LECTURE 5

Public Goods

Public Goods Defined

- ***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

Characteristics of Goods

- ***Excludable vs Nonexcludable***
  - **Excludable** – preventing anyone from consuming the good is relatively easy
  - **Nonexcludable** – preventing anyone from consuming the good is either very expensive or impossible
- ***Rival vs Nonrival***
  - **Rival** – once provided, the additional resource cost of another person consuming the good is positive
  - **Nonrival** – once provided, the additional resource cost of another person consuming the good is zero

Types of Goods

		RIVAL	
		YES	NO
EXCLUDABLE	YES	PRIVATE GOODS	NATURAL MONOPOLY
	NO	COMMON RESOURCES	PUBLIC GOODS

Types of Goods

Ice cream is also exclud
because I can simply not

It is excludable, since the cable company can simply refuse to

Yet it is non-excludable be
is clearly very difficult to p
pedestrians from using
sidewalk.

It is also non-excludable, because once an area is protected, everyone "consumes" that protection.

s

Is the good excludable ?		Yes	No
	Yes	Ice cream	Cable tv
	No	Crowded city sidewalk	National defense

Valuation of public goods

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

Noteworthy Aspects of Public Goods

- Even though everyone consumes the same quantity of the good, it need not be valued equally by all
- Classification as a public good is not absolute; it depends on market conditions and the state of technology

Noteworthy Aspects of Public Goods

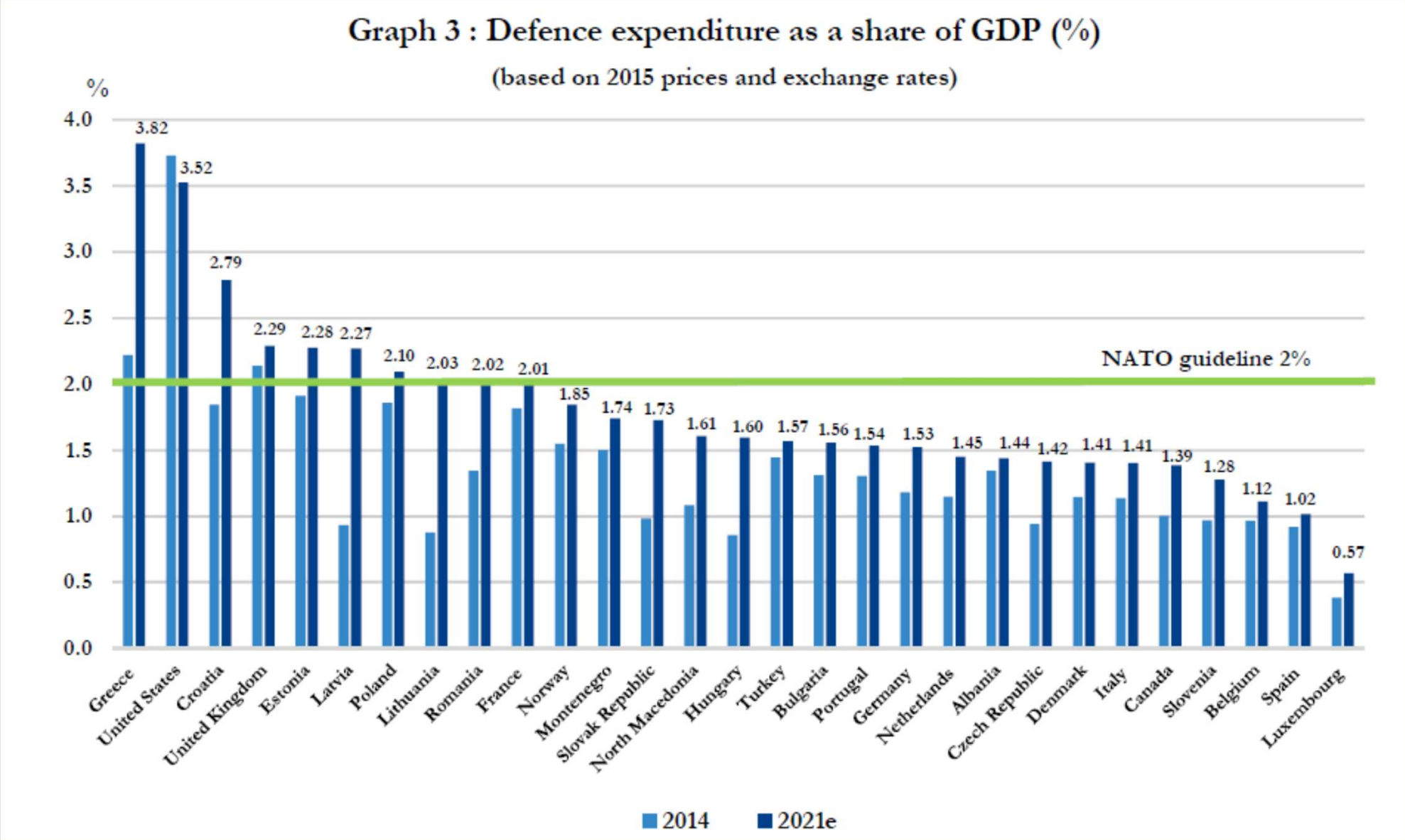
- **Impure public good**
- A commodity can satisfy one part of the definition of a public good but not the other
- Some things that are not conventionally thought of as commodities have public good characteristics
- Private goods are not necessarily provided exclusively by the private sector
  - **publicly provided private goods**
- Public provision of a good does not necessarily mean that it is also *produced* by the public sector

