Public Goods and Publicly Provided Private Goods

Basic questions

- The government supplies a wide variety of goods
- Some of these goods, like education, are also provided privately
- Some, like national defense, are exclusively provided by government
- What are the economic properties of goods?
- How do they differ from goods that are provided principally through private markets?

Basic properties

- In order to distinguish between private and public goods we look into two core properties of public goods
- Non – rival, non-excludable
- Goods for which there is no rivalry in consumption and for which exclusion is impossible are pure public goods.
- Public goods and market failure

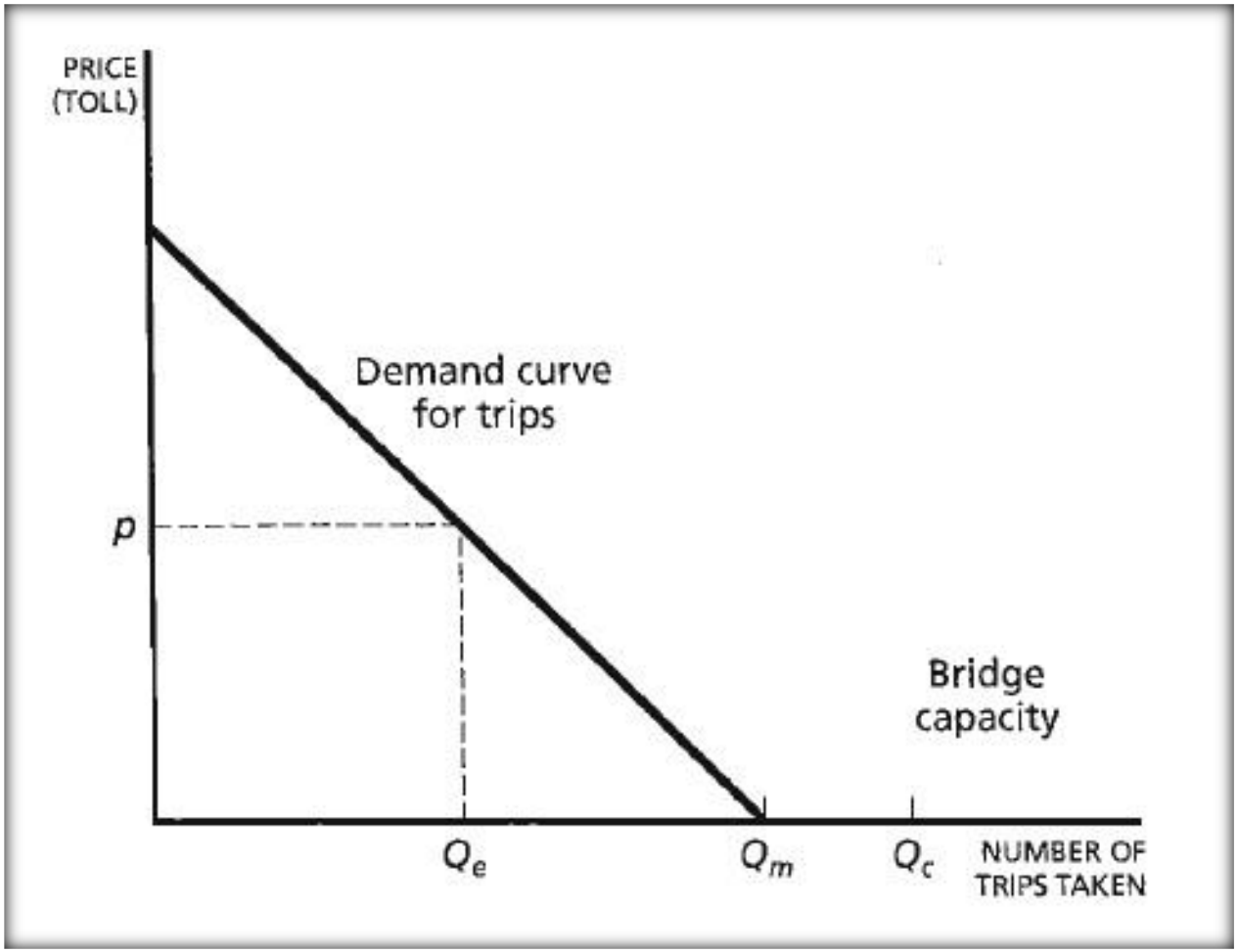
Paying for Public Goods

- If exclusion is possible, even if consumption is non-rival, governments often charge user fees to those who benefit from a publicly provided good or service.
- Toll on expressway
- User fees are often thought of as an equitable way of raising revenues, as those who use the public facility the most (and therefore presumably benefit from it the most) pay the most.
- However, when consumption is non-rival, user fees introduce an inefficiency.

Paying for Public Goods

- Demand curve for a bridge, number of trips taken is a function of the toll charged
- Lowering the toll results in increased demand for the bridge.
- The capacity of the bridge is say Qc.
- For any demand below Qc, there is no congestion and no marginal cost associated with use of the bridge.
- As long as the bridge is operating below capacity, consumption is non-rival; additional consumption by one individual does not detract from what others can enjoy.

Paying for Public Goods



Paying for Public Goods

- Because the marginal cost of usage is zero, efficiency requires that the price for usage be zero.
- Then, the revenue raised by the bridge will then be zero.
- This is the difference between ***public provision and private***
- With a single bridge, the monopoly owner would choose a toll to maximize its revenue, and would build the bridge only if those revenues equaled or exceeded the cost of the bridge

Paying for Public Goods

- The government would face a more complicated set of calculations.
- It might charge the toll required to just cover the costs of construction, to break even.
- In doing so, it would recognize that with any toll, the usage of the bridge would be reduced, and some trips whose benefits exceed the social cost (here, zero) would not be undertaken.
- Thus, it might charge a toll less than that required to break even, raising the revenue required to finance the bridge in some other way.

Paying for Public Goods

- It might not even charge any toll.
- In making these decisions, it would weigh equity considerations—the principle that those who benefit from the bridge should bear its costs—with efficiency considerations.
- The distortions arising from the underutilization of the bridge would need to be compared with the distortions associated with alternative ways of raising revenues (e.g., taxes) to finance the bridge.
- The government might build the bridge even if the maximum revenue it could obtain from the tolls was less than the cost

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Paying for Public Goods

- There are a few goods that have the property of at least high costs of exclusion
- Congested roads in Bangalore
- The infeasibility of rationing by the price system implies that the competitive market will not generate a Pareto efficient amount of the public good.
- Could a private firm enter to fill this gap?
- To do so, it would have to charge for the services it provided.

Paying for Public Goods

- However, because all individuals would believe that they would benefit from the services provided regardless of whether they contributed to the service, they would have no incentive to pay for the services voluntarily.

- That is why individuals must be forced to support these goods through taxation.

