Unit 8.1: Externalities

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1 Market Failure

Market Failure occurs when the free market outcome is not efficient. The first welfare theorem establishes that, in general, competitive equilibria *are* efficient. Therefore, if the market equilibrium is not efficient, it must be due to some kind of market failure. Economists have identified four sources of market failure.

- **Market Power**: If sellers are free to set the price, rather than being forced to accept the competitive price, then the private equilibrium is generally not efficient. We demonstrated earlier that monopolies price above marginal cost and generate deadweight loss (although this can be corrected with price discrimination).
- **Externalities**: If activities involve costs and benefits that are not priced into the market, then decision-makers will generally not make socially efficient decisions. For example, a firm that creates pollution as a byproduct of its production process over-pollutes relative to the efficient outcome because the social costs of the pollution are not built into the price.
- **Public Goods**: Public goods are goods that, once provided, are freely available for everyone to use because it is impossible or impractical to charge individuals for using them (e.g. fireworks shows or public parks). Public goods are generally underprovided in private markets
- **Information Problems**: If information in the market is asymmetric, such that the buyer or the seller is better informed, equilibria can arise that are not efficient.

We dealt with market power earlier. In this unit, we will address the other three sources of market failure.

2 Externalities

An *externality* occurs when a person's well-being or a firm's production capability is directly affected by actions of other consumers or firms in a way that is not reflected in market prices. If the effect of the actions on outside parties is negative, then we call the externality a negative externality; an example is air pollution. If the effect of the actions on outside parties is positive, then we call the externality a positive externality; an example is planting a nice garden for your neighbors to enjoy.

The last part of the definition is critical. Suppose that there is massive immigration into Dubai, which raises rents for the city's residents. This may have negative effects on residents, but it is not an externality since it goes through the market and is reflected in market prices. On the other hand, suppose that a firm generates air pollution as a by-product of its production process, and homeowners have to repaint their dirty walls. This is an example of an externality since the harm that the firm imposes on the homeowners is not reflected in any market price.

Basically, the problem with an externality is a missing market. Firms that exude pollution into the air do not have to pay homeowners for encroaching on their clean air. The problem is similar with a positive externality. If you plant flowers in your garden, there is no market where your neighbor is required to pay

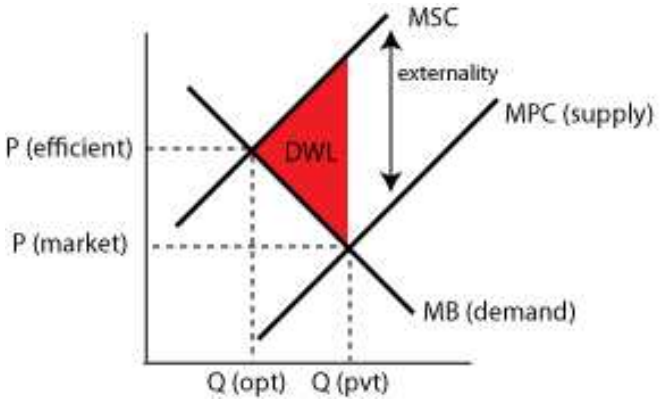

Figure 1: Competitive market with an externality

you for the benefits she gets from looking at your garden. If there were complete markets for pollution or other externalities generated, then the first welfare theorem would apply and the market equilibrium would be efficient. What creates inefficiency in the market equilibrium is missing markets for externality-generating parts of the transaction.

3 Social and Private Costs

The marginal private cost (MPC) of an activity is the cost *to the firm* of one additional unit. The marginal social cost (MSC) of an activity is the cost *to society* of one additional unit. Cost to society includes both the cost to the firm *and* the costs to outside parties of any externalities generated.

$$MSC = MPC + externality$$

Note that, if there are no externalities, social and private costs are equal. The cost to society of the activity is equal to the producer's cost, with no outside costs. A negative externality drives a wedge between the cost experienced by the producer and the cost experienced by society.

