car salesman
- Asymmetric information can generate two main problems eventually leading the market to fail:
  1. **Adverse Selection (AD)**
  2. **Moral Hazard (MH)**

Asymmetric information: the case of the insurance market

- **Risk and uncertainty are not a problem per se**
  $\Rightarrow$ In the presence of uncertainty, the market is able to find an efficient solution through insurance contracts
- An efficient equilibrium with total coverage against the risk exists if:
  - **Absence of transation costs**
  - **Adverse events are indipendent** from each other
  - **Perfect information** about the probability distribution of each adverse event
  - **Homogeneous distribution** of the risk across the population
- In reality:
  - Risks are not independent (e.g., epidemics)
  - The distribution of the risk is heterogeneous across the population (e.g., elderly, youngsters, smokers, drivers)
  - Firms have not perfect information on their clients: AS and MH

Asymmetric information: the case of the insurance market

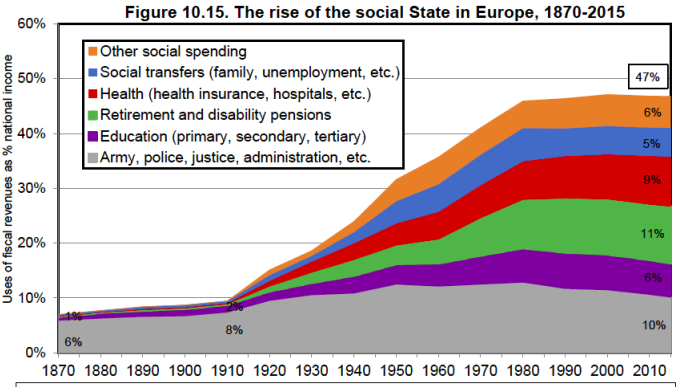
- **Insurance** consists of an unconditional payment of a premium to get payment in case of adverse event (e.g., auto insurance)
- **Social insurance programs**: Insurance against adverse events provided by government funded by taxation:

  (a) Disability insurance (Social Security)

  (b) Unemployment insurance

  (c) Health insurance (Medicaid, SSN)

- Growth in government over the 20th century is mostly due to the growth of social insurance (health and retirement benefits)



Interpretation. In 2015, fiscal revenues represented 47% of national income on average in Western Europe et were used as follows: 10% of national income for regalian expenditure (army, police, justice, general administration, basic infrastructure: roads, etc.); 6% for education; 11% for pensions; 9% for health; 5% for social transfers (other than pensions); 6% for other social spending (housing, etc.). Before 1914, regalian expenditure absorbed almost all fiscal revenues. **Note.** The evolution depicted here is the average of Germany, France, Britain and Sweden (see figure 10.14). **Sources and séries**: see piketty.pse.ens.fr/ideology.

Expected utility theory

- Utility function $U(C)$
- In the future, different state of the world might be realized, each of them with a different probability. How to measure the utility of an random outcome?
- **Expected utility theory**: Individuals want to maximize expected utility defined as the weighted sum of utilities across states of the world, where the weights are the probabilities of each state occurring.
- Let's assume that with probability q an adverse event occurs and a consumption c_{adv} can be afforded. Wit probability $1 - q$ the adverse event does not take place and the consumption is $c > c_{adv}$. Then the expected utility is:

$$\mathbb{E}U = (1 - q) \cdot U(C) + q \cdot U(C_{adv})$$

Risk aversion

- Suppose $U(c) = c$, $U(c_{adv}) = c_{adv} \rightarrow$ linear utility in consumption
- Then, $\mathbb{E}U = (1 - q)c + qc_{adv}$
  - Expected utility is equal to weighted average of c and c_{adv}
  - Is it better to get \$3 for certainty or to take a risk ℓ and get \$5 with $q = 0.5$ and \$1 with $q = 0.5$?
  - Compare $U(3) = 3$ with $0.5U(5) + 0.5U(1) = 3$.
  - Individual is indifferent because $EU(\ell) = U(3)$.

Definition

Risk neutrality: We say that an individual is risk neutral if she is indifferent between a certain amount and a lottery with equal expected value.