- The reluctance of individuals to contribute voluntarily to the support of public goods is referred to as the **free rider problem.**

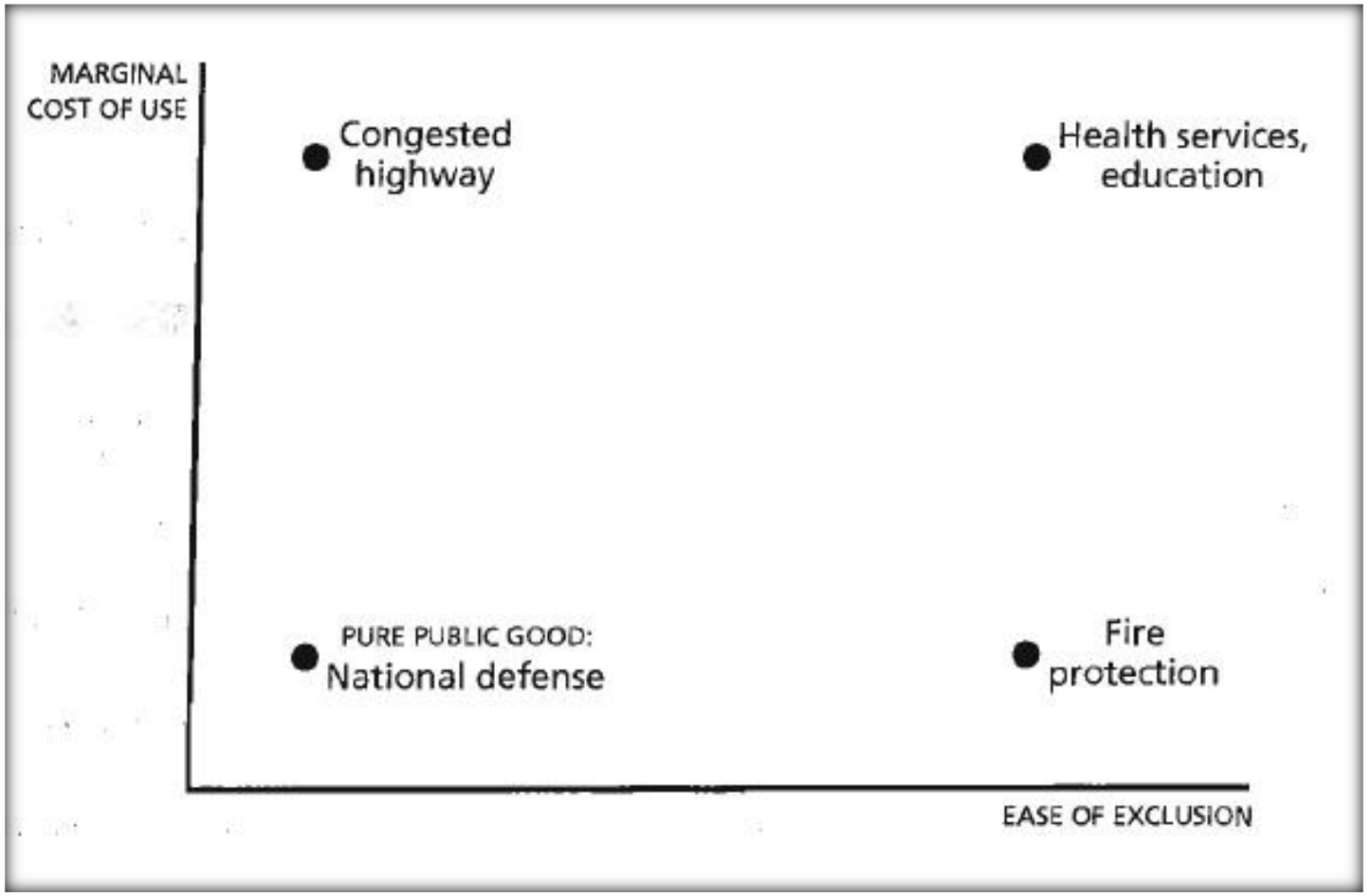
Pure and Impure Public Goods

- A pure public good is a public good for which the marginal costs of providing it to an additional person are strictly zero and for which it is impossible to exclude people from receiving the good.

- Many public goods that government provides are not *pure public goods in this sense*.

- The cost of an additional person using an uncrowded highway is very, very small, but not zero, and it is possible, though relatively expensive, to exclude people from (or charge people for) using the highway.

Pure and Impure Public Goods



Pure and Impure Public Goods

- For many goods, the issue is not so much the feasibility of rationing, but the cost.
- Thus, TV and radio provided over the airwaves has one of the two properties of a public good: consumption is non-rival.
- However, it is now feasible to exclude some consumers, as in the use of cable TV and satellite radio, although there is a cost to exclusion without any benefit to society from doing so.
- There are, of course, costs associated with exclusion for private goods as well as for public goods.

Pure and Impure Public Goods

- Economists call these **transactions costs.**
- Although the costs of exclusion are relatively small for most private goods, they may be large (prohibitive) for some publicly provided goods.
- Externalities as impure public goods: Goods for which there are externalities in consumption have the property that others are affected, but not necessarily in the same amount.
- Externalities can thus be viewed as a form of impure public goods

Global and Local Public Goods

- The benefits of some public goods are enjoyed only locally—by those living in a particular community.
- These are called *local public goods, and include, for instance, local police* security.
- However, more and more public goods are **global public goods,** the benefits of which accrue to anyone in the world.
- The most important global public goods include the global environment (global warming), global health (Covid), global knowledge (everyone can benefit from developments in modern science), and global security.

Global and Local Public Goods

- Whenever there is a public good, there is a need for **collective action;** that is, individuals and firms acting privately will result in an undersupply of the public good.

- Within a country, the national government provides for national public goods, and at the local level, local governments provide for local public goods; however, there is no global government that provides for global public goods.

- On the other hand, steep declines in transportation and communication costs have created a world in which everyone is more interdependent. Everyone can be affected by threats to global economic security (contagion of financial crises) and physical security through global terrorism, cyber warfare, and increased nuclear proliferation.

Publicly provided private goods

- Publicly provided goods for which there is a large marginal cost associated with supplying additional individuals are referred to as **publicly provided private goods.**

- Education is a publicly provided private good – If the number of students enrolled doubles, costs will roughly double (assuming that quality, as reflected in class size, expenditures on teachers and textbooks, and so on, are kept roughly the same).

- Health care… number of beds, doctors, nurses, medicines etc

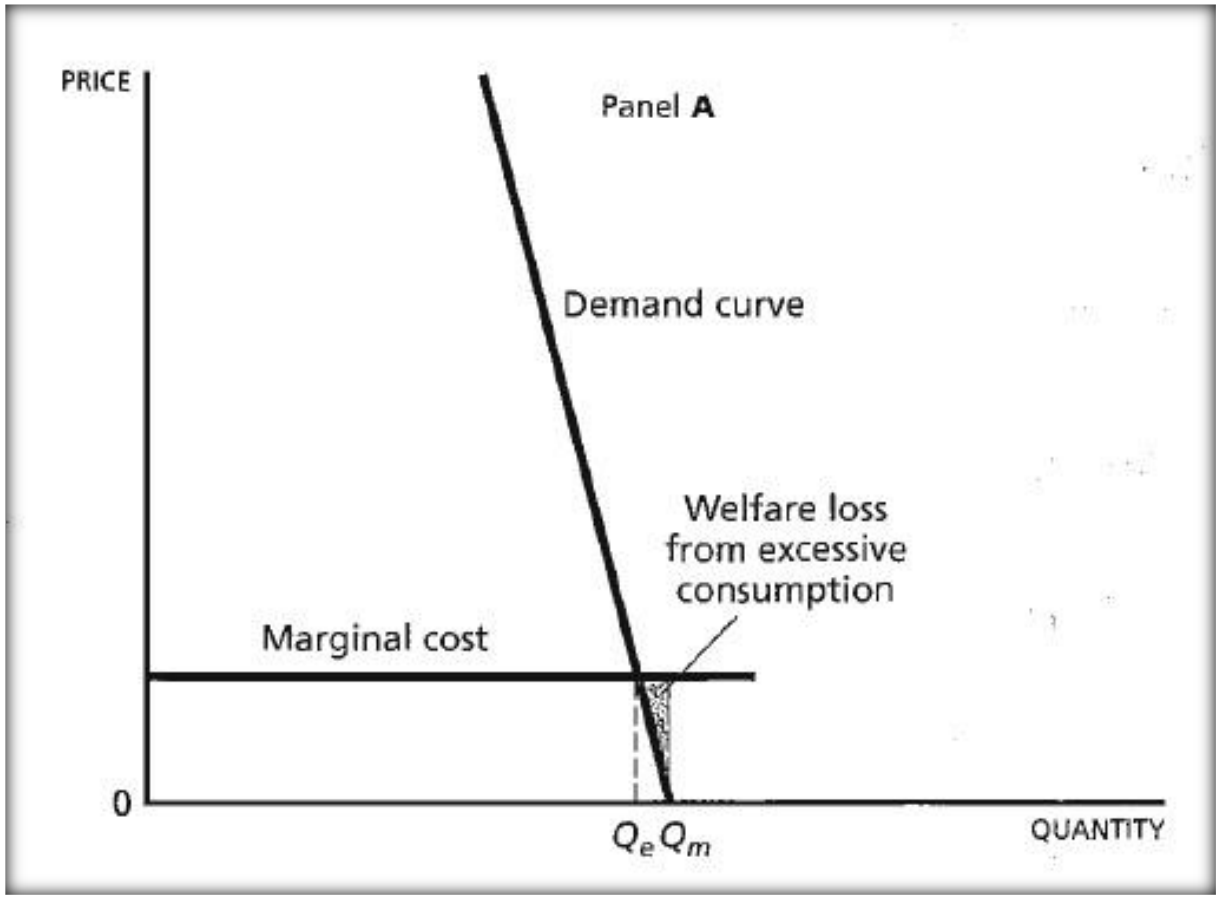
- Sometimes when the government provides a private good publicly (like water), it simply allows individuals to consume as much as they want without charge

