Roles of governments

Public Finance

SPSE, Waseda, Fall 2024

Today's talk

- First theorem of welfare economics
  - When the assumptions do not hold.
- Resource allocation
  - Externality
  - Public goods
- Income redistribution
  - Social welfare function
  - Tradeoff between redistribution and efficiency
 - As a correction to market failure

Extreme cases

- What if only government? If no market?
    - Socialism planned economy (as an ideal case)
- What if only market? If no government?
    - "Anarchy"
    - E.g.: Kowloon Walled City (Fortress), 1945-1987
        - An enclave of China within British Hong Kong
        - No law: unplanned buildings, slums, prostitution, drug trafficking, gambling …
        - Organized crime syndicates "governed" the city

(Wikipedia)
Now developed as a park

Market and Government
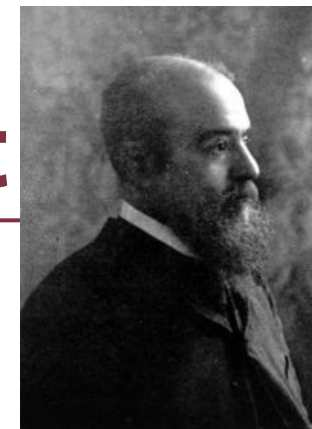
The 1st fundamental theorem of welfare economics

Market failure

If market is perfect,
Competitive eqn is Pareto efficient

If market does not work

Even if market works

Outcome is not desirable
w.r.t. Pareto criteria

Outcome is not desirable
w.r.t. other (not Pareto) criteria
(equality, fairness, stability…)

How to achieve Pareto
efficient outcome

Government
steps in

How to achieve equal, fair or
stable outcome

What, when, how should government do?
(How should policy be?)

Government failure

But government is not perfect

Assumptions of First theorem

- ❑ "Markets are perfect" means…
  - ■ Markets exist for all goods, and economic agents exchange goods
  - ■ Consumer and firms are all price takers
  - ■ There is no transaction costs: productive factors move freely
  - ■ Perfect information
    - ❑ No asymmetric info. Agents know about goods perfectly
  - ■ Convexity of preference and production technology
    - ❑ Marginal rates of substitution are decreasing, marginal costs are increasing

- ❑ Market fails if any one of these does not hold.
  - ■ Focus on: "Markets exist for all goods"
    - ❑ Property rights are not established or incomplete

What if only markets exist?

- First theorem of welfare economics
  - Through productions and exchanges in competitive markets, a Pareto efficient resource allocation is achieved as an equilibrium
  - In competitive markets, exchanges means "win-win" relationship
    - An exchange requires the consent of buyer and seller
  - Equilibrium is defined as a state where there is no more room for exchange
- Second theorem of welfare economics
  - Any Pareto-efficient allocation of resources can be achieved as an equilibrium in a competitive market by redistributing appropriate initial holdings
- These are mathematical "theorems", they hold as long as the assumptions are satisfied
  - Whether these assumptions are regarded as valid is another issue
  - E.g., what if there is no market for some goods?

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Imperfect markets

- What "market does not exist" means?
- Property rights are not established
  - A market is a place where agents trade "what you have"
    - Exchange: I give you what I have and receive what you have
  - "What you have" is not clear
    - Thief, fraud, murder,….
    - Violation of property rights, including intellectual ones.
- "Inefficient" equilibrium
  - Productions/consumption may increase or decrease
  - Other examples of "market failure"
    - Public goods: free riding
    - Externality: pollution
    - Monopoly, duopoly, oligopoly
- Roles of governments to protect property rights
  - Judiciary, security, police, patents, etc.
  - Regulation, taxes, subsidies

Externality: definition

□ Definition

- Impacts or effects of choices of economic agents on other economic agents, not through (external path of) markets
  - □ Directly on utility functions or production functions, or indirectly through budget constraints
- From viewpoints of affected agents,
  - □ Negative externality when the effect is unfavorable
  - □ Positive externality when the effect is favorable
- Also called as "forced consumption"
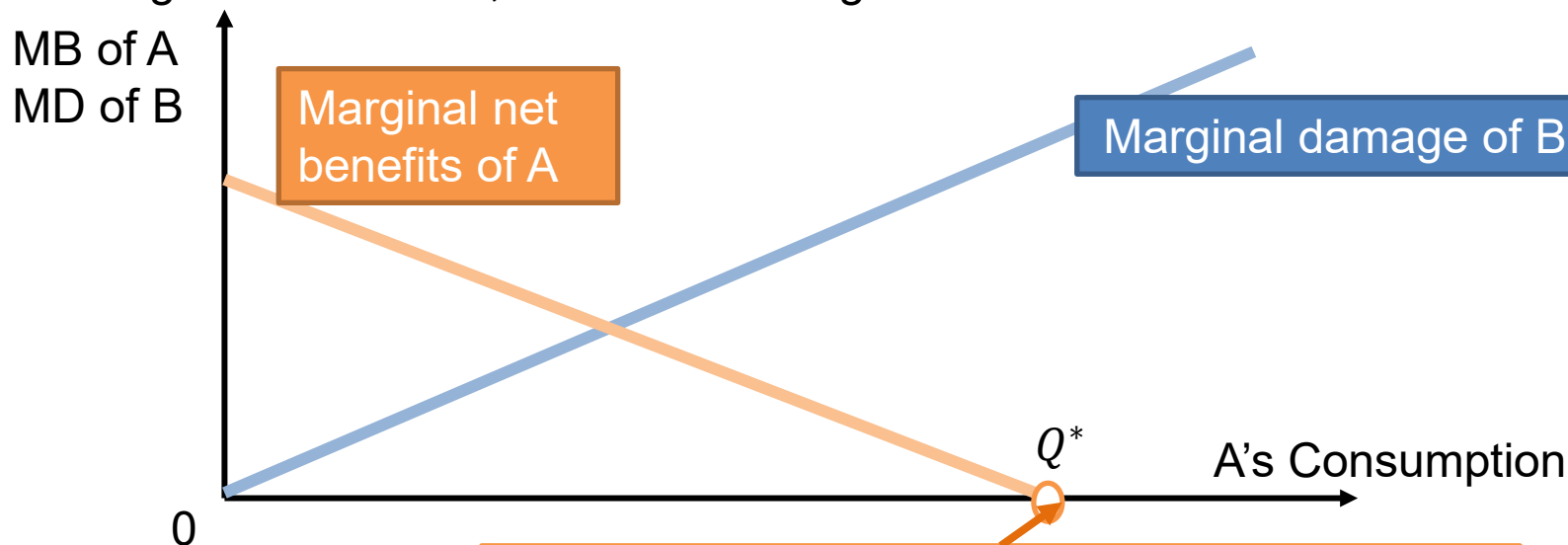 - □ Property rights of externality are not well defined

□ Examples?