The marginal benefit (MB) is the benefit of one additional unit. Notice that the MB curve is the demand curve. The maximum price that consumers are willing to pay for a particular unit is equal to their marginal benefit from obtaining that unit. The supply curve is the marginal private cost curve. In other words, on the margin, we have to pay the firm its marginal cost of supplying an additional unit in order to supply it.

Figure 1 illustrates a market with a negative externality. Notice that the distance between the marginal private cost and the marginal social cost of the activity is exactly equal to the externality.

The firm balances out marginal benefit and marginal *private* costs, producing Q_{pvt} units of output. It continues to produce additional output as long as marginal benefit exceeds its marginal cost, and does not produce units where the marginal cost exceeds the marginal benefit. So the market equilibrium is Q_{pvt} units of output sold at a price of P_{market}.

However, this is not optimal for society. From a social perspective, we should balance marginal benefit and marginal *social* costs. The efficient level of output is Q_{opt}. The problem is that units between Q_{pvt} and Q_{opt} are not efficient – the marginal benefit from the units is lower than the marginal cost to society. However, firms will produce these units in a private market since the marginal benefit exceeds the marginal cost *to the firm*. The problem is that firms consider only their private costs, and not the external costs imposed on the rest of society.

This generates a deadweight loss – exactly the efficiency loss resulting for the units that are produced for which the marginal cost to society exceeds the marginal benefits. Another way to think about this problem

is that the market price paid by consumers reflects only the private costs of producing the item, not the social costs. So when you buy paper, the price reflects the private costs to the producers of the paper, but does not reflect the external costs that the pollution imposes on the rest of society. If the price reflected the full social cost, you would buy less paper.

A competitive market will overproduce a good that generates a negative externality, relative to the efficient level of production. The problem is that firms are considering only private costs, not the full costs to society. One important point, though is that the optimal level of the externality is *not* zero. Just because an activity generates externalities does not mean that it should be stopped completely – rather, there is some socially efficient level of the activity that is lower than the level in a competitive market.

Traffic is a good example. Driving a car produces all kinds of externalities – air pollution, increased risk of accidents, congestion to other drivers, etc... There is clearly *some* driving for which the benefits exceed the costs and the driving is efficient: operating ambulances or trucks delivering food, for example. However, the level of driving is above the efficient level since individual drivers do not internalize all of the relevant costs.

A positive externality occurs when there are external benefits. In that case, the marginal social benefit exceeds the marginal private benefit, and so the good is *underprovided* in the competitive market equilibrium.

4 Solutions to Negative Externalities

- **Output Regulation**: Force the firm to produce Q_{opt}. The problem is that there usually is not enough information to calculate social costs perfectly. Social costs of pollution include things like long-term health consequences or irritation that are hard to measure.

- **Pigouvian Tax**: Charge producers a tax equal to the externality. This raises the firm's marginal private cost up to the level of marginal social costs, at which point it will choose to produce Q_{opt} units of output. In this case, we say that the producer is *internalizing* the externality since we are forcing him to pay both the private and the external costs of the output he produces. Again, the problem is that it is difficult to calibrate these taxes properly because social costs are hard to measure.

- **Tradeable Pollution Permits**: These sorts of schemes involve issuing pollution permits to firms, allowing them to produce a certain amount of pollution, but then allowing the firms to sell these permits to each other. This is attractive from an economic perspective since it allows firms for which it would be expensive to reduce pollution to buy permits from firms for which it would be cheap to reduce pollution. In other words, a firm that can reduce pollution cheaply can sell its pollution permits to a firm for which it would be difficult to reduce pollution. This means that, for a given level of pollution abatement, the abatement is ultimately undertaken by the firms that can reduce pollution the most cheaply. The problem, of course, is figuring out the efficient number of permits to issue in the first place.

- **Monopolize the Market**: Monopolies reduce output below Q_{pvt} anyway as part of their profit-maximizing behavior to restrict output and raise price. Of course, there is no reason to believe that their reduction will reduce output to exactly the efficient level. Monopoly output might be above or below Q_{opt}.

- **Assign Property Rights**: Assigning property rights and letting parties negotiate can resolve externality issues. This is discussed below.