Publicly provided private goods

- For these goods, there is a marginal cost associated with each unit consumed.
- It costs money to purify water and to deliver it from the source to the individual's home.
- If a private good is provided freely, there is likely to be over consumption of the good.
- Because individuals do not have to pay for the good, they will demand it until the point at which the marginal benefit they receive from the good is zero, in spite of the fact that there is a positive marginal cost associated with providing it.

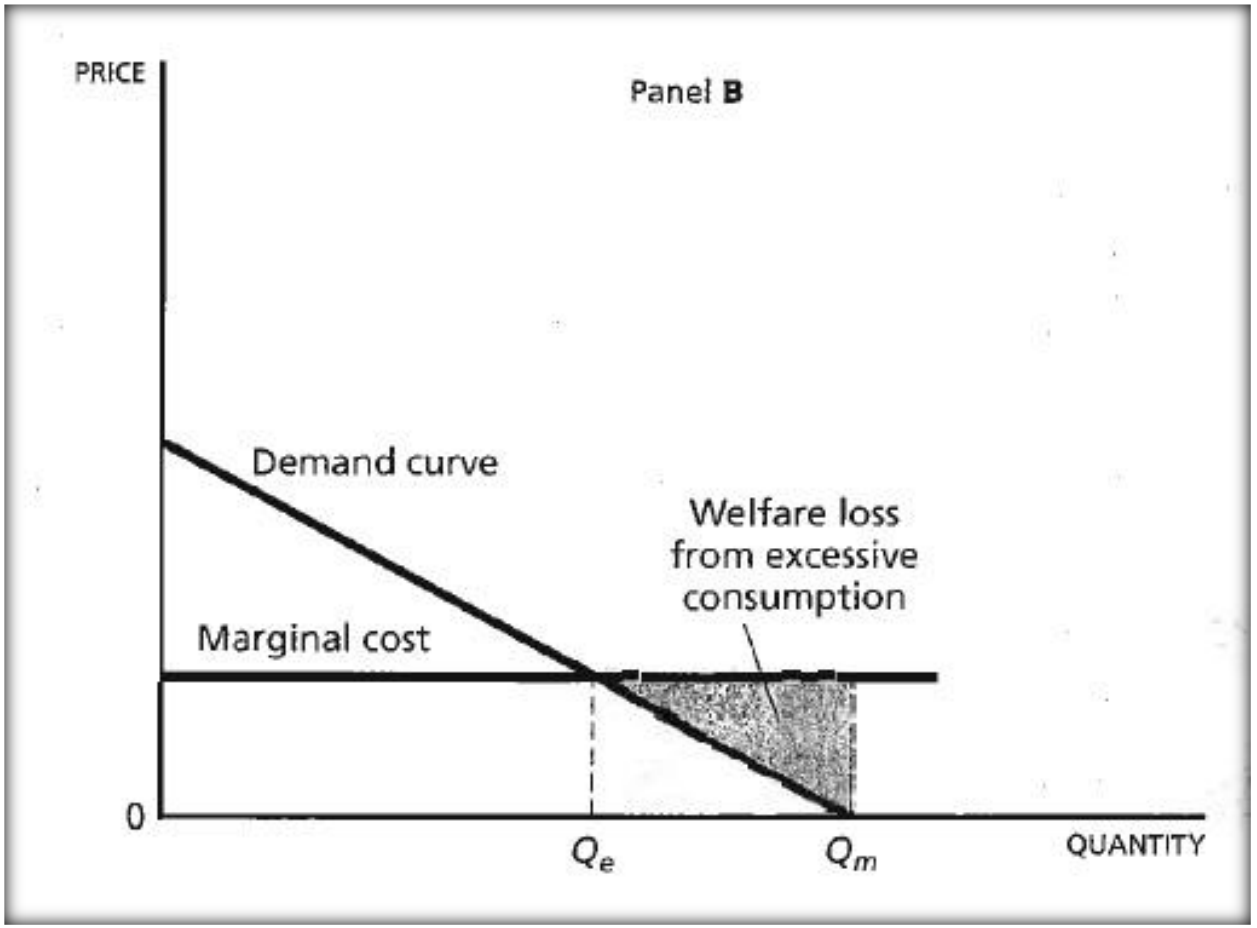
Publicly provided private goods

- In some cases, such as water, satiation may be quickly reached, so the distortion from over-consumption may not be too large



Publicly provided private goods

- In some cases, such as the demand for certain types of medical services, the distortion may be very large



Publicly provided private goods

- The welfare loss can be measured by the difference between what the individual is willing to pay for the increase in output from *Qe* (where price equals marginal cost) to *Qm* (where price equals zero) and the costs of increasing production from *Qe* to *Qm*.

- **Rationing Devices**: When there is a marginal cost associated with each individual using a good, if the costs of running the price system are very high, it may be more efficient simply to provide the good publicly and to finance the good through general taxation, even though providing the good publicly causes a distortion.

- When transactions costs are sufficiently high, it may be more efficient to supply the good publicly than to have the good supplied by private markets

Publicly provided private goods

- Consider a good with constant marginal costs of production, *c*.
- However, to sell the good entails transactions costs, which raise the price to *p**.
- Assume now that the government supplies the good freely.