Externality: market equilibrium

□ Partial equilibrium

  ■ Negative externality of A on B

     □ E.g. A is a smoker, B hates smoking

MB of A
MD of B

Marginal net benefits of A

Marginal damage of B

Q^*

A's Consumption

0

If A can choose her consumption without considering B, A choose Q*
A maximize her benefits until MB become 0

Social Cost is a sum of costs that A pays (production costs) and damages that B receives

Solutions of externality

- ❑ Negotiation
- ❑ Pigou tax / subsidy
- ❑ Direct regulation / quantity quota (allocation)
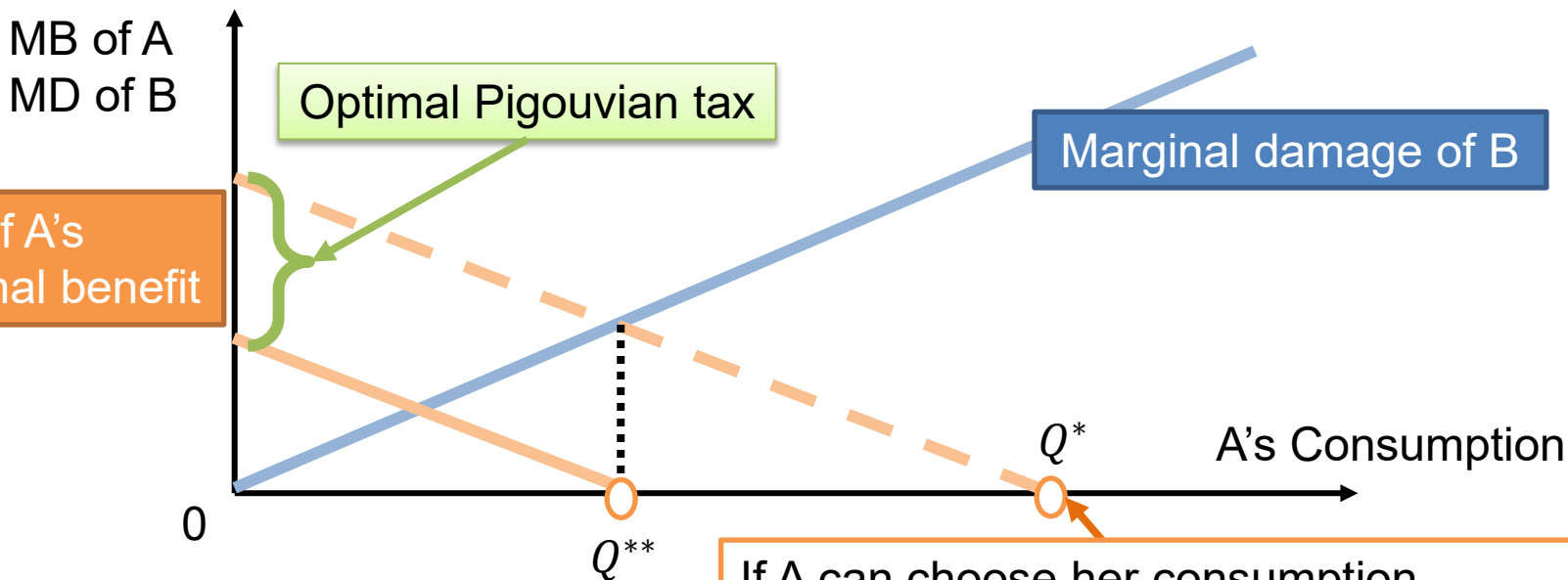- ❑ Permits trading

- ❑ Usually use combinations of these methods

Pigouvian tax

- Pigouvian tax
    - If A does not take B's damage into account, a government should decrease A's net marginal benefits by the same amount (**internalize**)
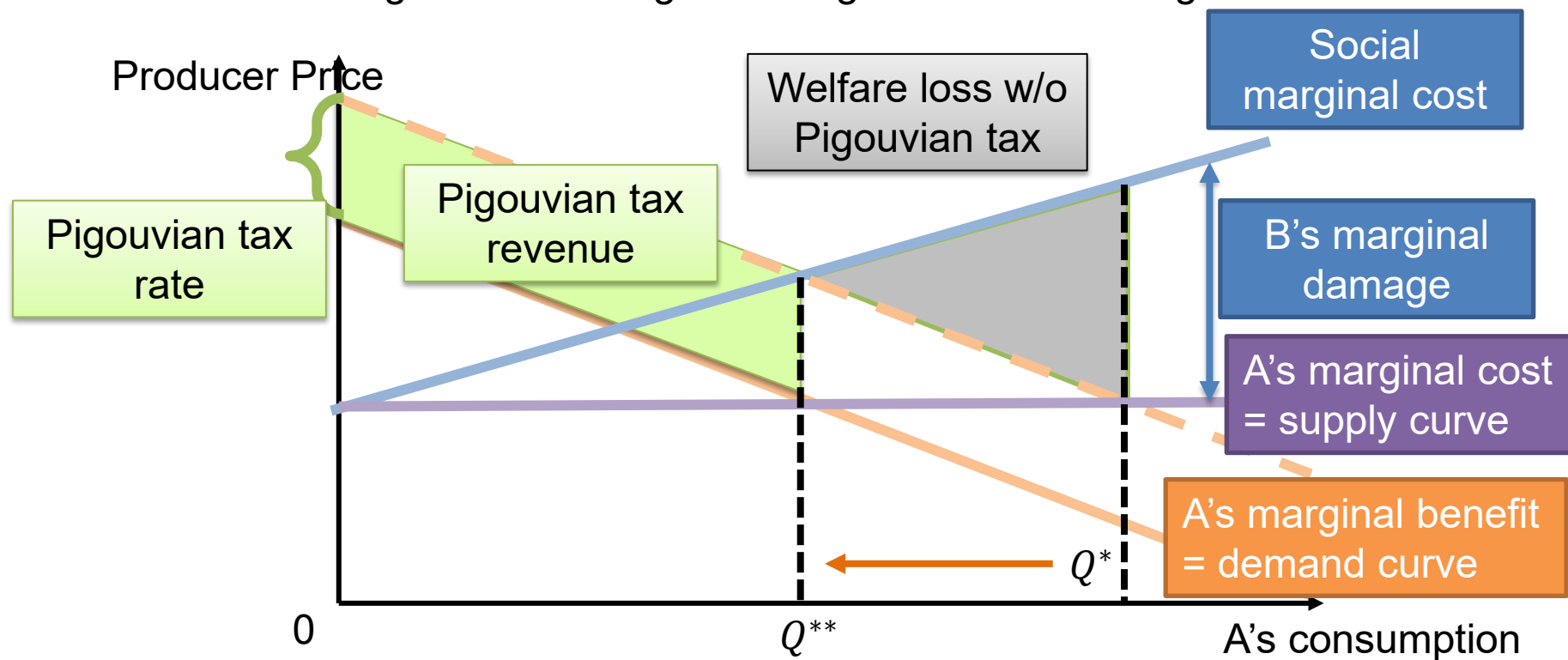   - Pigouvian subsidy: positive externality
    - Previous example

