Lecture 9 – Land use externalities and the Coase theorem

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19 March 2009

1 Introduction

1. Land use, externalities, and land use controls
   (a) Overlaps: Congestion, building codes
   (b) More detailed discussion of land use regulation
   (c) Coase theorem

2 Land use, externalities, and land use controls

We started the course with a discussion of why cities form. Increasing returns to scale and natural (or unnatural) locational advantages both play a role. We also discussed how both positive and negative externalities play a role. Positive externalities tend to increase city sizes and the incentives to form cities. Negative externalities tend to limit city size and reduce incentives to form cities. This discussion did not mention how government policies such as taxation or regulation could be employed when externalities are an issue. Nor did it discuss the role of other institutions such as firms, legal institutions, traditions, social norms, religious institutions, non-governmental institutions or families.

We then looked at location choice, transportation, and housing. Inititially we developed a model with not externalities. Later we studied transportation when congestion externalities are important. When congestion externalities are present, government policy can potentially reduce inefficiencies either by appropriate taxation or by creating appropriate markets for tradeable road-use permits.

We now want to discuss externalities arising in urban economies in more detail. A lot of local government policy and law deals with solving disputes and problems caused by or related to local externalities. For example, local government policies aim to deal with problems arising from congestion, fire hazards, and various forms of pollution. Other local government policies are aimed at addressing externalities associated with land use and with property rights disputes.

Basic land use externalities arise because one person's land use affects either the utility or the profits of their neighbours in a way that is not intermediated by the market.

Here are some examples of some local land use externalities and the problems arising from them:

1. (a) Land assembly problem
   (b) Everyone in a community might benefit if a subset of owners invest to convert property to build a new road, a shopping mall, a housing development, or other project. There is an external benefit if an investment is made but if residents cannot agree how to share the costs, the investment will not be made. The problem is, how does one assemble the land for the project?
2. Building a shopping mall may destroy parks that provide public goods. How should efficient land use decisions be made in this case? How should the benefits and costs of such a development be distributed?
3. Public facility location choice problem
   (a) Suppose a large city needs a new public facility such as an incinerator, a landfill for wate disposal, or an airport. There is a public benefit from building the facility but there are also costs that will be incurred by those living closest to the facility because it produces local negative externalities. The question arises, where should the facility be built? Where is the efficient location? And how should the neighbours be compensated?
   (b) Other examples of externalities
   (c) Large factories such as cement factories are noisy and very dirty.
   (d) Large apartment buildings create congestion in traffic and parking, noise, crime. Plus they may change a neighbourhood's architectural character. Is this a good or a bad thing?
   (e) If schools (or other public services) are paid for by council tax (or local property tax), residents of apartment building may not pay fair share.

What are the best policies to deal with these types of externalities?

1. Taxation of harmful activity?
2. Subsidise reduction of harmful activity?
3. Tradeable permits?
4. Location specific regulations on types of activities?
   (a) Zoning and planning law restrict the set of activities that are allowed at different locations

(b) Building codes set minimum standards for investment in fire safety, safety, public health. Sometimes these codes detail specific investments that must be made (they regulate inputs). Sometimes they detail admissible outputs of pollution or other harmful outputs (regulation of outputs).

5. Adjustsment to property law? Property law and how rights to use property are defined can significantly affect the impact of externalities, how disputes are managed, etc.

3 Example: Fire safety

The previous set of lecture notes detail a model in which there is a fire externality. In that model, private incentives for investment in fire safety do not equal social incentives and there is under investment.

In that case, a subsidy to investment in fire safety could be an efficient policy if the subsidy is set so that the marginal private cost of investment equals the marginal social benefit. The optimal subsidy depends on how much investment e reduced the probability of fire $P(e)$ and on the damage caused by fire F_i. However, if the government has incomplete knowledge of $P(e)$ or of F_i, then it may be difficult to set the optimal subsidy. Moreover, the administrative costs of the subsidy policy may be high. In such a case, a regulation requiring a minimum investment (e.g. all households must install electrical wiring that meets a certain standard and must have the wiring certified by a qualified electrician), may be preferred. It would be preferred if it is likely to get closer to the efficient outcome when information is lacking about $P(e)$ or F_i or when such a regulation has lower administrative costs than a subsidy policy. On the other hand, the subsidy policy has more flexibility than the regulatory policy because households can change their investment choices when either $P(e)$ or F_i changes.

