CHAPTER 16: PUBLIC GOODS AND EXTERNALITIES

Introduction
Markets are central to our form of economy, distributing resources and products to their most highly valued uses. In some circumstances, though, the market fails. Chapter 16 discusses the role of government intervention in firms and industries experiencing market failures of public goods and externalities. The actions of government can help to move markets toward greater efficiency, illustrating the importance of government in our mixed-market economy. Material from Chapter 16 is found in a few multiple-choice questions and very frequently appears as a free-response question on the AP microeconomics exam.

Private and Public Goods
Private goods, which constitute most goods in our economy, exhibit the characteristics of rival consumption and excludability. With rival consumption, once a person consumes a product, no one else can consume the same product. Excludability makes it easy for the firm to prevent those who do not pay from receiving the product. Supply and demand determine the price and quantity sold, and equilibrium exists without shortage or surplus.

Public goods, though, are non-rival. One person’s consumption does not prevent another person’s consumption of the same product. While you and your friend could not both eat the same slice of pizza, you can both share the same national defense or roadway. Public goods also have the characteristic of non-excludability—it is difficult or impossible to prevent those who did not pay from receiving the good. While it is easy enough for the restaurant to prevent you from receiving a pizza you didn’t pay for, it’s much more difficult to prevent you from receiving national defense or stop you from using the roads. These two characteristics create a free-rider problem for public goods. Once a public good is provided, it is nearly impossible to keep non-payers from getting it. Knowing this, consumers will prefer to use the product without paying for it—riding along for free. As a result, firms cannot profit from producing and selling the product and will choose not to produce it, even though a clear demand exists in society. The market has failed.

The Role of Government in Providing Public Goods

The optimal amount of a public good
Demand for a public good is calculated a little differently from the way market demand is calculated for private goods. For private goods, we horizontally add the demands of all consumers to determine total demand at each price. For public goods, we must determine how much consumers would be willing to pay for each additional unit of a public good, and then vertically add all of those values to determine what everyone together would be willing to pay for each unit of the public good. This curve is the demand for the public good, or the marginal benefit citizens expect to gain from the public good.

Supply of a public good is government's marginal cost of producing each additional unit. As the government adds workers to a fixed amount of capital, diminishing returns occur and marginal cost increases. The optimal quantity of the public good is where marginal benefit (demand) equals marginal cost (supply). With cost-benefit analysis, government provides public goods as long as the marginal benefit of providing the next unit is greater than or equal to the marginal cost of producing that unit of the public good. The optimal quantity of the public good is where marginal benefit equals marginal cost of the last unit.

**Externalities**

Externalities are spill-over costs or benefits to people who are not involved in the market transaction. With a negative externality such as pollution, a firm passes some of its costs onto society. Therefore, the firm's marginal cost (S) is lower than society's marginal cost (S_s). This distortion causes the firm to over-allocate resources, producing more products and selling them for a lower price than is socially optimal. Governments can resolve the market failure by placing a control on the externality, preventing the firm from imposing the externality and forcing the firm to absorb the full cost of production, so the supply curve shifts back to S_s. A second option is for government to place a tax (amount T) on the product, shifting the firm's supply back to the marginal social cost (S_s). Both options reduce the quantity and raise the price, restoring efficiency. A third potential solution is to create a market for externality rights, allowing firms to buy the right to pollute and sell that right to other firms, as an incentive to reduce pollution and achieve efficiency.
Correcting for positive externalities

A positive externality, like a vaccination, brings benefits to people who did not purchase the product. Because consumers do not consider all of the benefits of the purchase, the marginal social benefit \( D_s \) is higher than marginal individual benefit \( D \). As a result, society underallocates resources, producing fewer products than is socially optimal. For positive externalities, government has three solutions. First, it can grant subsidies to buyers, increasing their marginal individual benefit \( D \) to meet marginal social benefit \( D_s \). Second, government could instead provide subsidies to producers, lowering their cost of production from \( S_i \) to \( S_j \). Both solutions correct the under-allocation of resources to production, but the subsidy to consumers does so through demand, while the subsidy to producers does so through supply. A third solution, if the positive externalities are extremely large, is for the government to simply provide the product as a public good.