MB of A
MD of B

Optimal Pigouvian tax

Marginal damage of B

Shift of A's marginal benefit

Q^*

A's Consumption

0

Q^{**}

If A can choose her consumption without considering B, A choose Q*

Pigouvian tax and surplus

- ☐ Maximize "social surplus"
  - ■ A's net marginal benefit = gross marginal benefit – marginal cost

Producer Price

Welfare loss w/o Pigouvian tax

Social marginal cost

Pigouvian tax revenue

Pigouvian tax rate

B's marginal damage

A's marginal cost = supply curve

A's marginal benefit = demand curve

Q^*

Q^{**}

0

A's consumption

Pigouvian tax

- ❑ Tax or subsidy?
  - ■ Either is ok, if it decreases the net benefit
  - ■ Subsidy: to subsidize the reduction from Q^*
    - ❑ "Reducing the goods with a *negative* externality" has a *positive* externality
    - ❑ Opportunity cost of losing subsidies
    - ❑ Graph is the same
  - ■ Government does not need revenue sources
    - ❑ subsidize the reduction from Q^{**}, tax the increase from Q^{**}
    - ❑ In equilibrium, no tax, no subsidy
- ❑ Examples
  - ■ Tax: Carbon tax, gasoline tax, car tax, cigarette tax, …
  - ■ Subsidy: Vaccinations, landscape, environment, …
  - ■ Setting the optimal rate of tax/subsidy requires the information on marginal benefit/damage. The actual tax/subsidy rate may be suboptimal

Pigouvian tax and behavior

- Purpose of Pigouvian tax/subsidy
  - Change the behavior of agents who generate externalities
- If Pigouvian tax/subsidy does not change the behavior
  - No improvement in efficiency
  - Just an income transfer
  - E.g., Subsidy for particular OTC drugs
    - OTC (Over-The-Counter) : similar to prescription drugs
    - To reduce the visits to clinics/hospitals and improve the fiscal situation of public health insurance
    - If no change from clinics/hospitals to drug stores…
      - Just a transfer from tax payers to OTC drug consumers (to pharmaceutical company)
  - Tax or subsidy may depend on political situations

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Public goods

❑ Definition: goods with both non-excludability and non-rivalyness

- Not defined by who provides the good

non-excludable	One cannot exclude individuals from enjoying its benefits when the good is provided ・Free riding ・Extreme positive externality
non-rivalrous	One individual's enjoyment of the good does not diminish the amount of the good available to others ・Connectedness ・Not perfectly non-rivalrous, "congestible"

❑ Some goods have only on property

	Non-excludable		Excludable
Non-rivalrous	Pure public good		(club good)
		Quasi public	
Rivalrous	(Commons)		Private good

Public good: examples

	Non-excludable		Excludable
Non-rivalrous	Information Knowledge Diplomacy Police	Water and sewage Terrestrial TV	Club Satellite broadcasting
Congestible	Road Park		Highway Library
Rivalrous			Private good

Non-excludability and non-rivalyness depend on technology

Optimal and voluntary provision

- Optimal provision of public goods: Samuelson condition
  - Sum of marginal benefits = marginal cost of production
  - Same as private goods because this means
    - Social marginal benefits = Social marginal costs

- Voluntary provision of public goods
  - Inefficiently small, compared to the optimal provision
  - An extreme case of positive externality: Free riding

2-persons economy

- ❑ Setting: 2 persons, A and B
  - ▪ $\max u_A(x_A, G), s.t. x_A + pg_A = M_A$
  - ▪ $\max u_B(x_B, G), s.t. x_B + pg_B = M_B$
  - ▪ $g_A + g_B = G$
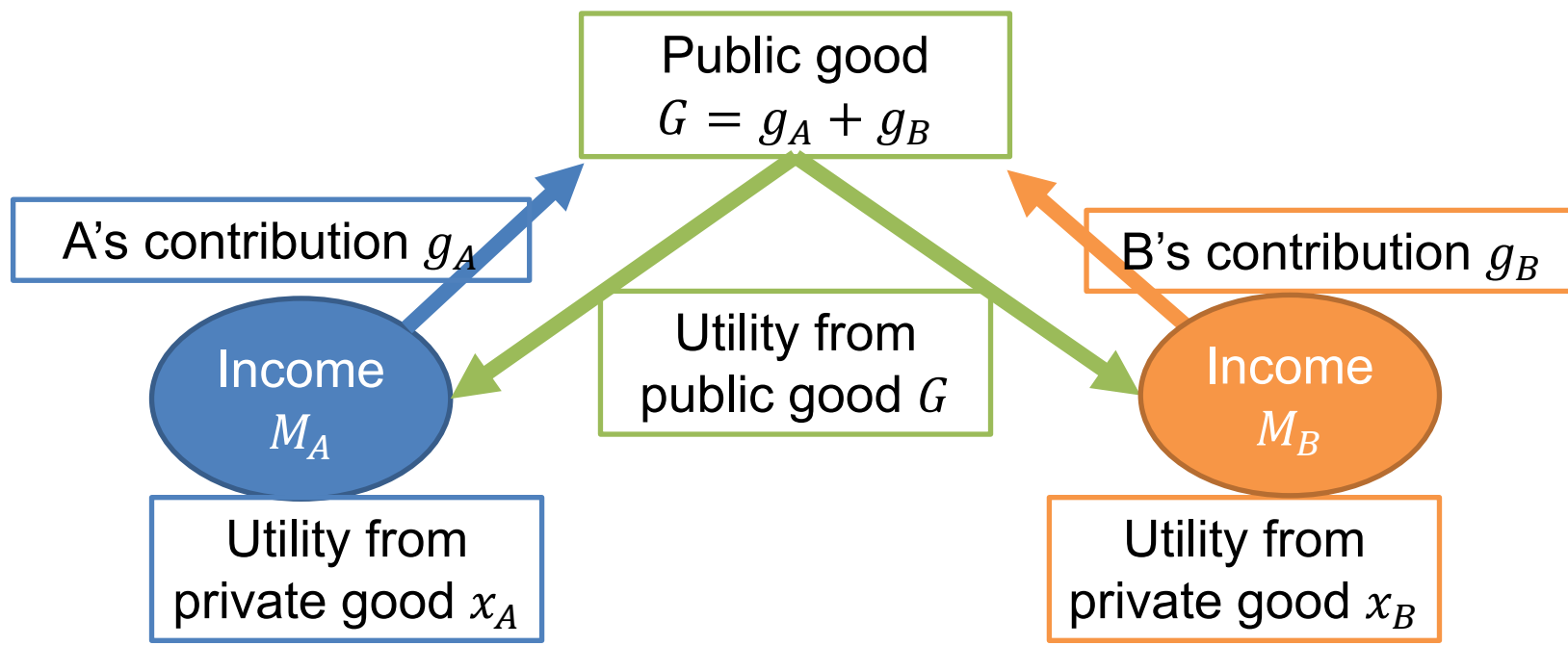
Pareto efficient allocation