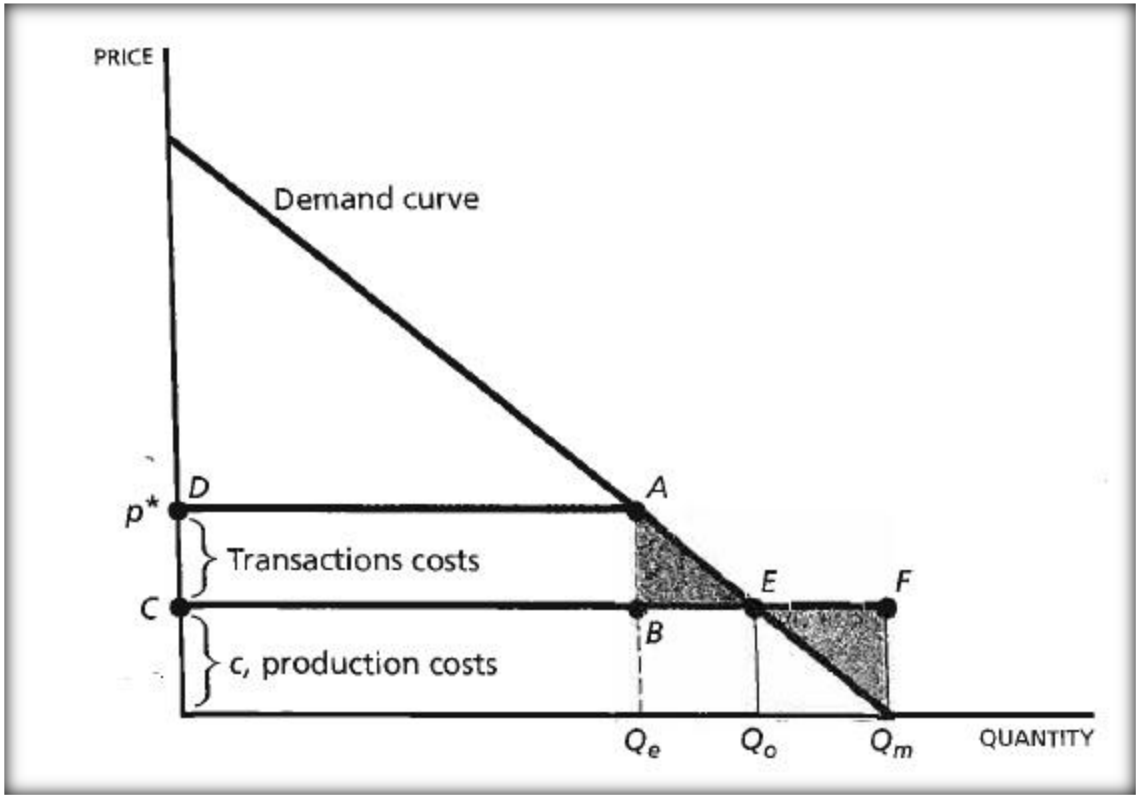
- This eliminates the transactions costs, and the entire area in rectangle *ABCD* is saved.

- There is a further gain as consumption increases from *Qe to Qo*, as individuals' marginal valuations exceed the marginal costs of production.

- The shaded area *ABE* measures the gain.

Publicly provided private goods

- On the other hand, if individuals consume the good until the marginal value is zero, in expanding consumption from *Qo* to *Qm*, the marginal willingness to pay is less than the cost of production.



Publicly provided private goods

- To decide whether the good should be provided publicly, we must compare the savings in transactions costs plus the gain from increasing consumption from *Qe* to *Qo* with

  (1) the loss from the excessive consumption of the good (the shaded area *EFQm)* and

  (2) the loss from the distortions created by any taxes required to finance the provision of the good publicly.

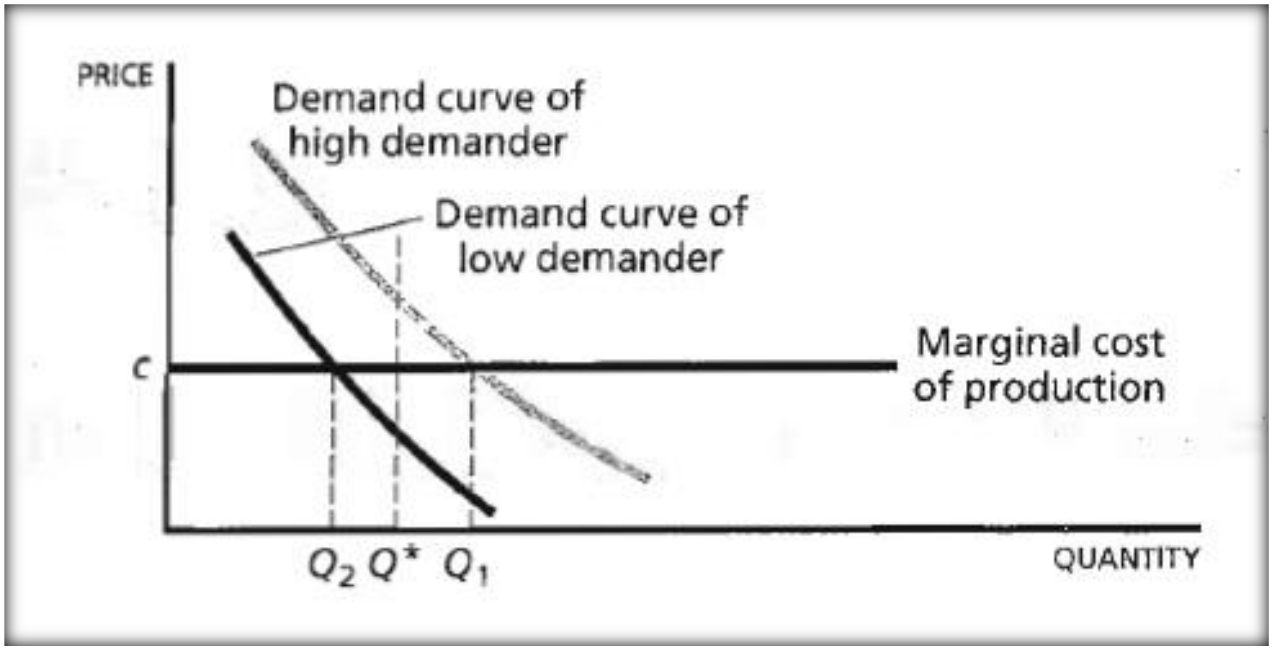
- Given the inefficiencies arising from overconsumption when no charges are imposed for publicly provided private goods, governments often try to find some way of limiting consumption.

Publicly provided private goods

- Any method restricting consumption of a good is called a **rationing system.**
- Prices provide one rationing system (user fees).
- A second commonly employed way of rationing publicly provided goods is **uniform provision:** supplying the same quantity of the good to everyone.
- Free primary education to all… basic health services in government run units..

Publicly provided private goods

- Those who would like to purchase more may be able to purchase supplemental educational services like tutoring on the private market



- When the publicly provided private good is supplied in equal amounts to all individuals, some get more than the efficient level and some get less.

Publicly provided private goods

- A third method of rationing that is commonly employed by the government is queuing: rather than charging individuals money for access to the publicly provided goods or services, the government requires that they pay a cost in waiting time.

- This allows some adaptability of the level of supply to the needs of the individual.

- Those whose demand for medical services is stronger are more willing to wait in the doctor's office.

Publicly provided private goods

- But queues are far from a perfect way of determining who is deserving of medical care, as those who are unemployed or retired may not be so needy of medical care but more willing to wait than either the busy corporate executive or the low-paid worker holding down two jobs.

- In effect, willingness to pay has been replaced as a criterion for allocating medical services by willingness to wait in the doctor's office.

- There is, in addition, a real social cost to using queuing as a rationing device—the waste of time spent queuing is a cost that could be avoided if prices were used as a rationing device.

Efficiency Conditions for Public Goods

- How large the supply of public goods should be?
- We have seen that a resource allocation is Pareto efficient if no one can be made better off without someone else becoming worse off
- What is required for Pareto efficiency in the supply of pure public goods?
- ***Pure public goods are efficiently supplied when the sum of the marginal rates of substitution (over all individuals) is equal to the marginal rate of transformation.***

Efficiency Conditions for Public Goods

- The *marginal rate of substitution of private goods* for public goods tells how much of the private good each individual is willing to give up to get one more unit of the public good.

- The sum of the marginal rates of substitution thus tells us how much of the private good all the members of society together are willing to give up to get one more unit of the public good, which will be consumed jointly by all.

- The *marginal rate of transformation tells us how much of the private good must be* given up to get one more unit of the public good.

Efficiency Conditions for Public Goods

- Efficiency requires, then, that the total amount individuals are willing to give up—the sum of the marginal rates of substitution—must equal the amount that they have to give up—the marginal rate of transformation.

- If the sum of the marginal rates of substitution exceeded unity, then, collectively, individuals would be willing to give up more than they had to; we could ask each of them to give up an amount slightly less than the amount that would make them indifferent, and it would still be possible to increase the production of ***guns*** by one unit.

- Thus, they could all be made better off by increasing the production of the public good (guns) by one.