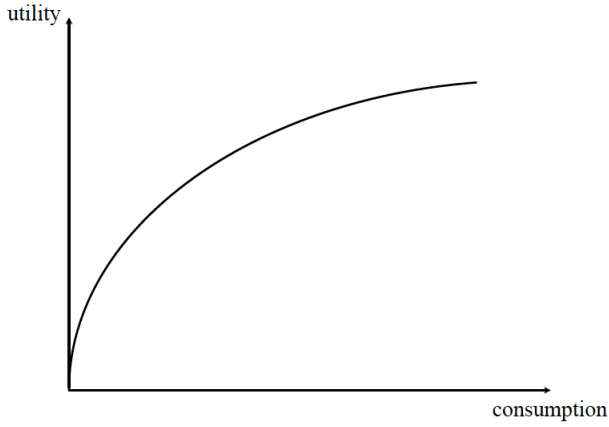
Risk aversion

- Suppose instead $U(c) = log(c) \rightarrow \mathbb{E}U = (1-q)log(c) + qlog(c_{adv})$
  - Expected utility is **no longer** equal to weighted average of c and c_{adv}
  - Is it better to get \$3 for certainty or to take a risk ℓ and get \$5 with $q = 0.5$ and \$3 with $q = 0.5$?
  - Compare $U(3) = log(3) \approx 1.08$ with $0.5log(5) + 0.5log(1) \approx 0.8$.
  - Individual prefers not taking the risk because $EU(\ell) < U(3)$.

Definition

Risk aversion: We say that an individual is risk averse if she prefers a certain amount compared to a lottery with equal expected value.

- We usually assume that individuals are risk-averse $\rightarrow$ utility function is strictly concave.
- We usually assume that firms are risk-neutral.


utility
consumption

Equilibrium in the insurance market

- Let $U(c)$ be the utility function, increasing and concave in c: $U'(c) > 0$ and $U''(c) < 0$. Person has income W (regardless of health)
- Individual becomes sick with probability q
- If sick, individuals pays medical cost d to get better
- Feasible insurance contract: always pay a premium p and receive payout b only if sick

$$\mathbb{E}U = (1 - q) \cdot U(W - p) + q \cdot U(W - p - d + b)$$

- Expected profits of insurers: $EP = p - qb$
- If insurance market is perfectly competitive, then $EP = 0 \Rightarrow p = bq$
  - **Actuarially fair premium:** the premium equal to the insurer's expected payout.

Equilibrium in the insurance market

- Individual chooses premium p to maximize

$$\mathbb{E}U = (1-q)\cdot U(W-p) + q\cdot U(W-d-p+\frac{p}{q})$$

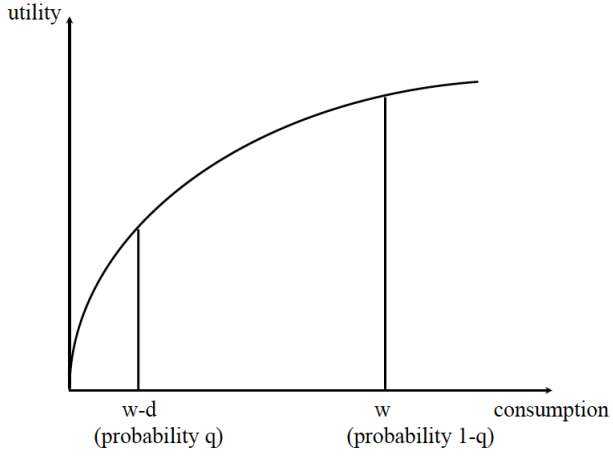
- **First order condition**:

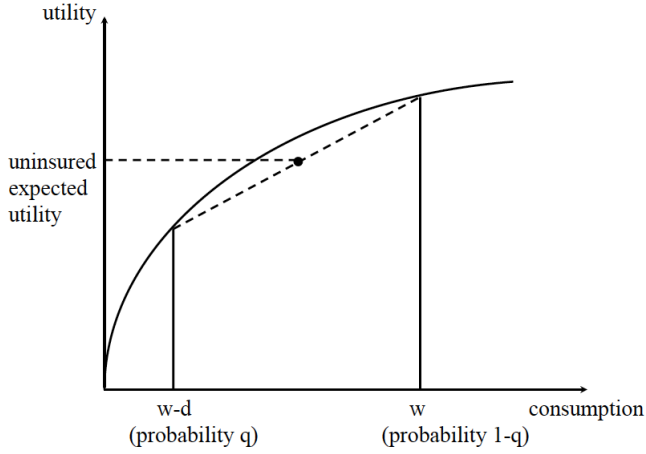
$$-(1-q)U'(W-p) + q[-1+\frac{1}{q}]U'(W-d-p+\frac{p}{q}) = 0$$

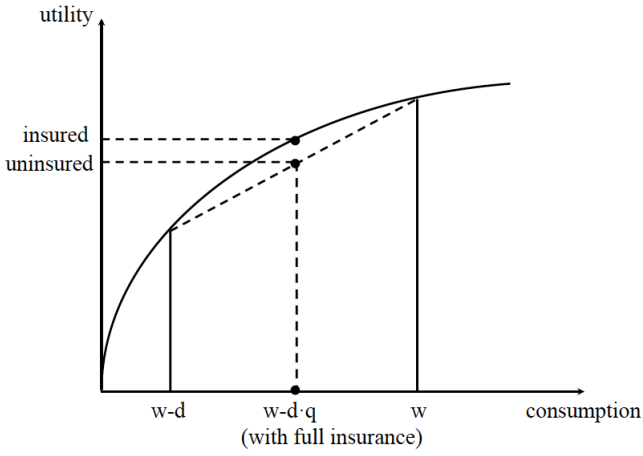
- from which we obtain

$$W-p = W-d-p+\frac{p}{q} \rightarrow -d+\frac{p}{q} = 0 \rightarrow p = d\cdot q$$

- The individual is perfectly insured: consumption is the same in both states and equal to $W-d\cdot q$.
- **Intuition**: with concave utility, marginal utility decreases and it is always desirable to reduce consumption in high income states to increase consumption in low income states


utility
w-d
(probability q)
w
(probability 1-q)
consumption


utility
uninsured
expected
utility
w-d
(probability q)
w
(probability 1-q)
consumption


utility
insured
uninsured
w-d
w-d·q
w
consumption
(with full insurance)

Introducing heterogeneity in risk across individuals

- Suppose now that risk of becoming sick can be high or low
  - $q = q_H$ for high-risk individuals and $q = q_L$ for low-risk individuals ($q_H > q_L$)
- **First scenario - Symmetric Information:** both insurance companies and individuals can observe risk (for example, could be age or smoking status)
- Insurance companies will charge 2 policies, each actuarially fair:
  - $p_H = b_H q_H$
  - $p_L = b_L q_L$
- Each type will still choose to buy perfect insurance.
  - Private insurance does not equalize incomes across types only within types
  - Pre-existing conditions will lead to inequality in insurance premia and welfare but no failure in the insurance market

Introducing heterogeneity in risk across individuals

- **Second scenario - Asymmetric Information:** Insurance companies cannot observe (or cannot price on) q_L vs. q_H types but individuals do
- If insurance companies proposes the same two policies as before ($p_H = b_H q_H$; $p_L = b_L q_L$), all individuals would buy the cheaper insurance and pay a premium p_H.
  - Insurance company will have negative expected profits $\Rightarrow$ cannot be an equilibrium
- Two equilibrium possibilities:
  1. **Pooling equilibrium:** Insurance companies offer a contract based on average risk
     - ⋆ Good deal for high risk, mediocre deal for low risk. Better than no insurance?
  2. **Separating equilibrium:** Insurance companies offer two contracts: one expensive contract with full insurance, one cheap contract with partial insurance
     - ⋆ High-risk individuals choose the full insurance contract; low-risk individuals choose the partial insurance contract
- In both cases, outcome not efficient as healthy are under-insured (**Adverse selection**)

Adverse selection

Definition

Adverse selection in a context of asymmetric informaton is the higher tendency for high risk individuals to purchase insurance programs compared to low-risk individuals.