- ❑ Pareto efficiency
  - One cannot raise a person's utility without decreasing another's utility
  - Keeping B's utility level, maximize A's utility: $\max u_A, \text{s.t. } u_B \geq \bar{u}$
- ❑ Solve this!

Substitute various terms, we get

$$\mathcal{L} = u_A(M_A - pg_A, g_A + g_B) + \lambda\big(\bar{u} - u_B(M_B - pg_B, g_A + g_B)\big)$$

Take partial derivatives w.r.t. g_A and g_B

Eliminate λ and rearrange.

$$p = \frac{\partial u_A/\partial G}{\partial u_A/\partial x_A} + \frac{\partial u_B/\partial G}{\partial u_B/\partial x_B}$$

Marginal cost of public good provision	Sum of marginal benefits from public good

Voluntary provision

❑ Most simple Nash case

   ■ Given the other's behavior, maximize one's utility

   ■ Keeping B's contribution g_B, maximize A's utility: $\max u_A$, s.t. g_B constant

❑ Solve this!

Substitute various terms, we get

$$u_A = u_A(M_A - pg_A, g_A + g_B)$$

Take partial derivatives w.r.t. g_A

$$p = \frac{\partial u_A/\partial G}{\partial u_A/\partial x_A}$$

We can obtain similar equation for B

$$2p = \frac{\partial u_A/\partial G}{\partial u_A/\partial x_A} + \frac{\partial u_B/\partial G}{\partial u_B/\partial x_B}$$

The smaller G, the larger $\partial u_A/\partial G$. Thus G is smaller than the optimal.

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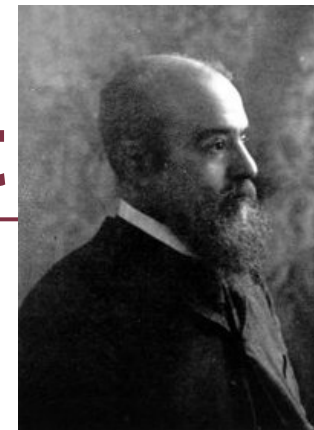
The 1ˢᵗ fundamental theorem of welfare economics

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Inequality: Gini Index

❏ Gini indexes of income after redistribution move stable

■ Japan positions middle among G7 countries. Less equal than the continental European countries.

(source) OECD Income Distribution Database
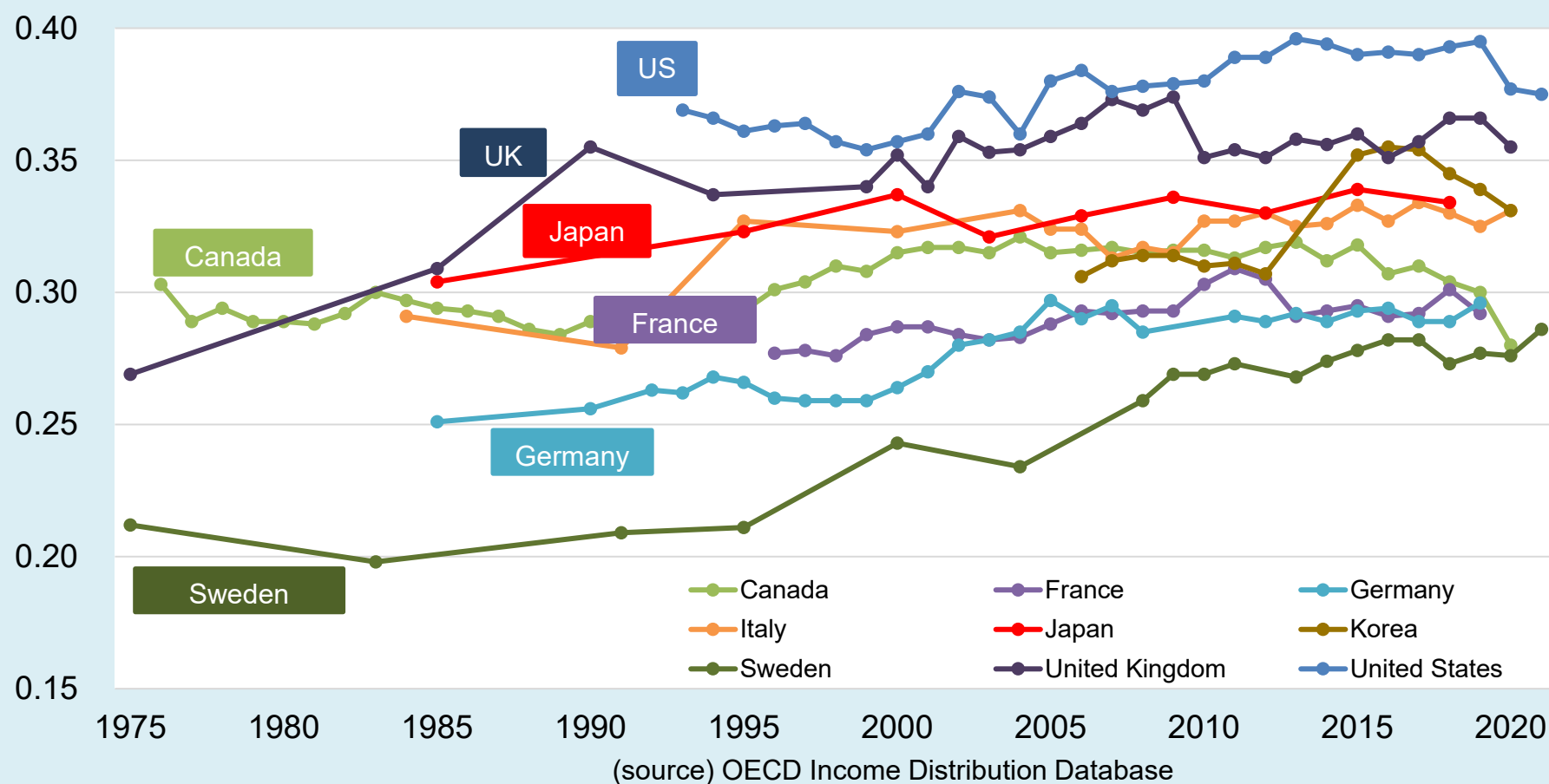
Poverty rates