Demand curves for public goods

- Individuals do not buy public goods.
- We can, however, ask how much individuals would demand if they had to pay a given amount for each extra unit of the public good.
- as expenditures on public goods increase, so do individuals' taxes
- **Tax price** - the extra payment that an individual has to make for each extra unit of the public good

Demand curves for public goods

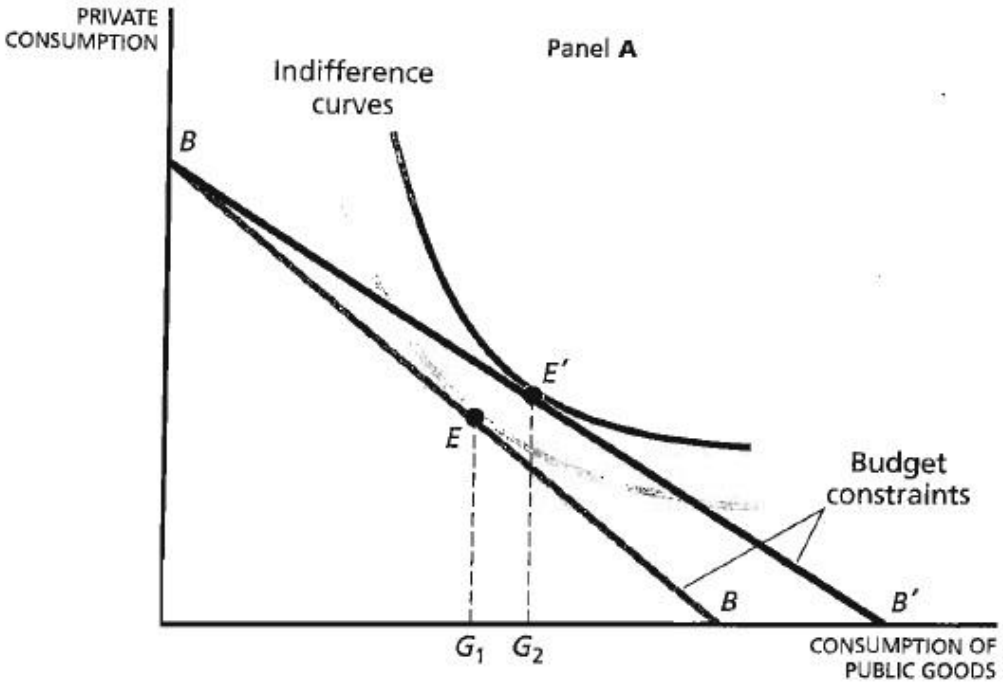
- Assume that the individual's tax price is *p;* that is, for each unit of the public good, the individual must pay *p*.

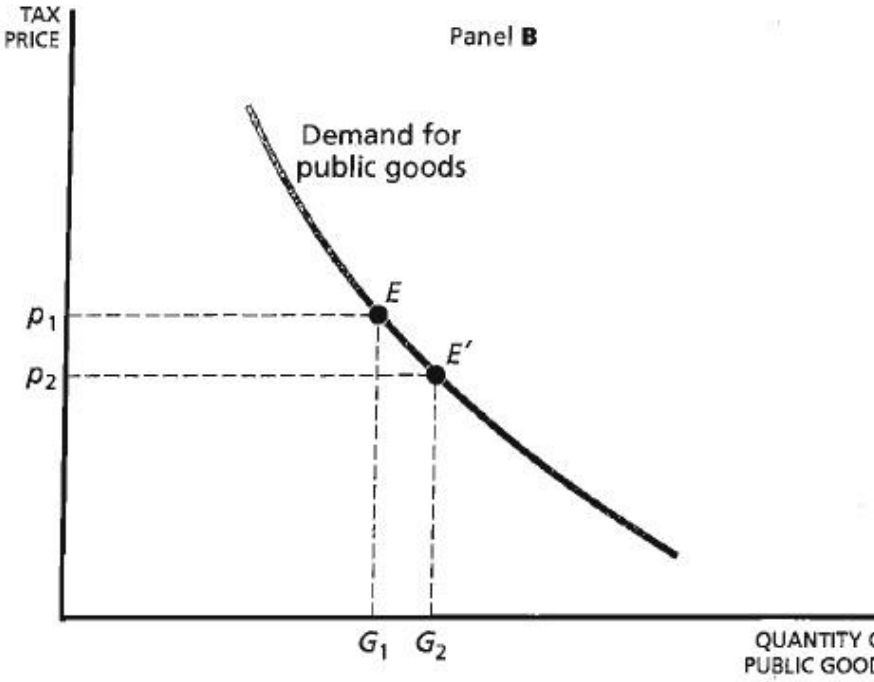
- Then, the total amount the individual can spend, the budget constraint, is:

$$C+p.G=Y$$

where *C* is the individual's consumption of private goods, *G* is the total amount of public goods provided, and *Y* is the individual's income.

Demand curves for public goods





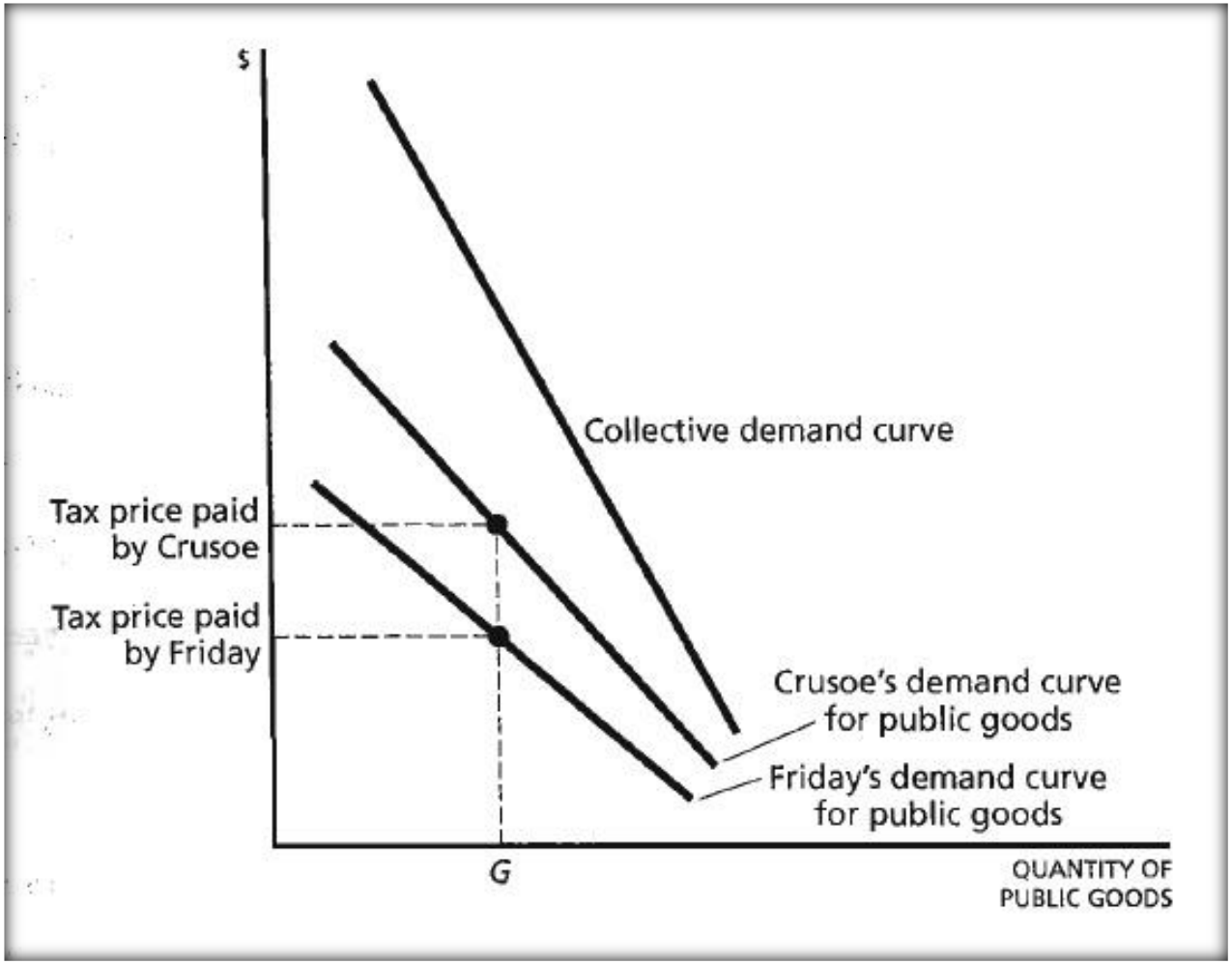
Demand curves for public goods

- We can first use this approach to trace out the demand curves for public goods of two individuals, Crusoe and Friday, and then add them vertically to derive the **collective demand curve**.

