Microeconomics
Topic 9: "Explain externalities and public goods
and how they affect efficiency of market outcomes."

Reference: Gregory Mankiw's *Principles of Microeconomics*, 2nd edition, Chapters 10 and 11.

The Efficiency of Private Exchange

A private market transaction is one in which a buyer and seller exchange goods or services for money or other goods or services. The buyers and sellers could be individuals, corporations, or both.

Voluntary private market transactions will occur between buyers and sellers only if *both* parties to the transaction expect to gain. If one of the parties expected to end up worse off as a result of the transaction, that transaction would not occur.

Buyers and sellers have an incentive to find all the voluntary, private market transactions that could make them better off. When they have found and made all such possible transactions, then the market has achieved "an efficient allocation of resources." This means that all of the resources that both buyers and sellers have are allocated so that these buyers and sellers are as well off as possible.

For these reasons, private market transactions between buyers and sellers are *usually* considered to be "efficient" because these transactions result in all the parties being as well off as possible, given their initial resources.

A more precise way of defining efficient production of a good is that we should produce more of a good whenever the added benefits are greater than the added costs, but we should stop when the added costs exceed the added benefits.

> Summary of conditions for efficient production
> (1) all units of the good are produced for which the value to consumers is greater than the costs of production, and
> (2) no unit of the good is produced that costs more to produce than the value it has for the consumers of that good. In other words,

For more on the efficient level of production, see the notes for Micro Topic 8.

Externalities

The argument above for the efficiency of private market exchanges works well with "pure private goods."

> A pure private good is a good whose production and consumption neither harm nor benefit people uninvolved in its production or consumption.

But some goods are not pure private goods, because they involve externalities.

> An externality occurs if a person's activity, such as consumption or production, affects the well-being of an uninvolved person. (The term *externality* comes from the fact that someone *external* to the action or transaction is affected by the production of consumption of the good.)

There are two types of externality:

> A negative externality occurs if an activity creates costs (harm or discomfort) for uninvolved people.
>
> Examples of negative externalities: Cars and factories generate air pollution that affects people's health. Cars entering congested freeways impose time costs on other drivers, as all cars slow down as a result.
>
> A positive externality occurs if an activity creates benefits for uninvolved people.
>
> Examples of positive externalities: People who get vaccinations against a communicable disease reduce other people's chances of getting the disease. People who improve their property may create benefits for their neighbors by creating a more pleasing neighborhood and increasing property values.

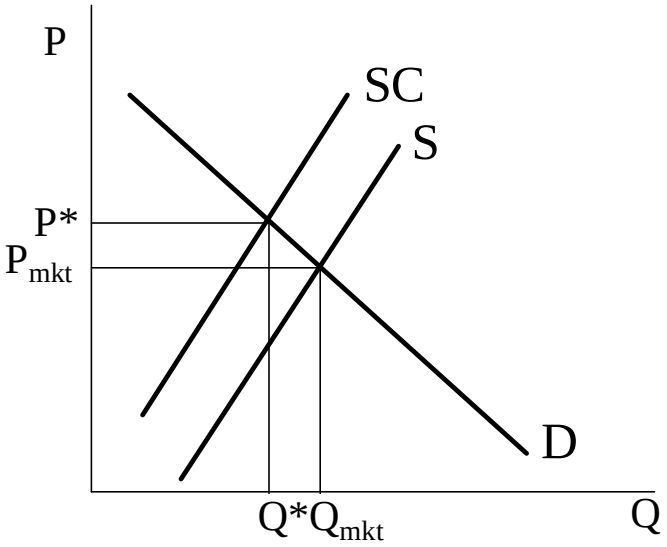
The problem with goods with externalities is that private market transactions do not produce efficient amounts of these goods. Private market transactions will lead to overproduction of goods with negative externalities and underproduction of goods with positive externalities.

Analysis of a Negative Externality

Non-economists sometimes make the mistake of thinking any activity that creates a negative externality should not be done at all. But many activities with negative externalities also create great benefits. To an economist, the problem with negative externalities is not that the activity occurs, but that *too much* of it occurs.

Let's take the case of a good whose production creates a negative externality. (The following discussion corresponds to Mankiw's "negative externalities in production." Mankiw also discusses "negative externalities in consumption," but you are not responsible for that material.)