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).



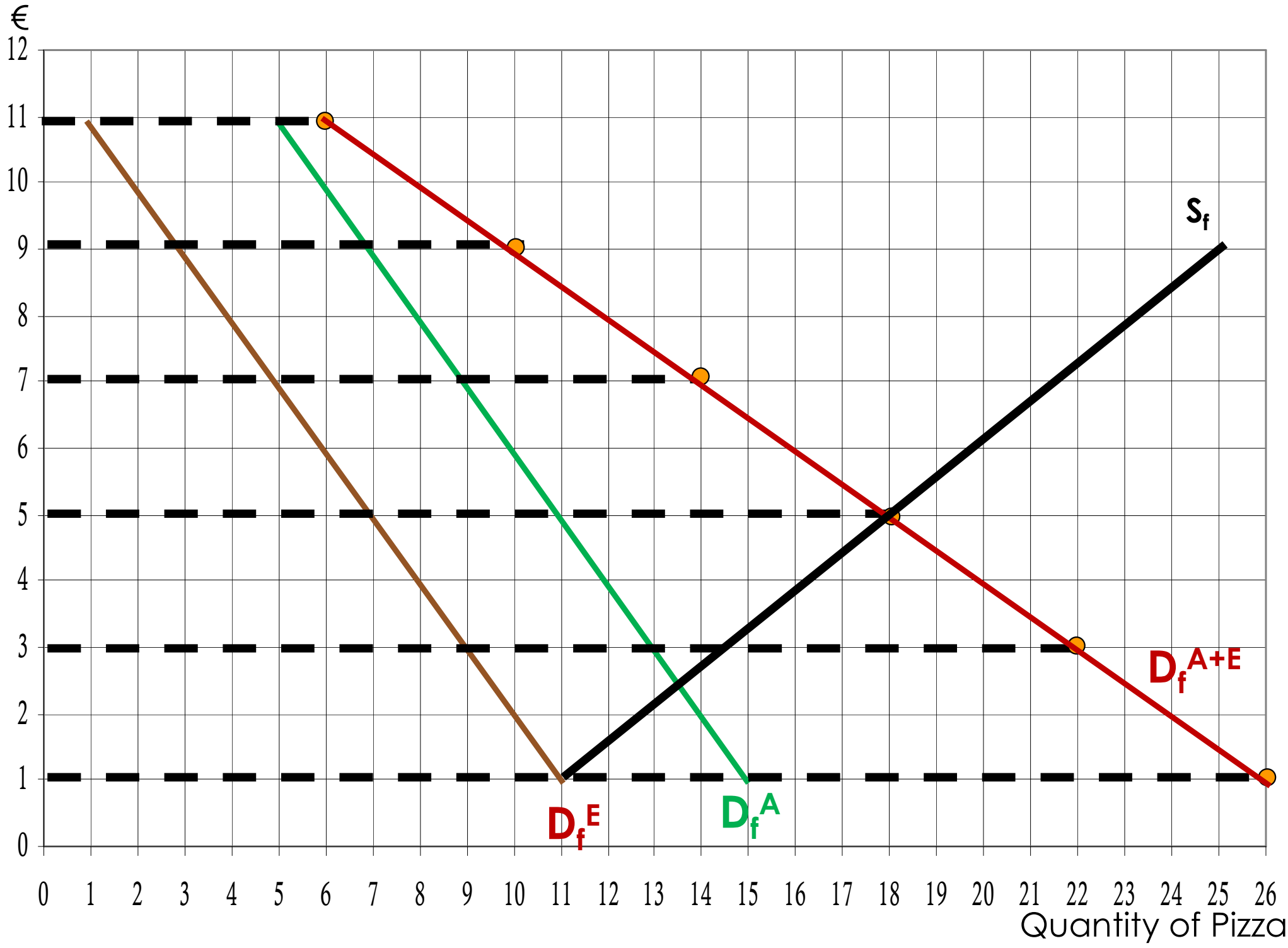
Source: NATO Press Release, June 2021

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

Efficient provision of private goods

Price	Adam (D_f^A)	Eve (D_f^A)	**Market (D_f^{A+E})**
€11	5	1	**6**
€9	7	3	**10**
€7	9	5	**14**
€5	11	7	**18**
€3	13	9	**22**
€1	15	11	**26**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0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
Quantity of Pizza
S_f
D_f^{A+E}
D_f^A
D_f^E

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.

Equilibrium in private goods market Pareto efficiency

- $MRS_{fa} = P_f/P_a$
- Set $P_a = €1$
- $MRS_{fa} = P_f$
- D_f^A shows MRS_{fa} for Adam
- D_f^E shows MRS_{fa} for Eve
- S_f shows MRT_{fa}
- Necessary condition for Pareto efficiency:

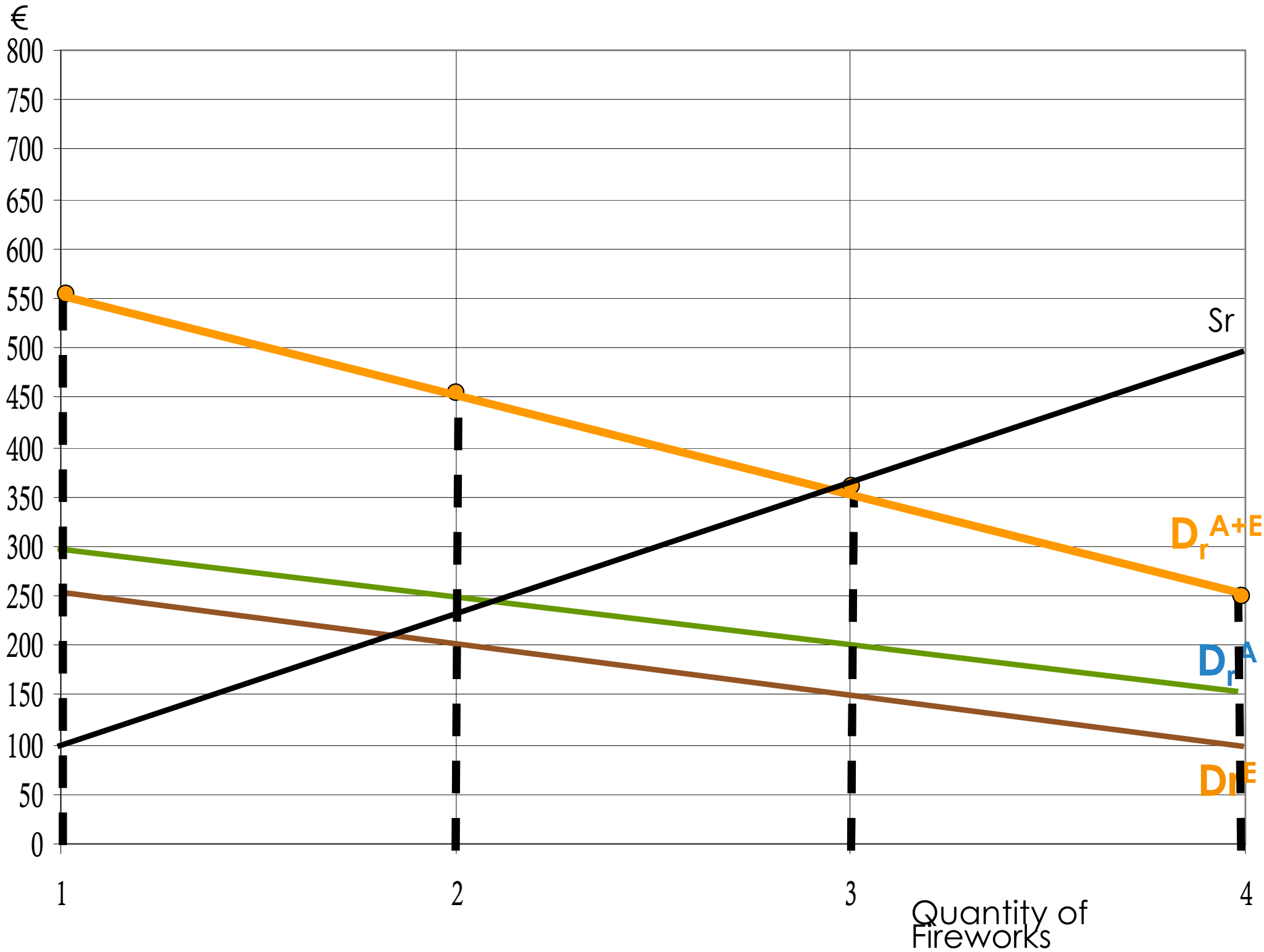
$$MRS_{fa}^{Adam} = MRS_{fa}^{Eve} = MRT_{fa}$$

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.

Efficient provision of public goods

Units of Fireworks				
	1	2	3	4
Adam ($D_r^{A)}$	**€300**	**€250**	**€200**	**€150**
Eve (D_f^E)	**250**	**200**	**150**	**100**
Market (D_f^{A+E})	**€550**	**€450**	**€350**	**€250**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Quantity of Fireworks
Sr
D_r^{A+E}
D_r^{A}
D_r^{E}

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.
- This is called the ***Samuelson rule***

Efficiency in public goods market

- $MRS_{fa} = P_f/P_a$
- Set $P_a = €1$
- $MRS_{fa} = P_f$
- D_f^A shows MRS_{fa} for Adam
- D_f^E shows MRS_{fa} for Eve
- S_f shows MRT_{fa}
- Necessary condition for Pareto efficiency: $MRS_{fa}^{Adam} + MRS_{fa}^{Eve} = MRT_{fa}$

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.

Solutions to the free rider problem

- Government intervention can potentially lead to a more efficient outcome.
  - Government can use ***coercive*** power to force people to pay for public goods, through taxation.
- Free riding is not a *fact*, however. There are instances when individuals do act collectively without coercion.
- Laboratory experiments on college students contradict the notion that free riding will lead to zero contributions for the public good. Some suggest the results derive from a "warm glow" of giving.

Privatization debate

- ***Privatization*** means taking services that are supplied by the government and turning them over to the private sector for provision and/or production.
- Examples with competing public/private ***provision*** include policing, parks, and even the judicial system.

Private provision

- Mix of private and public ***provision*** depends on:
  - ***Relative wage and materials costs***: Which sector is less expensive?
  - ***Administrative costs***: Can these fixed costs be spread over a large group of people?
  - ***Diversity of tastes***. Private provision is more efficient with diverse tastes because people can tailor their consumption to their own tastes.
  - ***Distributional issues***. Notions of fairness may require that some commodities are available to everyone – such as education or health care.