- Japan

	1985	1988	1991	1994	1997	2000	2003	2006	2009	2012	2015	2018
Poverty rate (%)	12.0	13.2	13.5	13.8	14.6	15.3	14.9	15.7	16.0	16.1	15.7	15.4
Children (%)	10.9	12.9	12.8	12.2	13.4	14.4	13.7	14.2	15.7	16.3	13.9	13.5
Median (a), 10K Yen	216	227	270	289	297	274	260	254	250	244	244	253
Poverty line (a/2)	108	114	135	144	149	137	130	127	125	122	122	127

$$\text{Equivalent income} = \frac{\text{Household income}}{\sqrt{\text{\# of household members}}}$$

- Society at a Glance 2019 (OECD)
  - Figure 6.4: Percentage of persons living with less than 50% of median equivalised disposable income, by gender, in 2016 (or nearest year)
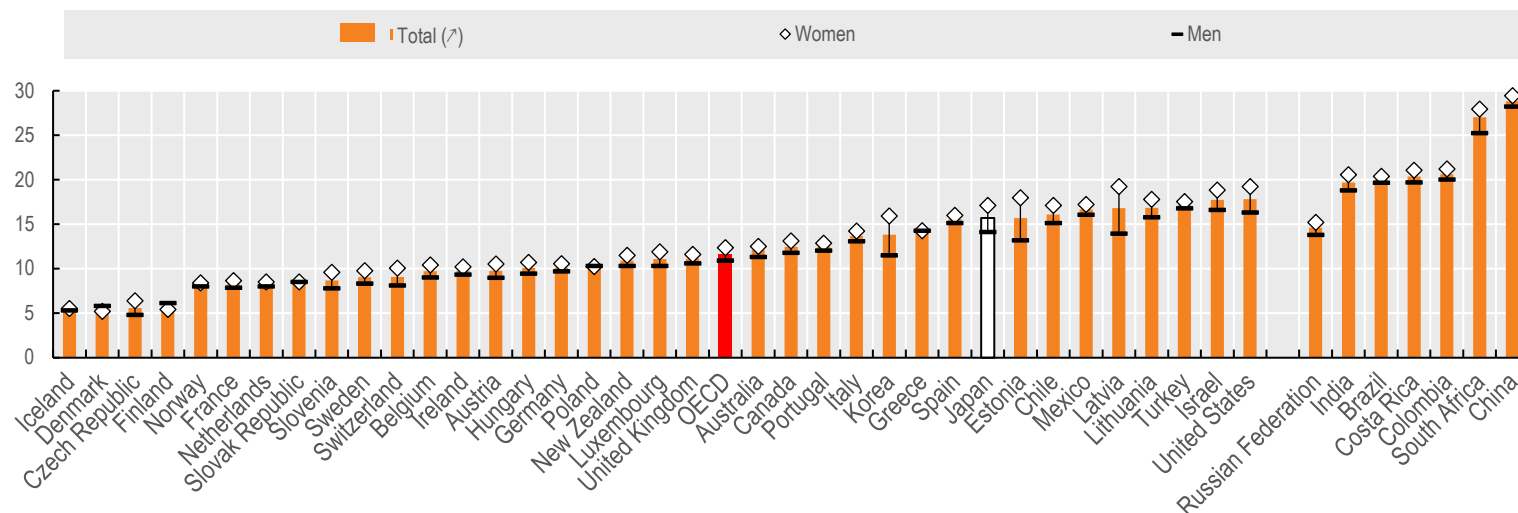
Redistribution

- □ Definition
  - ■ Change distributions of income, consumption and/or utility
    - □ Redistribution policy
  - ■ Typically, correct inequality/unfairness by transferring income
  - ■ Social security (pension, health, welfare, long-term care), education

- □ Why necessary?
  - ■ Socially desirable
    - □ How to judge?
  - ■ Pareto improvement
    - □ Altruism
    - □ Market failure: insurance market

Socially desirable?

- Pareto criteria may be difficult to use for policy evaluation
  - Pareto criteria is not satisfied

    = there is a room for all people to increase their utility

    = All agree with such a change in allocation

    = Such a policy may have already been implemented

    (Often not, because of coordination failure etc)
- Pareto criteria may be hard to use to evaluate redistribution policies
  - This policy takes something from someone and gives it to another
  - E.g., 2 persons economy
    - Income: Scrooge with 1M, Cratchit with 50K
    - If a government take some money from Scrooge and give it to Cratchit…
    - Utility of selfish Scrooge decreases, it is not Pareto improvement
- How should we evaluate social desirability?

Social welfare function

- A function to represent a social desirability of resource allocation
  - Assume: utility is comparable and cardinal
  - A function from allocation to real number

  Set of "individual's consumption set"

- Welfarism (consequentialism) welfare function
  - A function from individuals' utilities to welfare
 $$W = W(u_1, u_2, \ldots, u_N)$$
  - Depend on distribution of utility, not distribution of consumption
- Unobservable
  - Useful concept
  - (note: utility is not observable)

