

Applied Economics For Managers  
Recitation 4  
Wednesday June 30th 2004

Topics:

**Externalities**

Theory

Pollution Exercise

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Externalities

We have seen so far many examples in which the market works well. In these cases the best economic policy advice to the government is to simply leave the market alone. Even some cases like monopoly which appear at first sight to create inefficiency reasons for government intervention are more subtle when we take into account the possibility of price discrimination for example.

Externalities are a broad class of economic situations in which the market left alone reaches an equilibrium which is inefficient – a MARKET FAILURE. This motivates studying the policies that can remedy the economic inefficiency. It's important to understand externalities as the economic logic for many government interventions can be understood in these terms – a particular example would be pollution regulation.

What is an externality?

THERE IS AN EXTERNALITY WHEN SOME OF THE BENEFITS OR COSTS OF A TRANSACTION BETWEEN 2 AGENTS FALL ON A THIRD PARTY

In other words there are other agents – consumers/firms – which are affected by my actions, but have no control over my decisions.

Why is this a problem? Markets work by agents carrying out all the mutually beneficial trades between themselves. When no one else is affected by those trades, that mutual benefit is precisely equal to the benefit to society as a whole. However if there is a third party, two agents might undertake trades which although privately beneficial between themselves would impose costs on the third party – these costs to the third party diminish the desirability of the transaction and can even outweigh the benefits generated by the trade – the third party would prefer to pay them not to trade...(more on this later).

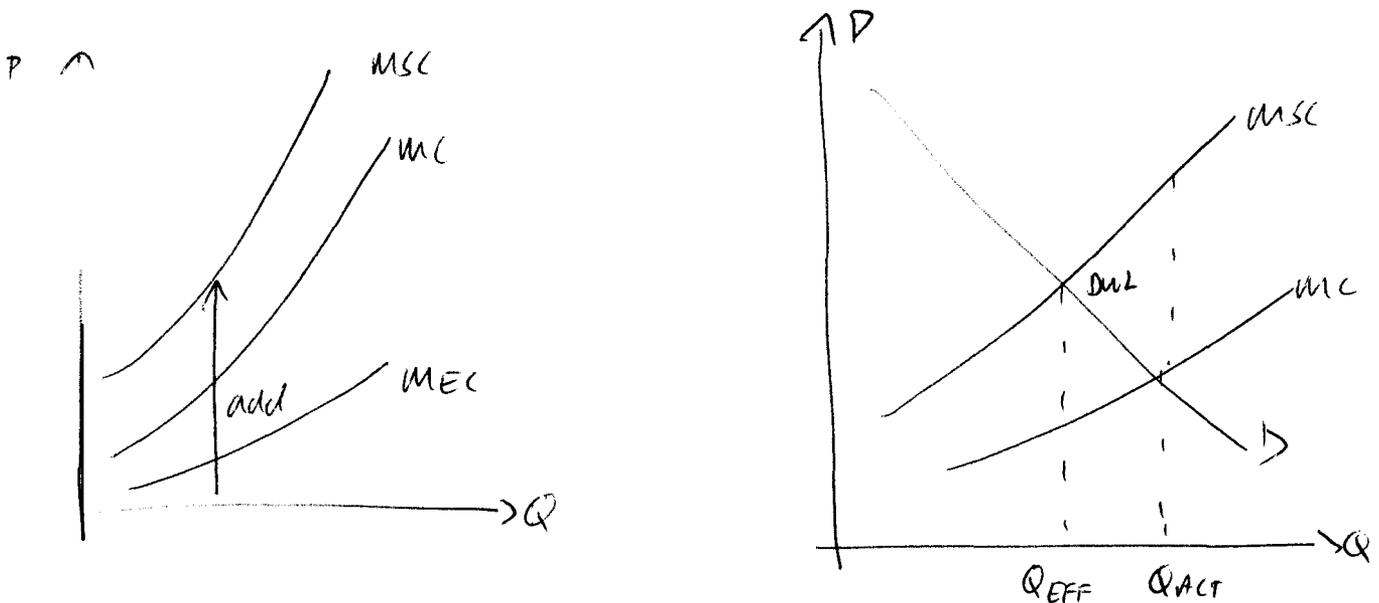
Classic example – POLLUTION

Pollution is a byproduct of transactions between a firm and its consumers, since it is generated in producing its product – the third party is whoever feels the effects of the pollution- local residents, users of local water sources, etc.