Private production

- Even if there is agreement that the public sector should provide a good, it is not clear whether the public sector should ***produce*** it.
  - Airport security workers are a timely example.
- Public sector managers may not have a strong incentive to control costs because of the lack of profit motive or fears of takeovers or bankruptcy.
- Quality of public services may be higher, however. This is more relevant when contracts are incomplete.

Education provision

- Government spends approximately €400 billion on education annually.
- Why such extensive intervention?
  - Education primarily a ***private*** good.
  - Some efficiency concerns – socialization, political stability.
  - Equity concerns – access to education increases social mobility.
- Elementary and secondary education is subsidized, compulsory, and produced by the government. This cannot be rationalized on efficiency grounds alone.

What do expenditures for public education accomplish?

- Educational inputs include teacher/pupil ratio, teacher education, experience, and salary, and expenditures per pupil.
- Educational outputs include test scores, attendance records, dropout rates, and labor market outcomes.
- Hanushek (2002) finds virtually no correspondence between inputs and outputs, though this conclusion is controversial.
- One especially noteworthy result is that over wide ranges, class size does not affect educational outcomes.

Public versus Private Production

- Efficiency of private production
- Problems in comparing cost differences
- Incomplete Contracts
- Competition to supply good or service
- Reputation building
- Policy Perspective: Should airport security be produced publicly or privately?
- Market Environment

Distributional Issues

- Commodity egalitarianism – notion that some commodities ought to be made available to everyone

Distributional Issues

- Suppose that each of 1000 rich people are willing to contribute €100 to 100 poorer citizens-- AS LONG AS **ALL MAKE THE CONTRIBUTION.**
- Assume that each member of the richer group gains a benefit of €0.10 per €1 redistributed, up to €100 per person.

Distributional Issues

- If one person contributes a €1 individually, the person would gain €0.10 but expend a €1. (Of course, this motivates free-rider status)
- But if each person contributes a €1 the collective gain is €1 * 0.10 * 1000 = €100.
- The net gain for a particular contributor is €100 - €1 = €99.
- So €100 transferred by each of the 1000 rich people would yield a gain of

  €100 * 1000 * €99 = €9,900,000

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- €100 * 1000 * €99 = €9,900,000
- For an individual alone the results would be
- (€100 * 0.10) - €100 = -€90

Preference Revelation Mechanisms

- Imagine a government agent approaches Eve and says, “Please tell me your demand curve for fireworks displays. I will use this information plus the information I receive from Adam to select a Pareto efficient quantity of fireworks and to assign each of you a tax. But before you give me your answer, I want you to realize that you will be taxed in the following way:

Preference Revelation Mechanisms

- Whenever the level of public good provision increases by a unit, the change in your tax bill will be the incremental cost of that unit, minus the value that everyone else puts on the increase."
- After the agent departs, the first thing Eve does is to represent the tax structure algebraically.

Preference Revelation Mechanisms

- If ΔT^{Eve} is the change in her tax bill when provision of the public good is expanded by one unit, MRT_{ra} is the incremental resource cost of the one unit, MRS_{ra}^{Total} is the marginal value of one more unit to Adam and Eve, and MRS_{ra}^{Eve} is the marginal value to Eve alone, then

Preference Revelation Mechanisms

- $\Delta T^{Eve} = MRT_{ra} - (MRS_{ra}{}^{Total} - MRS_{ra}{}^{Eve})$
- Eve's choice: $\Delta T^{Eve} = MRS_{ra}{}^{Eve}$
- By substitution:
  $MRT_{ra} - (MRS_{ra}{}^{Total} - MRS_{ra}{}^{Eve}) = MRS_{ra}{}^{Eve}$
- Add $(MRS_{ra}{}^{Total} - MRS_{ra}{}^{Eve})$ to both sides:
  $MRT_{ra} = MRS_{ra}{}^{Total}$

Recap of public goods

- Public good definition
- Derivation of aggregate demand curves
- Inefficient provision of public goods
- Free rider problem
- Public versus private provision
- Education