- Vertical summation is appropriate because a pure public good is necessarily provided in the same amount to all individuals.

- the vertical sum of the demand curves is just the sum of their marginal willingness to pay

Demand curves for public goods



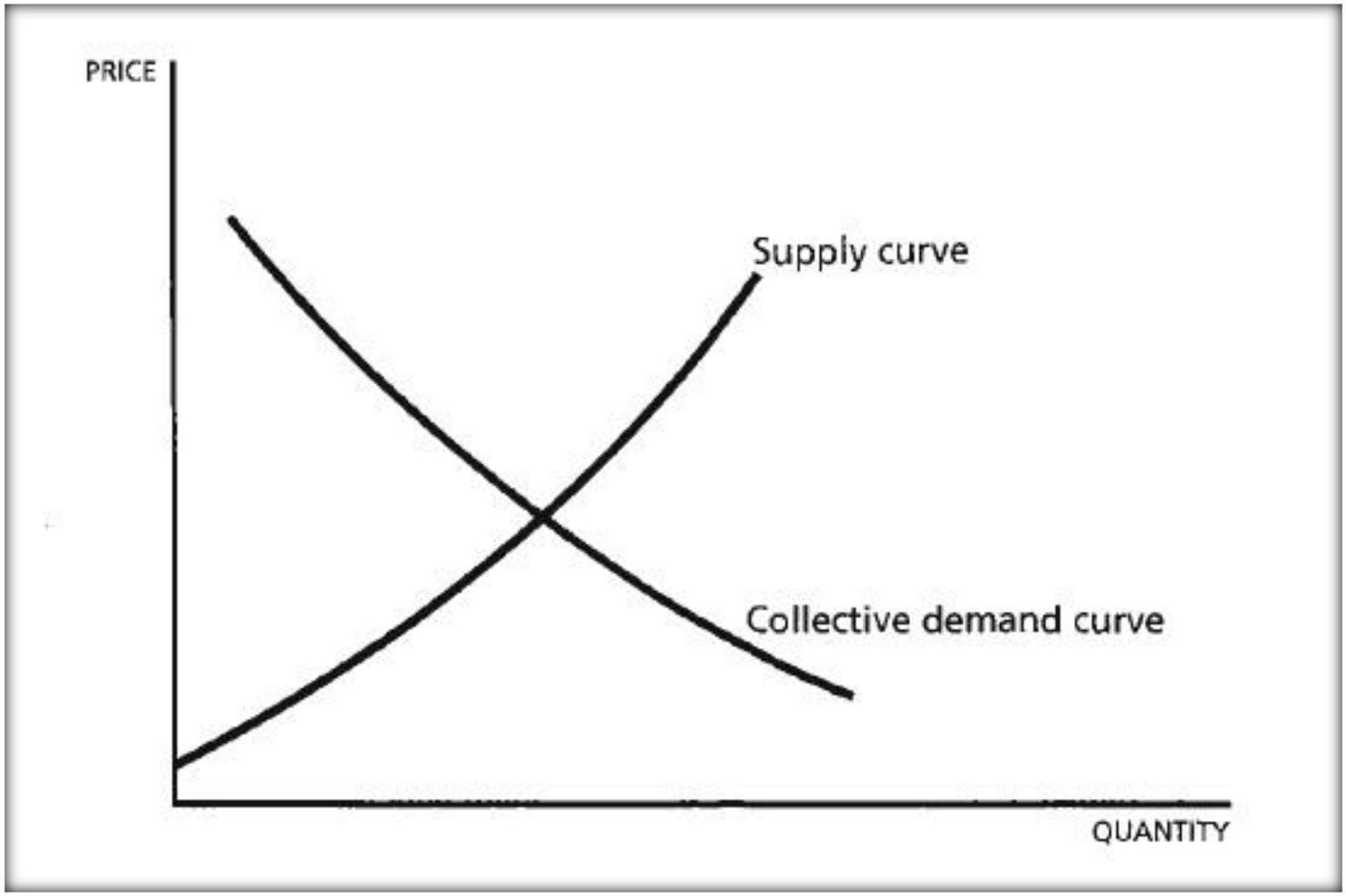
Efficient production of public goods

- An efficient supply of public goods occurs at the point of intersection of the demand curve and the supply curve.

- The collective demand curve gives the sum of what all individuals are willing to give up, at the margin, to have one more unit of public goods (one more gun)

- The supply curve gives the amount of other goods that must be given up to obtain one more unit of the public good.

Efficient production of public goods



Efficient production of public goods

- Efficient production requires that the sum of the marginal rates of substitution equal the marginal rate of transformation.

- Efficient production occurs at the intersection of the collective demand curve, formed by vertically adding the demand curves for each individual, with the supply curve.

Pareto Efficiency and Income Distribution

- There are many Pareto efficient resource allocations - any point on the utility possibilities schedule is Pareto efficient
- The market equilibrium in the absence of market failures corresponds to just one of those points
- Similarly, there is not a unique Pareto optimal supply of public goods
- The intersection of the demand and supply curves is one of these Pareto efficient levels of supply, but there are others as well, with different distributional implications

Pareto Efficiency and Income Distribution

- The efficient level of public goods depends on the distribution of income
- Assume that the government transferred a dollar of income from Crusoe to Friday
- This would normally shift Crusoe's demand for public goods (at any price) down and Friday's up
- These changes might not exactly offset each other.
- So the aggregate level of demand will change

Pareto Efficiency and Income Distribution

- With this new distribution of income, there is a new efficient level of public goods.
- However, efficiency is still characterized by the sum of the marginal rates of substitution equaling the marginal rate of transformation.
- Each point on the utility possibilities schedule may be characterized by a different level of public goods
- But at each point the sum of the marginal rates of substitution equals the marginal rate of transformation

Pareto Efficiency and Income Distribution

- The fact that the efficient level of public goods depends, in general, on the distribution of income has one important implication –

- One cannot separate efficiency considerations in the supply of public goods from distributional considerations.

- Any change in the distribution of income, say, brought about by a change in the income tax structure, will thus be accompanied by corresponding changes in the efficient levels of public-goods production

Limitations

- Governments, in evaluating the benefits of a public program, often seem to be particularly concerned with the question of ***who benefits from*** the program.

- They seem to weigh benefits that accrue to the poor more heavily than benefits that accrue to the rich

- However, efficient production implies MRS = MRT … the amounts that each individual is willing to pay at the margin for an increase in the public good, treating the rich and the poor equally

- How can these approaches be reconciled?

Limitations

- Re-visit the orange transfer from Crusoe to Friday such that some are lost in the process.