We start by using supply-and-demand (see the notes for Micro Topic 3) to find the market outcome. The market price and quantity are denoted P_{mkt} and Q_{mkt} in the graph below.



However, the market outcome is not the efficient outcome. The supply curve represents only private costs of production – that is, the costs experienced by firms producing the good. It does not represent *all* costs, because the negative externality imposes costs on some uninvolved bystanders. So we draw another curve, the "Social Cost" or SC curve. This curve represents *all* costs of production, including both private production costs and external costs. It is to the left of the usual supply curve.

The efficient level of outcome occurs where the demand curve and SC curve cross. This outcome is shown by P* and Q* in the graph. Notice that $Q_{mkt} > Q^*$. That means the market produces more than the efficient amount of this good; this is called "overproduction." Also notice that $P_{mkt} < P^*$. That means the market price is less than the efficient price.

What makes the market outcome inefficient? The private market leads suppliers to produce some units of the good (the units between Q* and Q_{mkt}) whose cost of production exceeds their value to consumers. We know this is true because for units of the good between Q* and Q_{mkt}, the demand curve (which measures value to consumers) is below the SC curve (which measures all costs).

The overproduction of goods with negative externalities occurs because the price of the good to the buyer does not cover all of the costs of producing or consuming the good. If all costs were accounted for, the prices of these goods would be higher and people would consume less of them. If the cost of the negative externality (the harms from air pollution, for example) were put on the good as a tax, then people would realize the full cost of producing and consuming that good, and the smaller amount demanded would be the efficient amount. This is assuming, of course, that the tax is set correctly.

Similarly, if the congested freeway entrant paid a toll equal to the value of the other drivers' time costs of being slowed down by his entrance, then people would enter congested freeways less often and congestion would be reduced. The congestion toll for

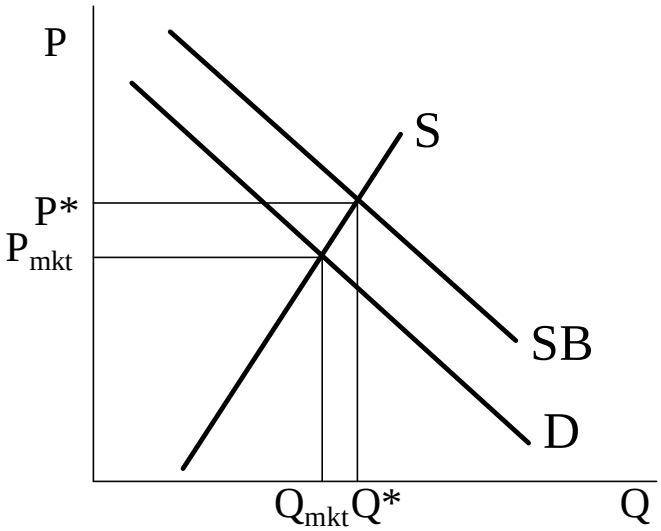
entering the congested freeway would "internalize" the externality. That is, the toll would price the cost of the delays that the freeway trip imposes on other drivers and reduce the number of freeway trips taken at congested times, producing an "efficient amount of freeway congestion."

Analysis of a Positive Externality

We can use a similar approach to analyze positive externalities. (The following discussion corresponds to Mankiw's "positive consumption externalities." Mankiw also discusses "positive production externalities," but you are not responsible for that material.)

We will again use the supply-and-demand framework. This time, the supply curve is okay because it takes all costs into account. But now there's a problem with the demand curve. It represents the private benefits to the buyers of the good, but not the external benefits to uninvolved people. So we will introduce a new curve, the "Social Benefit" or SB curve, which includes all benefits to buyers and uninvolved people. It is to the right of the usual demand curve.

The graph below shows the market price and quantity as P_{mkt} and Q_{mkt}, which result from the usual supply and demand curves. But the market outcome is not the efficient outcome. The efficient outcome occurs where supply crosses the SB curve, and it is marked with P* and Q*.