- In the presence of adverse selection, market for insurance can unravel in a **death spiral**:
  1. Insurance is offered at average fair price: bad deal for low risk people and hence only high risk people buy it
  2. Insurers make losses and raise the price further
  3. Only very high risk people buy it
  4. Insurers make losses again [...]
  5. No insurance contract is offered at all even though everybody wants full actuarially fair insurance
- Adverse selection is a clear market failure because market equilibrium is not efficient.

Government interventions to address adverse selection

- Government can address adverse selection and improve market efficiency
- Natural solution is to impose a **mandate**: everybody is required to purchase insurance $\Rightarrow$ If price is the same for everybody, low risk people end up subsidizing high risk people
  - From a social perspective, being high risk (e.g. having a sickly constitution) is often not a consequence of individual choices $\Rightarrow$ Society may want to transfer resources to unhealthy individuals
- This solution explains why all OECD countries (except US) have adopted universal health insurance paid for by government
- US case: Obamacare as a three-legged-stool (a) forbids insurers from charging based on pre-existing conditions, (b) mandates that everybody needs to get insurance, (c) subsidizes health insurance for low income families
  - Mandate weakened by eliminating fine for not having insurance in 2019, will see whether this leads to death spiral on Obamacare exchanges

Other reasons for government funded social insurance

- **Redistribution:** Private insurers cannot provide insurance against pre-existing conditions so those with high risk have to pay more: society may want to compensate high risk people (as being high risk is often not the fault of the person)
  - Universal health insurance funded by taxation effectively redistributes from high-risk people to low-risk people
- **Healthcare is a right (Commodity egalitarianism):** Access to quality health care (regardless of resources) is perceived as a right. Low income families cannot pay for it so need for government funding.
  - Universal health insurance funded by taxation effectively redistributes from high-income people to low-income people
- **Externalities:** Your lack of insurance can be a cause of damage for me
  - Universal health insurance funded by taxation can be seen as a Pigouvian transfer scheme

Other reasons for government funded social insurance

- **Administrative Costs:** The administrative costs for Medicare are less than 2% of claims paid. Administrative costs for private insurance average about 12% of claims paid.
  - High administrative costs arise because private insurers try to screen away sickly customers and steal healthy customers from competitors
- **Individual Failures (Behavioural Econ.):** Individuals may not appropriately insure themselves against risks if the government does not force them to do so (myopia, lack of information, self-control problems)
  - If individuals understand their own failures, they will support social insurance (e.g., Medicare health insurance for elderly is very popular). If individuals really want to be myopic, they will oppose govt social insurance (paternalism)
  - Individuals may also not understand well products and hence be sensitive to flashy advertisements.

Consequences of insurance: moral hazard

Definition

Moral hazard: Propensity of insured individuals against bad outcomes to take risky actions that affect the probability that bad outcomes occur.

- **Example**: If you receive unemployment benefits replacing lost wages, you may not search as much for a new job
  - Insurance reduces incentives to remedy adverse events
- Moral hazard exists with both private and social insurance as long as insurer cannot perfectly monitor the behavior of person insured
  - Insurers do not offer perfect insurance
  - Market failure
- The existence of moral hazard problems creates the **central trade-off of social insurance**: insurance is desirable for consumption smoothing but insurance can create moral hazard

Moral hazard

- What Determines Moral Hazard?
  - How hard it is to observe whether the adverse event has happened
  - How easy it is to affect the probability of adverse event by changing behavior
- **Moral Hazard is multidimensional:** In examining the effects of insurance, three types of moral hazard play a particularly important role:
  1. Reduced precaution against entering the adverse state $\rightarrow$ **Example**: unemployment insurance reduces effort in current job
  2. Increased odds of staying in the adverse state $\rightarrow$ -¿ **Example**: unemployment insurance reduces effort in search for new job
  3. Increased expenditures when in the adverse state $\rightarrow$ -¿ **Example**: health insurance gives the incentive of demanding extra treatment

Optimal social insurance

- Optimal social insurance trades-off two considerations:
  1. The benefit of social insurance is the amount of consumption smoothing provided by social insurance programs
  2. The cost of social insurance is the moral hazard caused by insuring against adverse events
- Optimal social insurance systems insure partially, but not completely, individuals against adverse events.

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