Social welfare function

- Bergson-Samuelson type SWF assumes:
  - Pareto criteria
    - Pareto dominant allocation has higher social welfare
  - Annoymity/symmetry
    - Social welfare does not depend on who has high utility
    - Exchange of utilities of 2 persons does not change social welfare
  - Inequality aversion
    - Equal utility distribution is more socially desirable.
    - E.g.: Income: Scrooge with 1M, Cratchit with 50K
      - If a government take some money from Scrooge and give it to Cratchit…
      - Utility of selfish Scrooge decreases, it is not Pareto improvement
      - Social welfare increases
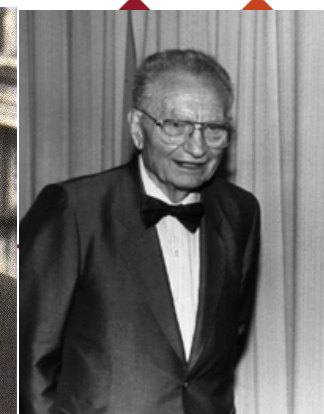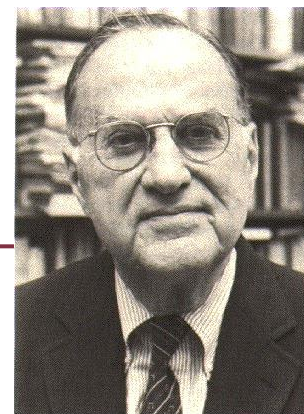
B-S type SWF: 2 persons case
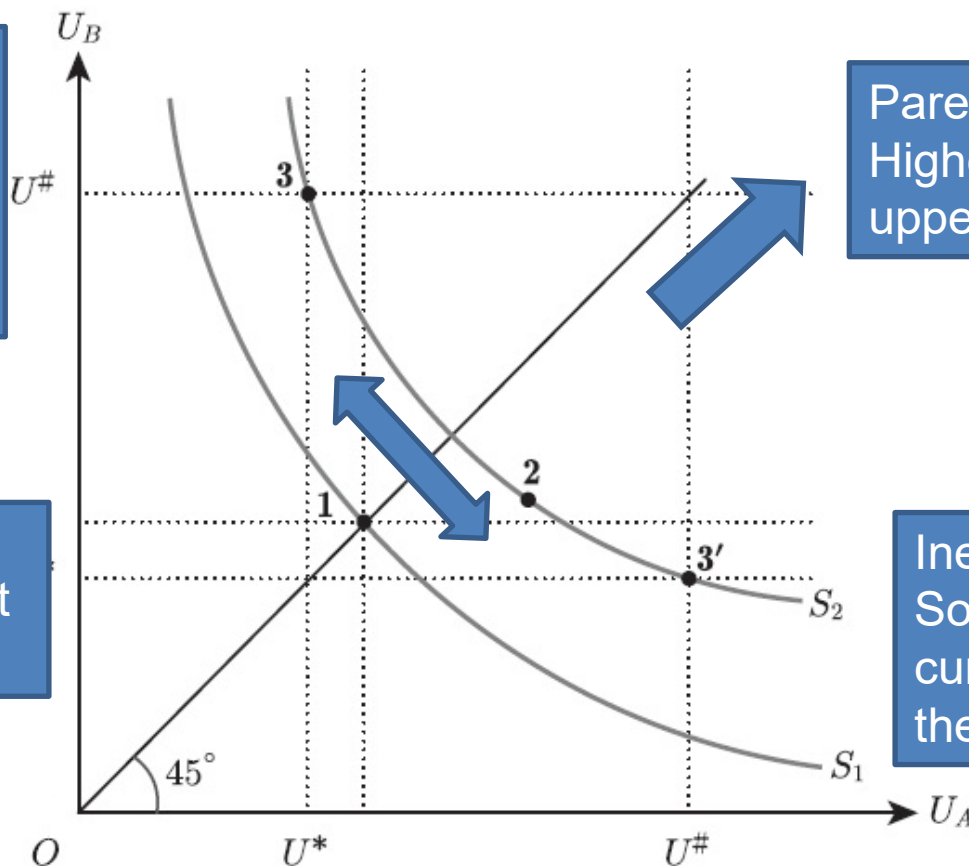
Welfarism: $W = W(U_A, U_B)$	Pareto criteria: $\frac{\partial W}{\partial U_i} > 0$
Annoymity: $W(U_A, U_B) = W(U_B, U_A)$	Inequality aversion: decreasing $-\frac{\partial W / \partial U_A}{\partial W / \partial U_B}$

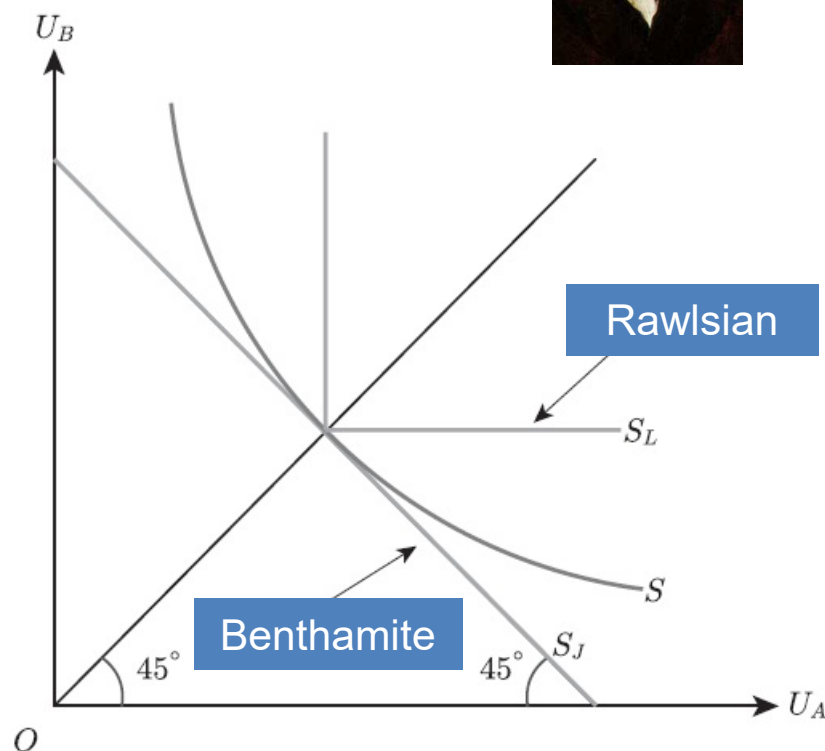Welfarism: Social indifference curves on the utility plane

Pareto criteria: Higher SW in the upper right
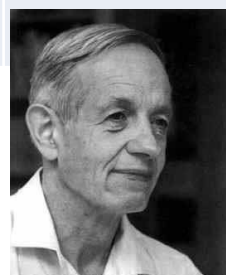
Annoymity: symmetric about 45 degree line

Inequality aversion: Social indifference curve is convex to the origin

Typical social welfare function

	Benthamite	Nash	Rawlsian
2 persons	$W = U_A + U_B$	$W = U_A U_B$	$W = \min(U_A, U_B)$
Degree of inequality aversion	0	$\rightarrow 1$	$\rightarrow \infty$

Denoting the degree of inequality aversion as ρ, these are special cases of social welfare functions with constant degree of inequality aversion,

$$W = \frac{1}{1-\rho}\left(U_A^{1-\rho} + U_B^{1-\rho}\right)$$

Distributionally optimal allocation

□ On the utility plane,

- Utility Possibility Frontier: Set of feasible combinations of utilities
- Social indifferent curve: Social evaluation of combinations of utilities