How do we represent this idea analytically?

We need to distinguish between the private and social costs of economic activity. Without externalities these are exactly the same thing, so we didn't need to make the distinction.

Now we measure the effects by quantifying the EXTERNAL COST. This is the additional cost that falls on other parties



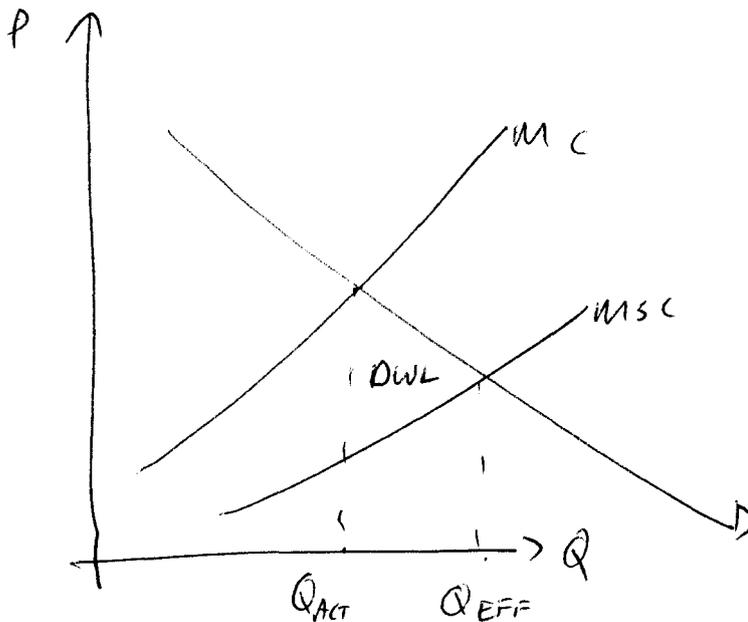
Can see the precise sense in which this is inefficient:

At the margin, PRIVATE marginal costs and benefits are equalized, but SOCIAL COST exceeds benefit – everyone could be made better off if the level of production was reduced.

This is an example of a **NEGATIVE PRODUCTION EXTERNALITY**. Typically with negative externalities there is **OVERPRODUCTION** in a market equilibrium.

We can also think of **POSITIVE EXTERNALITIES**. For example suppose that when a firm produces it generates know-how which benefits all the firms in the industry. The social marginal cost is lower than the private – with a positive externality there is **UNDERPRODUCTION** in the market.

Just as pollution is the classic example of a negative externality, **KNOWLEDGE/INFORMATION** is a classic example of a positive externality.

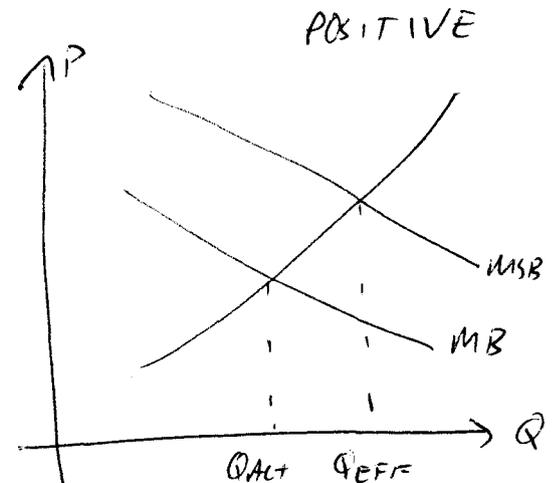
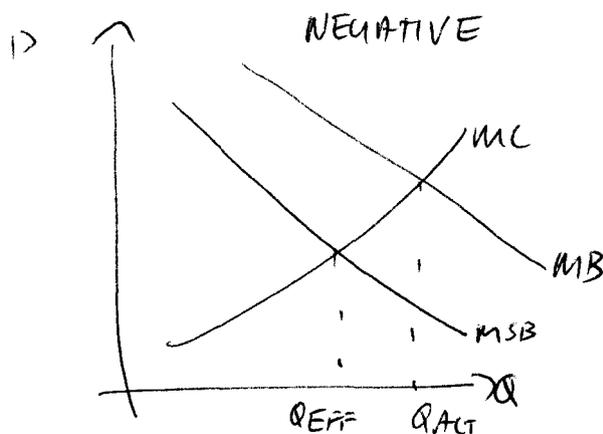


Finally we can also think about externalities on the demand side – these function in exactly the same way – the private benefits of some action diverge from the social benefit.