5 Assigning Property Rights

Consider a simple externality: A candymaker runs a loud machine that increases his profit, but running the machine reduces the profit of the doctor whose office is next door. We might be tempted to say that

the candymaker is violating the doctor's property rights and needs to stop running the machine, but this is not exactly the right way to think about it. If the doctor forces the candymaker to stop running the machine, then in some sense the doctor is violating the candymaker's property rights; after all, it's not the candymaker's fault that the doctor needs a quiet office.

We say that the person with the property rights is the one who gets to make the decision. Let us consider what the outcome would be depending upon whom we assign the property rights to.

Suppose that the benefit to the candymaker from running the machine is $10 per day, but that the loss in profits to the doctor is $25 per day.

- The **efficient** solution is that the candymaker should not run the machine, since the costs exceed the benefits.
- If the **candymaker has the property rights**, the doctor will offer the candymaker $10 not to run the machine (actually, the candymaker could demand as much as $25 depending upon who is the better negotiator). Notice that this is a good deal for both of them. The doctor avoids a $25 loss by paying off the candymaker, and the candymaker recovers the profit that he would have made by running the machine.
- If the **doctor has the property rights**, the candymaker will not run the machine and no transfer will be made. After all, the candymaker would need to pay $25 to the doctor to make him agree to allow the machine to be run. However, the most that the candymaker would pay is $10.

Here is the important point. Regardless of whether we assign the property rights to the doctor or to the candymaker, the candymaker does not end up operating his machine, *which is the efficient solution*. If the candymaker has the property rights, then the doctor pays him not to run the machine. If the doctor has the property rights, he simply forbids the candymaker from running the machine. Either way, the machine isn't operated. Notice that the distribution of the surplus is different – obviously the doctor and the candymaker would each prefer to be the one with the property rights, but the *outcome* is the same either way, and is the efficient outcome.

Suppose instead that the benefit to the candymaker from running the machine is $50 per day and the loss in profits to the doctor is only $30 per day.

- The **efficient** solution is that the candymaker should operate the machine since the benefits to the candymaker exceed the doctor's costs.
- If the **candymaker has the property rights**, he will simply operate his machine. The most the doctor would be willing to pay to stop him is $30, but the candymaker would need to be paid $50 to stop running the machine.
- If the **doctor has the property rights**, then the candymaker will pay the doctor $30 and the doctor will allow the candymaker to run his machine (actually, the doctor could demand up to $50 depending on how good of a negotiator he is). This is a good deal for both of them.

Again, either way, the candymaker operates the machine, which is the efficient outcome. If he has the property rights, he operates the machine without any transfer payments. If the doctor has the property rights, then he pays the doctor to allow him to run his machine. Again, the distribution of the benefits is different, but the *outcome* is the efficient one either way.

This is a general point. The *Coase Theorem* asserts that, as long as property rights are assigned and the parties can negotiate costlessly, then private bargaining will result in the optimal levels of externalities.

The Coase Theorem is attractive in principle because it provides a market-based solution to externality problems. Government-based solutions are fraught with practical problems because of imperfect information on the part of the government. However, the Coase solution is not without its own problems.

- Transactions costs could potentially be very high. Especially in the case of externalities that involve many parties, negotiations may be too difficult and costly for the parties to reach an efficient solution.
- The parties might engage in strategic bargaining behavior. For example, households who suffer from pollution might overstate their costs associated with the pollution in order to manipulate the negotiations to their advantage. This kind of behavior could cause negotiations to break down.
- Property rights are difficult to assign in some cases. Air and water are free-flowing, so it is difficult to assign a particular parcel of air or water to a particular firm or consumer. Furthermore, it is difficult to identify the source of pollution in these cases. If I find that my parcel of air is dirty, it's not clear who I should be negotiating with to resolve the problem.

All in all, bargaining tends to be a good solution for small-scale externalities that involve a limited number of parties – two roommates who can't agree on whether to allow smoking in an apartment, or a neighbor with a dog that barks. It is an impractical solution for large-scale externalities like traffic or air pollution.