Clearly defined and enforced property rights can also help to resolve externalities. If firms produce negative externalities that harm property owners, those property owners can sue to protect the value of their properties. In other cases, negotiation between those creating externalities and those affected by those externalities can result in a resolution.

**Optimal Externality Reduction**

*Society's optimal amount of pollution abatement*
Although we want to limit negative externalities and support production in the case of positive externalities, as a society we must determine the optimal amount of government intervention in the market. To reduce pollution or subsidize vaccinations, society must use resources that could have been used for other purposes, so every decision involves an opportunity cost. As society performs more clean up, the marginal cost of each additional unit of clean up increases because of diminishing returns. At the same time, the marginal benefit to society of each additional unit of clean up falls because of diminishing marginal utility. As long as the marginal benefit of the clean up is greater than the marginal cost, society should continue to reduce the effects of the externality. The socially optimal amount of externality reduction occurs where the marginal benefit equals the marginal cost of the policy. In reality, determining these costs and benefits is very difficult, so policy decisions are subject to a great deal of debate.

**Bear in Mind**

Asymmetry of information creates another market failure that requires government intervention for the benefit of consumers, workers, and firms. Because this information is not covered on the AP economics exams, it will not be covered in this text.

**Multiple-Choice Questions**

1. Public goods have all of the following characteristics EXCEPT
   (A) a free-rider problem develops with public goods.
   (B) those who do not pay cannot be excluded from consuming the good.
   (C) firms find public goods profitable to produce because people value them.
   (D) one person's consumption does not affect another person's consumption.
   (E) tax dollars are used for the provision of public goods.

2. An example of a public good is
   (A) a sailboat.
   (B) a restaurant.
   (C) a doctor's office.
   (D) a road.
   (E) an airplane.

3. If the marginal social cost for a public good increases,
   (A) the marginal social benefit will increase, as well.
   (B) more of the public good will be provided.
   (C) less of the public good will be provided.
   (D) the government can afford more public goods.
   (E) demand for the public good increases.

4. Which of the following is an example of a negative externality?
   (A) a truck dumping trash in a legal landfill
   (B) a college student listening to music through his headphones
   (C) spoiled milk served at a restaurant
   (D) a worker calling in sick to work in order to go to a movie instead
   (E) cigarette smoke in a bowling alley

5. Which of these policies would resolve a negative externality?
   I. Institute a per-unit tax on production
   II. Limit the amount of external cost the firm can impose
   III. Fine firms that produce the externality
6. If a product creates a positive externality,
(A) the firm will tend to overproduce the product.
(B) society’s marginal benefit is greater than the individual marginal benefit.
(C) the firm will produce at an allocatively efficient level of output.
(D) the government should establish policies to reduce output of the product.
(E) the market will return to long-run equilibrium as firms enter the industry.

7. If a firm creates a positive externality, government can promote efficiency by
(A) increasing taxes on the firm.
(B) increasing income taxes for consumers.
(C) subsidizing production of the product.
(D) putting a limit on the amount of externality produced.
(E) requiring the firm to shut down.

8. If an oil tanker spills oil into sensitive environmental areas, the government, to promote efficiency, should continue to clean up the effects until the
(A) marginal benefit of the next unit of clean up equals the marginal cost.
(B) firm cannot afford to pay for any more clean up.
(C) additional cost of the next unit of clean up would require a tax increase.
(D) marginal cost of clean up equals the firm’s marginal cost of production.
(E) area is returned to the condition it was in before the oil spill.