- The fact that redistributing resources through the tax and welfare systems is costly implies that the government may look for alternative ways to achieve its redistributive goals

Distortionary taxation and efficient supply

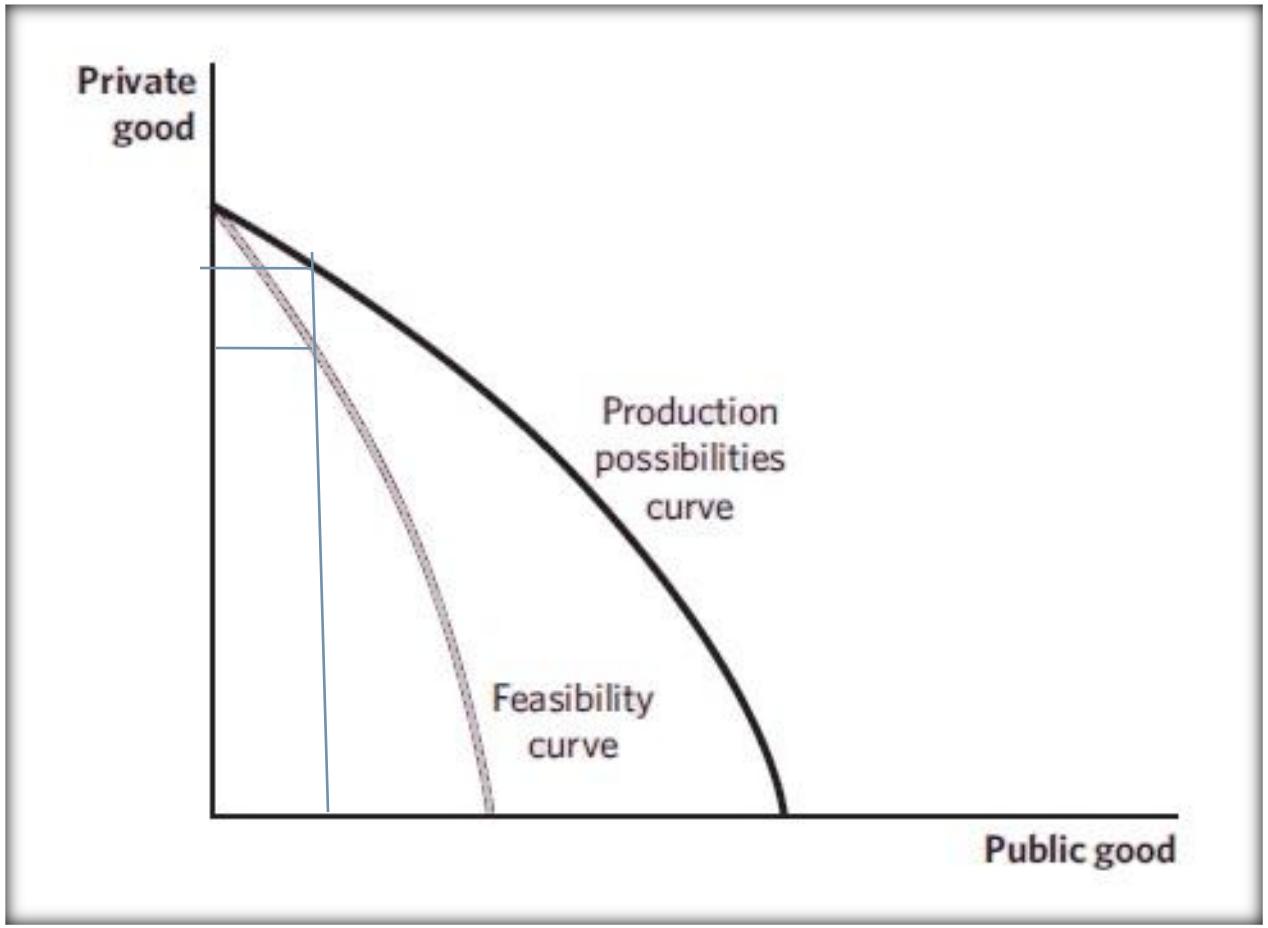
- The fact that the revenue raised to finance public goods is raised through distortionary taxes, such as the income tax, has some important implications for the efficient supply of public goods.

- The amount of private goods that individuals must give up to get one more unit of public goods is greater than it would be if the government could raise revenue in a way that did not entail distortionary incentive effects and that was not costly to administer

- We can define a **feasibility curve,** giving the maximum level of private-goods consumption consistent with each level of public goods, for our given tax system.

Distortionary taxation and efficient supply

- The tax system introduces inefficiencies, so this feasibility curve lies inside the production possibilities schedule



Distortionary taxation and efficient supply

- The amount of private goods we must give up to obtain one more unit of public goods, taking into account these extra costs, is called the ***marginal economic rate of transformation***, as opposed to the marginal (physical) rate of transformation

- Marginal (physical) rate of transformation is completely determined by *technology*.

- Marginal economic rate of transformation takes into account the costs associated with the taxes required to finance increased public expenditure

Distortionary taxation and efficient supply

- Condition replaced: marginal economic rate of transformation must equal the sum of the marginal rates of substitution

- Because it becomes more costly to obtain public goods when taxation imposes distortions, normally this will imply that the efficient level of public goods is smaller than it would have been with non-distortionary taxation

- Most of the debate regarding desirable level of public goods provision centers around this issue

Distortionary taxation and efficient supply

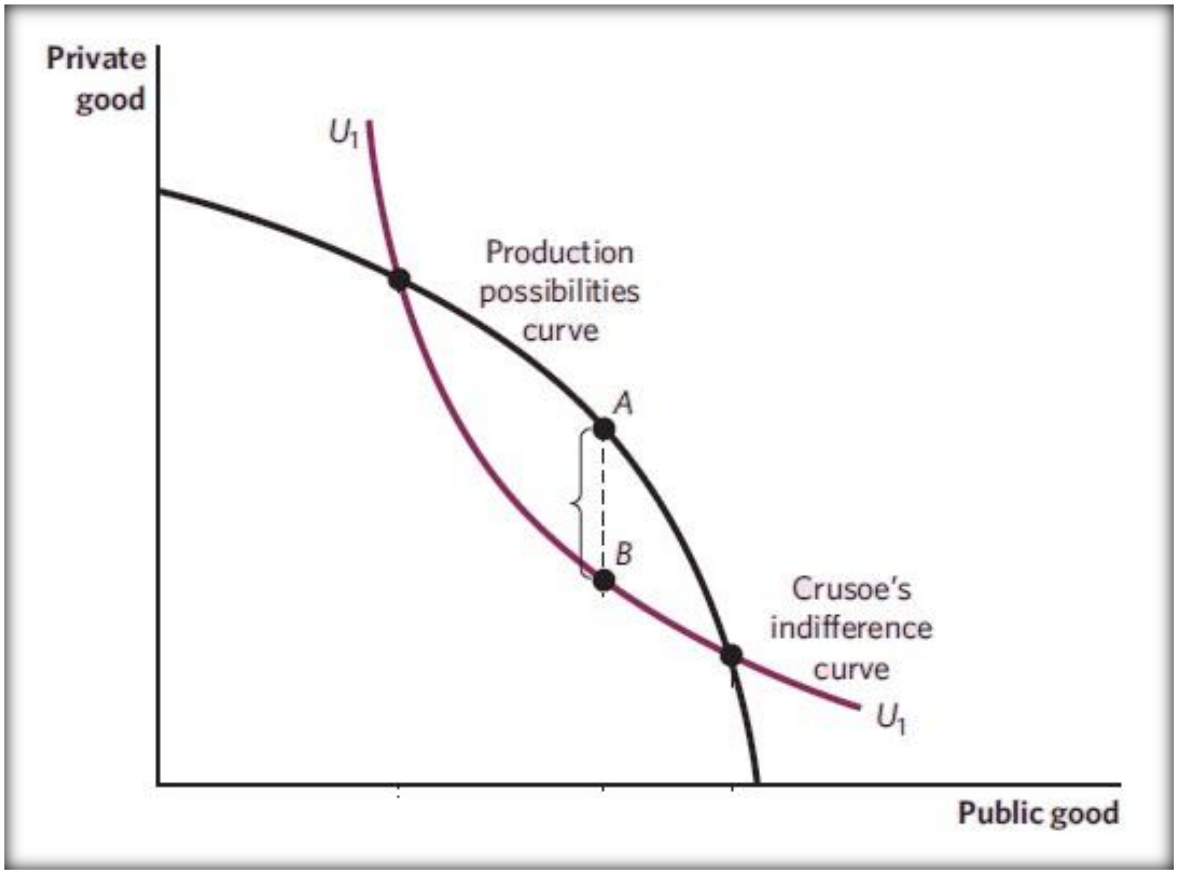
- Some believe that the distortions associated with the tax system are not very great, whereas others contend that the cost of attempting to raise additional revenues for public goods is great