Examples:

Smoking is a negative consumption externality

Investing in keeping up the quality of your house has spillovers on the neighborhood



Exercise: Pollution regulation and the optimal quantity of pollution

Answers:

a. What allocation of pollution reduction efforts between the two firms will achieve the desired pollution reduction at least cost? Will the emissions tax of \$115 per ton achieve this least cost allocation?

***The least cost allocation of the 60 thousand-ton reduction is for Kristl Light to do 20 thousand tons of reduction and Kutheedrl Power to do 40 thousand tons. Note that with this allocation,***

*the marginal cost of the last unit of reduction is almost the same at both firms, \$110 vs. \$112.5 (using the averaging method) per ton. The total cost associated with this allocation is \$4800 (in 000's). The emissions tax of \$115 will achieve the target. Kristl Light will reduce its emissions as long as the marginal cost of doing so is less than or equal to the charge for not cleaning up the air and paying the tax. The marginal cost per ton is \$112.5 at 20 thousand tons of reduction so it pays to do this amount. However, an increase in reduction to 30 thousand tons requires an incremental cost of at least \$135 per ton so it is not worthwhile. Similarly, Kutheedrl Power will decide to do 40 thousand units of clean-up since the marginal cost at this point is \$110 and again, no worse than paying the tax. However, at 50 thousand tons, Kutheedrl Power now incurs a marginal cost of for additional reduction of \$120 and will therefore prefer to pay the \$115 tax at this point.*

b. Is the targeted total amount of pollution reduction of 60 thousand tons the right amount? Why or why not? Why is it not optimal to reduce the pollution by 100%, i.e., to cut emissions to zero?

*Optimal pollution balances the marginal benefit against the marginal cost. The marginal benefit (or demand for pollution reduction) schedule is given by:  $V = \$295 - 0.003Q$ . At  $Q = 60,000$  this implies a marginal benefit of \$115. We already know that at  $Q = 60,000$  the marginal cost of further reduction is just under \$115 at \$112.5. So,  $Q = 60,000$  is pretty close to the optimal amount. Further reduction would have a marginal benefit of less than \$115 and, as we know from above, cost of at least \$120. It is therefore not worth it. This is the reason that it is not worth it to cut emissions to zero. Pollution reduction is expensive and gets more so the more that society does. Saying that it is expensive is another way of saying that it uses up a lot of resources that could be otherwise used to produce schools, or shelter, or health care, or fire protection, or a host of other goods and services that society also values. To obtain perfectly clean air would sacrifice a large amount of these alternatives and is not a trade that society would voluntarily make. We are willing, in other words, to tolerate some pollution in order to obtain more of these other commodities.*

Key points:

- i) what is the efficient outcome – not zero pollution, there is an optimal amount

Note: in economic terms it is rarely efficient to completely eliminate all pollution – the marginal benefit declines and the marginal cost of reduction increases. Most environmental debate talks as if we have no other objectives beyond preserving the environment, but if we have competing claims on resources, time, effort etc, then it will rarely be optimal to go all the way to that extreme – the cost would be a lower level of economic activity than many people would find acceptable.

This analysis presumes we know the real social benefit and cost functions – maybe a heroic assumption. How do we know that levels of pollution that seem OK in the short run won't have terrible long-run consequences? However this doesn't invalidate taking an economic approach – here we have to explicitly recognize uncertainty – risk aversion gives

an economic rationale for taking a cautious approach to activities that might generate large, but uncertain social costs.

- ii) what is the optimal way to get to the efficient outcome?

We've seen that the market outcome is not efficient by itself. What can we do to get there?

### Price and Quantity Regulation

In this case we see that the optimum could be achieved either with QUANTITY REGULATION or PRICE REGULATION

How would we choose between the two options? One criterion depends on the potential losses if we get the regulation wrong....

Quantity regulation does not always achieve reduction at minimum cost

Price regulation can leave actual quantity of reduction very uncertain.

Permits combine the benefits of both:

- i) can determine the quantity of reduction, but
- ii) let the market allocate the reduction in the most efficient way

but still need to know something about the industry to determine the OVERALL quantity of reduction....