Notice that $Q_{mkt} < Q^*$. That means the market produces less than the efficient amount of this good; this is called "underproduction." Also notice that $P_{mkt} < P^*$. That means the market price is less than the efficient price. (This is not a typo. The market price is too low for both negative production externalities and positive consumption externalities, though for different reasons.)

The underproduction of goods with positive externalities occurs because the producers of the goods do not capture the extra value the goods create for others in the price they receive for their goods. Consequently, the producers of these goods do not produce as much of the good as they would if they received a higher price for the good with positive externalities. If a good with a positive externality received a government subsidy equal to the external benefits associated with the good, then the producers would be compensated for all of the value that these goods produce, and they therefore would supply an efficient quantity of the good. This is assuming, of course, that the size of the subsidy is set correctly.

Public Goods

Public goods are an extreme case of goods with positive externalities. When a unit of a public good is produced, everyone in the market gets to consume it, whether or not they paid for it. To be more precise, a public good is a good with two specific characteristics:

Defining characteristics of a public good

(1) Non-excludability: Once the good has been produced, non-payers cannot be excluded from using and benefiting from the good.
(2) Non-rivalry: The consumption of the good by one additional person does not reduce anyone else's enjoyment of the good.

Important note: Do not assume a good is "public" just because it is provided by government. Roads are an example of a good provided by government that is not a public good. (Non-payers can be excluded from a road by having toll booths. And when roads are congested, additional drivers do reduce others' enjoyment of the roads.) Also, do not assume a good is *not* public just because it is *not* provided by government. Lighthouses are an example of a public good that has sometimes been provided by private entrepreneurs.

Some examples of public goods are national defense, mosquito abatement, and weather prediction, among others.

The fact that public goods are non-excludable makes it very difficult to provide these goods efficiently through private market transactions. Also, the amount of benefit each person receives may differ and is hard to measure, and that can make it even harder to provide these goods privately. If people are charged the amount they *say* they benefit from a public good, then people will have an incentive to understate how valuable the good is to them. They know that if they claim the good has no benefit to them and they therefore do not have to pay for the good, they will still get to consume whatever amount of the good is provided. This is known as the "free rider" problem. Of course, everyone has this incentive, so this pricing system does not work very well. The public good will likely be underproduced as a result.

Commonly, governments try to support the provision of public goods with taxes because of the difficulty of relying on private markets or voluntary contributions to produce an

efficient amount of these public goods. Taxes are mandatory and commonly are based on incomes, purchases, or property values. The amount of public goods provided is usually determined by political bodies or institutions in a way that may or may not lead to efficient production of public goods.

Common Pool Resources

Some negative externality problems result from the existence of a "common pool resource."

> A common pool resource is a resource that has most of the characteristics of a pure private good, but that is owned in common by many people (such as the members of a community). Common pool resources are sometimes called "common resources" or just "commons."

One example of a common pool resource is a reservoir of oil that lies under a large area of land owned by many different people. Any one of the landowners can drill down and extract oil under his/her land and sell the oil on the market. The problem is that all of the landowners have the incentive to pump as much of the oil as fast as they can, because any oil that you don't pump and sell can be pumped and sold by someone else. There is no incentive to conserve the oil, so the reservoir will be overused and drained too fast.

A classic example of common pool resources is the "commons" that used to exist in English villages. A "common" was a community-owned pasture that anyone in the village could use for grazing their livestock. People quickly noticed that the commons were overgrazed relative to nearby private pastures. This occurred because people using the commons had no incentive to reduce their use of the commons in order to preserve some grass for tomorrow and next week, because someone else could bring in livestock to graze in the meantime. Anything preserved for the future by one person would not necessarily be available to that person in the future, so there was no incentive to conserve or protect the resource from over use.

The problem with common pool resources is that they are essentially private goods made available to several people who can use them at will, and this causes inefficient overuse of these resources. This is known as "the tragedy of the commons." Possible solutions to the overuse of these resources include licensing (restricting) their use or "privatizing" them so that the owner has an incentive to restrict usage to an efficient level.

Our national forests and national parks are candidates for a common pool resource problem. They could be overused immensely if any citizens could use them for any purpose they wanted with no restriction or charge. Water in our rivers or lakes likewise would probably experience the same overuse if anyone could draw as much water as they wanted with no charge or restriction.