→A point within utility frontier and with highest welfare is social optimal

□ If people's utility is identical,

- SWF is assumed to be symmetric,
- Perfect equality is

distributionally optimal

- Regardless of degree of

Inequality aversion

完 全 均 等
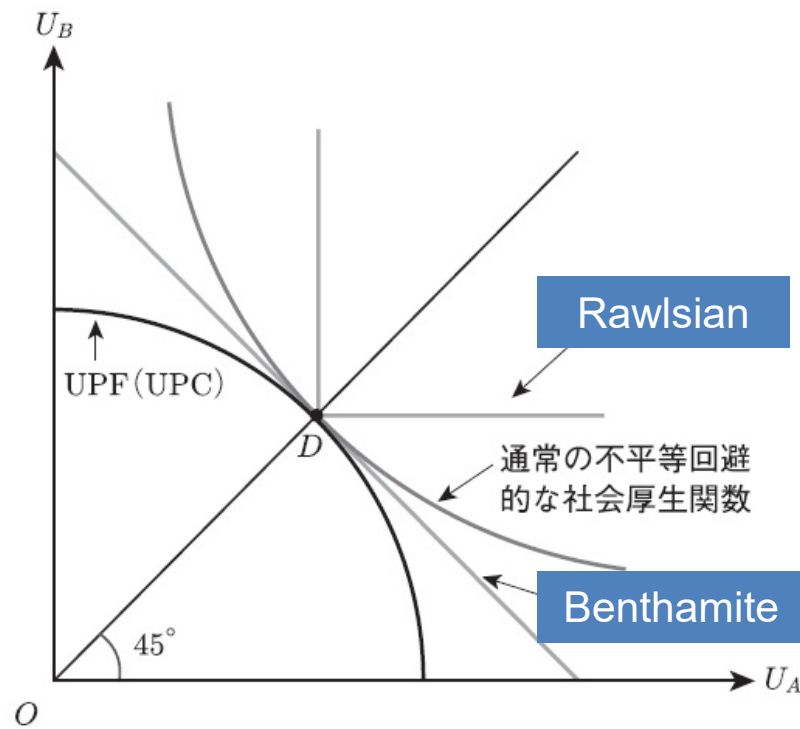
U_B

UPF (UPC)

Rawlsian

通常の不平等回避
的な社会厚生関数

D

Benthamite

45°

U_A

O

Today's talk

- ❑ First theorem of welfare economics
    - ■ When the assumptions do not hold.
- ❑ Resource allocation
    - ■ Externality
    - ■ Public goods
- ❑ Income redistribution
    - ■ Social welfare function
    - ■ Tradeoff between redistribution and efficiency
   - ■ As a correction to market failure

Tradeoff between redistribution and efficiency

- Redistribution so that everyone has the same level of utility?
- Cost of redistribution
  - Distortion
    - Taxation
    - Benefits
  - Administrative costs
    - Costs for collecting taxes and distributing benefits: Collecting info.
    - Costs of public sector
  - Compliance costs
    - Costs for tax payment: Filing tax return forms, …
- Resources are necessary
  - "Melting ice cream" : Utility frontier shrinks inside

Costs of redistribution

□ Redistribution from B to A: Utility frontier shrinks
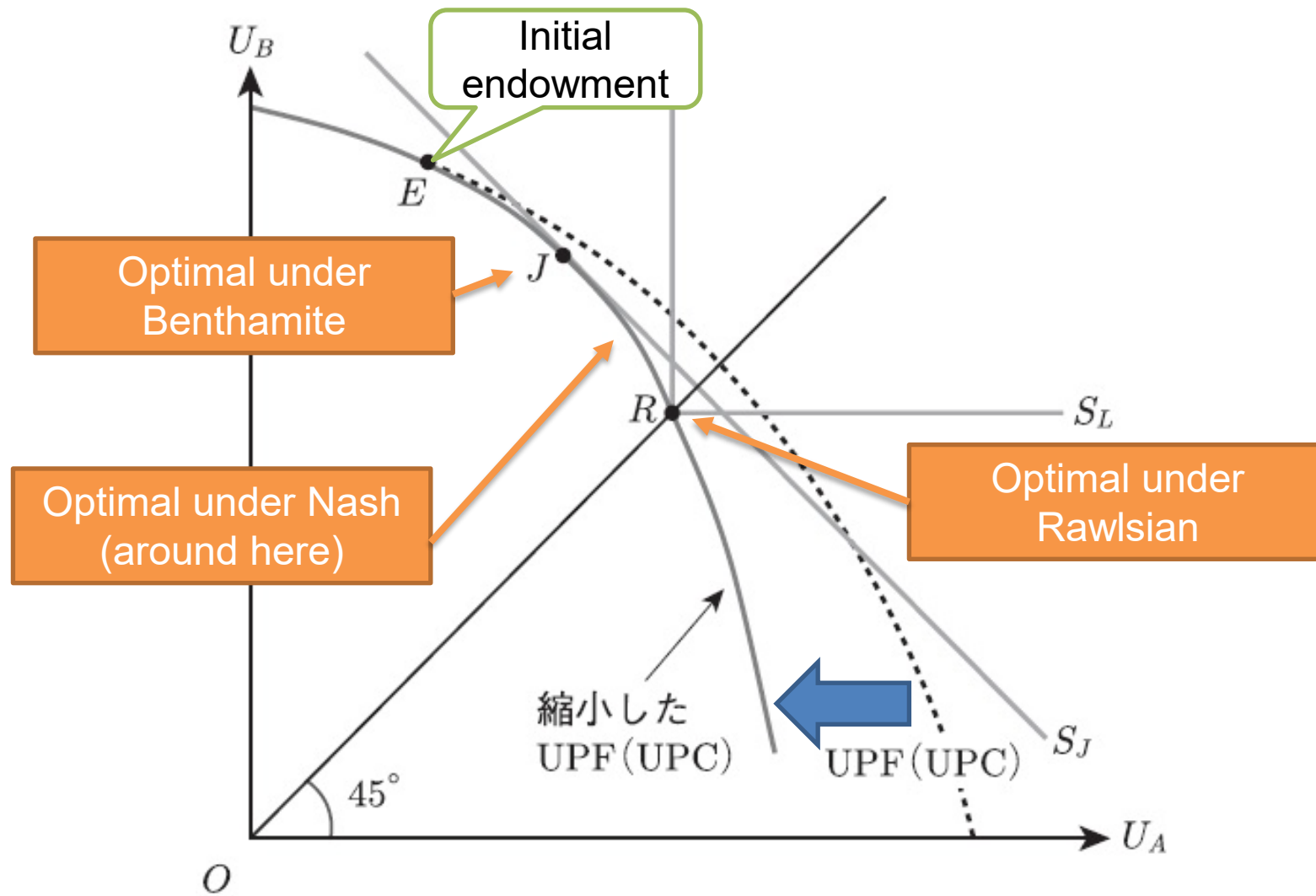
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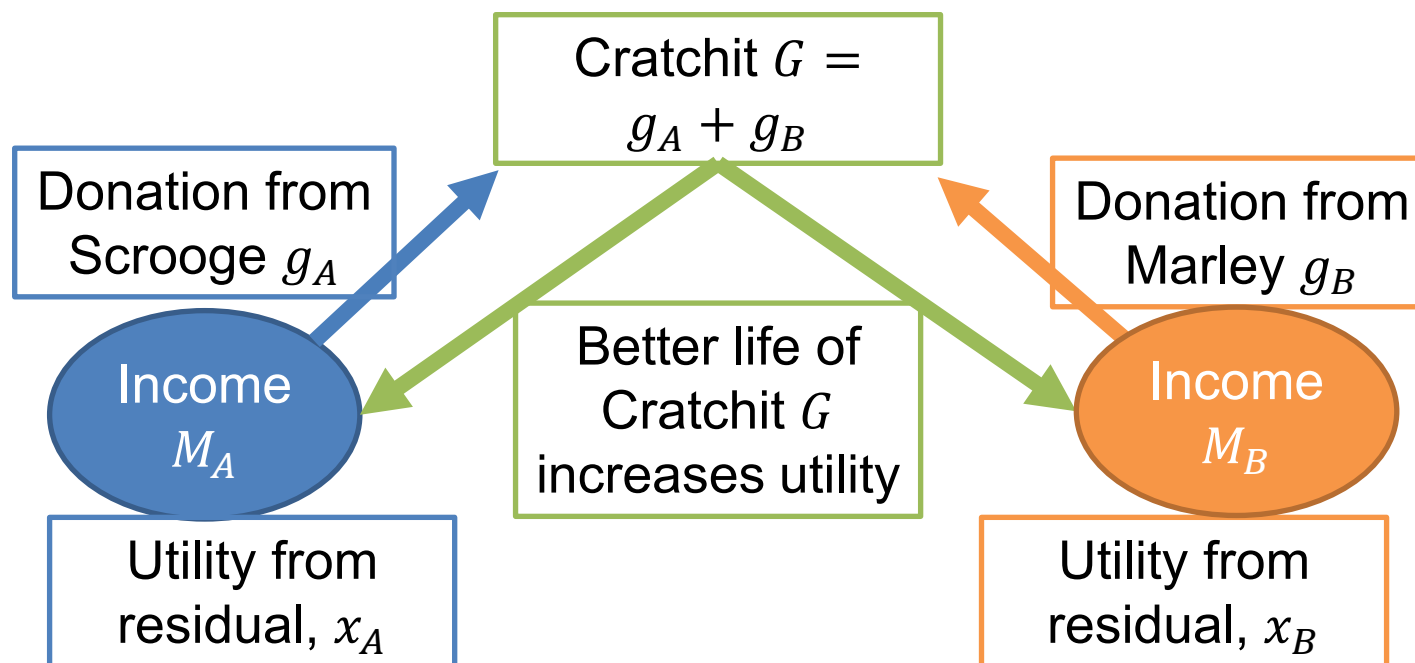   - As a correction to market failure