Free-Response Questions
1. Chickenpox vaccinations help protect the person who was vaccinated as well as others. Assume the chickenpox vaccine is produced in a competitive market.
   (a) Draw a correctly labeled graph of the vaccine market, showing each of the following:
      (i) the market equilibrium quantity of vaccines, labeled \( Q_M \)
      (ii) the market equilibrium price of vaccines, labeled \( P_M \)
      (iii) the socially optimal quantity of vaccines, labeled \( Q_{SO} \)
      (iv) the socially optimal price of vaccines, labeled \( P_{SO} \)
   (b) Identify the area of deadweight loss and explain what deadweight loss represents.
   (c) Identify one policy the government could undertake to correct this market failure.

2. A nightclub adjacent to a quiet neighborhood has an outdoor pavilion and plays loud rock music late into the night, annoying residents of the neighborhood.
   (a) Name the market failure described above.
   (b) Identify whether the nightclub is producing at its socially optimal output, and explain the reasoning for your answer.
   (c) Explain the relationship between the marginal private cost and the marginal social cost of the nightclub.
   (d) Identify one policy or action the government could take to correct this market failure.
Multiple-Choice Explanations

1. (C) The free-rider problem makes it nearly impossible for firms to profit from providing public goods; if people can get them for free, the firm has little revenue. So government provides public goods through tax dollars.

2. (D) A road is a public good provided by government and funded through tax dollars. Use of a road is non-rival and non-excludable, so it qualifies as a public good. The other four answers are privately-owned firms and goods.

3. (C) The marginal social cost curve (supply) would shift to the left, resulting in a smaller quantity of the public good.

4. (E) A negative externality imposes a cost on someone other than the persons involved in the transaction. While the other four situations contain negative aspects, none of them (as defined here) impose costs on others outside of the relationship of the buyer/seller or employer/employee.

5. (E) A per-unit tax or fine would force the firm to absorb all of its production costs. A limit on the amount of external cost that can be passed on to others (even zero) will help bring the market closer to efficiency.

6. (B) With a positive externality, consumers are not considering the full social benefit of their consumption; therefore, the individual's marginal benefit curve lies below society’s marginal benefit curve. The firm produces too little, so the government wants to encourage the firm to produce more.

7. (C) Positive externalities benefit society, so the government should subsidize the production, reducing production costs so that the firm produces more.

8. (A) Clean up should continue only as long as the marginal benefit is greater than or equal to the marginal cost. If cost outweighs the benefit, resources are wasted that could be used in other pursuits.

Free-Response Explanations

1. 8 points (5 + 2 + 1)

(a) 5 points:
- 1 point is earned for a correctly labeled graph of the market with marginal social benefit higher than marginal private benefit.
- 1 point is earned for QM where marginal private benefit equals marginal social cost.
- 1 point is earned for PM where marginal private benefit equals marginal social cost.
- 1 point is earned for QSO where marginal social benefit equals marginal social cost.
- 1 point is earned for PSO where marginal social benefit equals marginal social cost.

(b) 2 points:
- 1 point is earned for identifying the triangle of deadweight loss to the left of $\text{MSB} = \text{MSC}$ over to the quantity set where $\text{MPB} = \text{MSC}$.
- 1 point is earned for explaining that deadweight loss represents the lost consumer and producer surplus resulting from the externality.

(c) 1 point:
- 1 point is earned for identifying one correct policy. Examples include the following:
  - A government subsidy or tax cut for consumers getting a vaccination
  - A government subsidy or tax cut for producers selling a vaccination
  - A government mandating vaccinations

2. 5 points (1 + 2 + 1 + 1)

(a) 1 point:
- 1 point is earned for identifying the market failure as a negative externality.
(b) 2 points:
• 1 point is earned for stating that the nightclub is not producing at its socially optimal output.
• 1 point is earned for explaining that it is passing costs onto residents in the neighborhood (or that it is overproducing output or over-allocating resources to production).

(c) 1 point:
• 1 point is earned for explaining that the marginal private cost of the nightclub is lower than the marginal social cost.

(d) 1 point:
• 1 point is earned for identifying one correct policy. Examples include the following:
  o A noise ordinance limiting the sound, so neighbors are not affected
  o An ordinance prohibiting the piping of music outside of business establishments
  o A government subsidy for sound-dampening equipment
  o Fines for firms violating noise ordinances