- They may ***agree on the magnitude of the social benefits*** that may accrue from additional government expenditures, but ***disagree on the costs***

Leftover Curve

- Alternative approach to the basic efficient production of public goods

- Superimposed Crusoe's indifference curve on the PPC



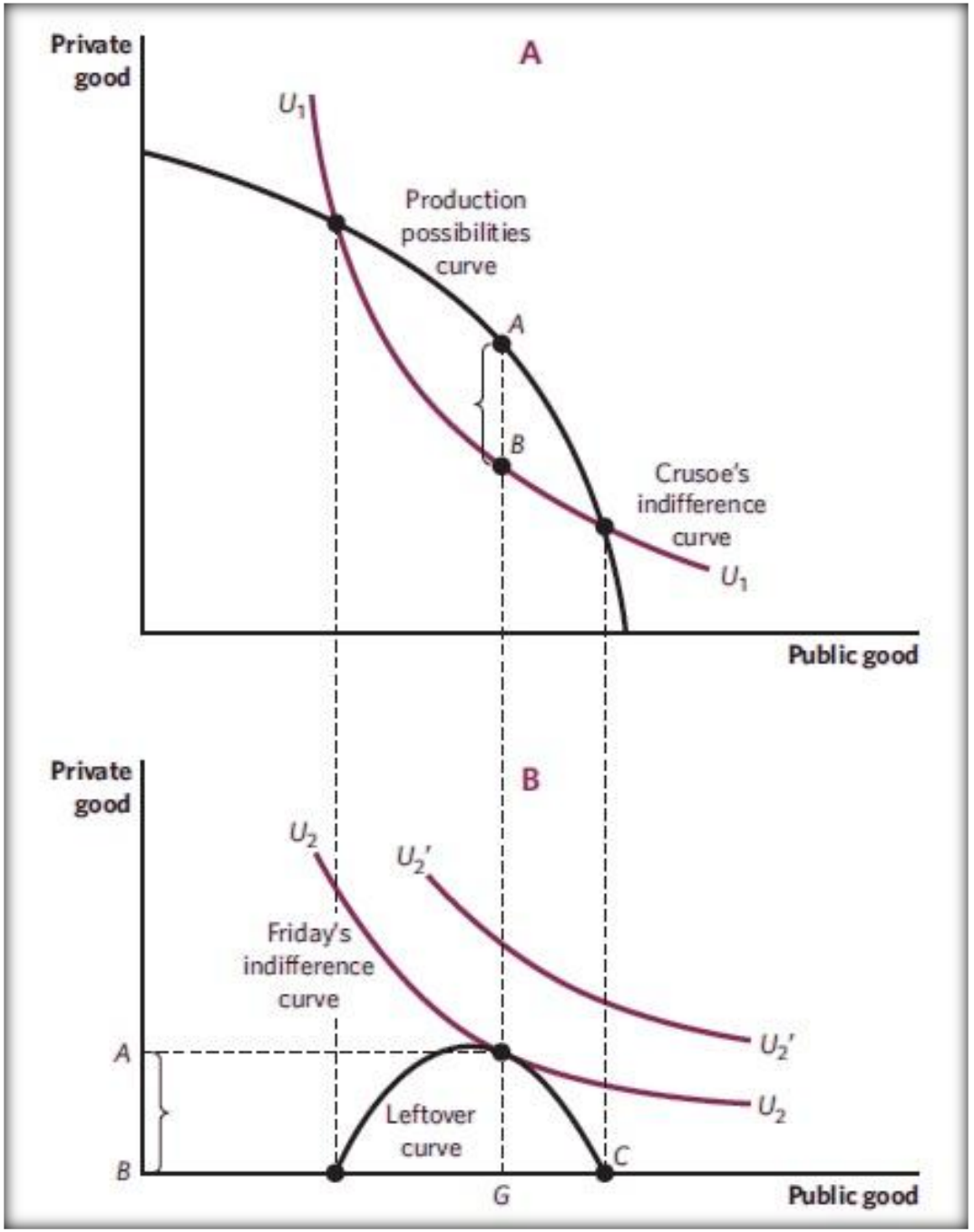
Leftover Curve

- If the government provides a level of public goods *G*, and wishes, at the same time, to ensure that Crusoe attains the level of utility associated with the indifference curve U_1, then the amount of private good that is "left over" for Friday is the vertical distance between the production possibilities schedule and the indifference curve.

- Accordingly, we call the (vertical) difference between the two the **leftover curve.**

- Now, superimpose Friday's indifference curves
- The highest level of utility he can attain, consistent with the PPF, and consistent with the pre-specified level of utility of Crusoe, is at the point of tangency between his indifference curve and the leftover curve.

Leftover Curve



Leftover Curve

- The leftover curve represents the difference between the production possibilities schedule for the economy and the first individual's indifference curve
- The slope of the leftover curve is the difference between the slope of the production possibilities schedule and the slope of the first individual's indifference curve.
- The slope of the production possibilities schedule is the marginal rate of transformation
- The slope of the first individual's indifference curve is his or her marginal rate of substitution

Leftover Curve

- If *G* is the optimal level of public goods, the leftover curve must be tangent to the second individual's indifference curve.

- Hence, Pareto efficiency of the economy requires that the slope of the leftover curve be equal to the slope of the second individual's indifference curve

- That is : $MRT - MRS_1 = MRS_2$ or $MRT = MRS_1 + MRS_2$

- Just start with a different initial level of utility for Crusoe, the leftover curve would be shifted and a new tangency – implying there is not necessarily a single "efficient" level of expenditure on public goods

A Simple Model

- A good is public if it is by nature available to all: if one man uses it, everyone can use it.

- Public goods can be viewed as goods with extreme external effects: if person i's consumption of the good is X, then *X* appears in each and every person's utility function.

- The model we use here has both production and consumption, because one principal question we want to answer is this: How much of the public good should be produced?

A Simple Model

- The answer to the question depends both on people's demand for it, and on the nature of the productive sector of the economy.
- We assume that there are only two goods, one private, and one public.
- Also we assume that the productive sector of the economy can transform units of the private good into units of the public good, in the ratio of one to one.
- Therefore, we assume the equilibrium prices of the two goods are 1 and 1.

A Simple Model

- We assume that person i's utility is the sum of the quantity of the private good he consumes, plus a well-behaved function of the quantity of the public good produced and available to all, including *i*.

- Such a utility function is said to be ***separable*** between private and public consumption.

- X = the quantity of the public good

- Note that x can be viewed as the quantity (or size) of the public good in physical units, or in dollars, since we assume that the prices of both the public and the private good are one

A Simple Model

- *yi* = person i's quantity of the private good
- person i's utility function: $u_i = v_i(x) + y_i$
- That is, i's utility is the sum of the function *vi*, which depends only on X, plus i's quantity of the private good.
- assume that *vi* is continuous, smooth, monotonic, and concave
- MU of the public good for i, when the quantity of the public good is *x*, $v_i'(x)$

A Simple Model

- We also assume that each person starts with an initial endowment of the private good. ω_i
- Feasibility condition: $$x + \sum_{i=1}^{n} y_i = \sum_{i=1}^{n} \omega_i.$$
- Pareto Optimal output (Samuelson condition): $$\sum_{i=1}^{n} v_i'(x) = 1$$