Altruism and redistribution

- Redistribution can be Pareto improvement
- Definition: Altruism
  - An increase in other's utility increase one's own utility
  - When redistribution happens, the payer's utility may increase
    - Scrooge is willing to pay the medical costs for Tim Cratchit
- Voluntary transfer (donation)
  - 2-person economy
    - Altruistic person A: $u^A = u^A(x^A, u^C) = u^A\left(x^A, u^C(x^C)\right)$
    - Low-income person C: $u^C = u^C(x^C)$
  - As C only receives, focus on A's behavior
    - A's utility is represented as $u^A = u^A(x^A, x^C)$
    - Voluntary transfer occurs under some usual assumptions

Altruism and redistribution

- ❑ 3-person economy
  - ■ Altruistic person A: $u^A = u^A(x^A, u^C),\ x^A + g^A = y^A$
  - ■ Altruistic person B: $u^B = u^B(x^B, u^C),\ x^B + g^B = y^B$
  - ■ Low-income person C: $u^C = u^C(x^C)\ ,\ g^A + g^B = x^C$

Cratchit $G = g_A + g_B$

Donation from Scrooge g_A

Donation from Marley g_B

Income M_A

Income M_B

Better life of Cratchit G increases utility

Utility from residual, x_A

Utility from residual, x_B

Altruism and redistribution

❑ Donation as a public good

  ■ Consumption level of C is a public good for A & B

    ❑ Consumption level of C become too small compared to Pareto efficient level

❑ Government can improve the situation by redistribution

  ■ Benefits from government complements private donation

  ■ Pareto efficient redistribution is difficult

Insurance and redistribution

□ Insurance

  ■ Pay premiums (contributions) ex ante
  ■ Receive benefits ex post (after the risk realized)
    □ Income transfer from those hit by the accident to those without

□ Actuarially fair

  ■ Premium a, probability of accident $1 - p$, benefit B
  ■ Income without the accident: $y_H - a$
  ■ Income with the accident: $y_L - a + B$
  ■ The number of enrollees N
  ■ Budget balance of insurance: $aN = B(1 - p)N$
  ■ Actuarially fair premium is $a = (1 - p)B$

Insurance market failure

- Financial balance of insurance is necessary for insurance market
  - Insurance is desirable if there is a risk
- Insurance may go into the red
  - If individual risk (probability) is unobservable
    - Some people with low risk consider premium too high and opt out
      - Hidden information
      - Adverse selection
    - Insurance company does not sell insurance to people with high risk
      - Cream skimming
  - Probability ex ante is higher than probability ex post
    - People with insurance care less
    - Hidden action
    - Moral hazard
- Private insurance market may fail

Government steps in insurance

- ❑ Note: If there is a risk, enrolling insurance is desirable
    - ■ If all people face the risk, compulsory enrollment may be desirable
- ❑ Social insurance
    - ■ Pension (risk of longevity), health, long-term care, unemployment, …
    - ■ "Compulsory" does not necessarily mean operation by government
        - ❑ E.g., Automobile liability insurance in Japan
    - ■ Government can charge different premiums depending on, say, income

- ❑ Risk of "how you are born"
    - ■ Ability, generation, area, ….
    - ■ Private insurance company cannot undertake these kinds of risk
    - ■ Taxes and benefits can be regarded as insurance premium and benefits

Another justification

- ❑ Merit goods
  - Paternalistic intervention
    - ❑ Making decisions on behalf of a person for his/her own benefit
      - Parents take their children to the doctor
    - ❑ "in trouble later", "bad for other people"
  - E.g.: mandatory insurance, drug control
  - E.g.: mandatory wearing of helmets and seat belts
- ❑ Issues
  - Right to self-determination and consumer sovereignty
  - Behavioral economics: myopic behavior
    - ❑ "I didn't see this coming"
    - ❑ Nudges as a weak intervention
  - Evaluation of social welfare: ex-ante or ex-post?