Now we discuss an alternative way of thinking about externalities; externalities arise from a failure to define property rights. This alternative way of thinking about property rights arises from the Coase Theorem.

4 Coase theorem

1. Discussions about externalities relate to the question of how to deal with situations where one person's activity affects another's welfare in a manner that is not transmitted through the market.

2. These can be interpreted as a failure to completely define property rights.

3. Zoning or planning laws define property rights by limiting the rights of land owners to use their land. These limitations proscribe activities that have harmful external effects on others

4. Pigouvian taxes also define property rights. A Pigouvian tax is a tax charged to an activity that charges a person for the harm they do to others because of externalities. A congestion tax is an example of a Pigouvian tax. The property right, is the right to use the road or engage in the activity, if you pay the tax.

5. Property rights for land are more complicated to define then property rights for simple goods like apples, pencils, or clothing. It is relatively costless to use these simple goods without causing any external affects. Property rights for apples give you the right to do whatever you want with the apple as long as you don't cause any external harm to anyone else. It is relatively simple to define property rights for apples. It is also relatively easy to enforce property rights to apples. Finally, it is relatively costless to buy and sell apples. Trading costs are very small.

6. Markets work well when property rights are simple to define, easy to enforce, and trading is costless

    (a) Markets may have problems when one of those conditions is not met

7. The problem then is determining the appropriate institutional, legal, economic, and political mechanisms to deal with these issues. The paper by Coase, "The problem of social cost," published in the 1960 *Journal of Law and Economics*, discusses this point. Though the paper does not contain a theorem of the following sort. An idea emerged from this paper that has come to be known as the Coase Theorem. The idea is the following.

8. In an economic environment where:

    (a) Property rights are defined completely

    (b) Property rights are costless to enforce

    (c) Transaction/bargaining costs are zero

9. Then the following outcome will be obtained

    (a) Bargaining will lead to an efficient outcome despite any externalities and regardless of the allocation property rights

    (b) Different allocations of property rights will generally result in different distributions of wealth

10. Example

    (a) Two people live next to each other. Each owns their property.

    (b) Person A runs a dry cleaner. Fumes and noise from dry cleaner reduce welfare of person B.

    (c) Suppose bargaining costs are infinite so no bargaining takes place.

(d) Imagine two legal rules that define the property rights relevant to this situation. Legal rule 1 is a "No Liability" rule. Under this legal rule, Person A is not liable for any harm imposed on person B. Person A has the right to freely use their land and pollute as much as they want. Without bargaining, person A will maximise profits from dry cleaning and will produce too much pollution because they will not take into account the negative effects of pollution on B. Person B will act to minimise the harm they suffer perhaps by keeping their windows shut even at the height of the summer. Consider legal rule 2, a "Full Liability" rule. Under this rule, person A is liable for the full amount of any damages the pollution from the dry cleaning causes to B. Person A will reduce the amount of pollution they create to avoid compensating B. B will increase activities that might make them more susceptible to harm from the pollution. They might leave their windows open all the time regardless of the fact that this might increase the costs to the drycleaner. They will be fully and completely compensated for all damages. In this case, there may be too little pollution created. It might increase social efficiency to increase the amount of pollution or require person B to close their windows on days when the dry cleaner is very busy.

   i. Obviously, the dry cleaner prefers legal rule 1 while person B prefers legal rule 2.
   ii. While these legal rules will not lead to the most socially efficient outcome, it may the case that one or the other leads to a more efficient outcome than the other.

(e) Suppose bargaining costs are zero.

(f) In this case, under the "No Liability" rule, person B has an incentive to pay the dry cleaner to reduce the amount of pollution. If such a reduction is efficiency improving, by definition, B can pay the dry cleaner to reduce pollution somewhat and still benefit because the increased utility from the lower pollution will more than compensate for the amount he must pay to reduce the pollution. The predicted outcome is that B will pay A to reduce the amount of dry cleaning to the efficient level. B will also increase activities that increase the amount of harm caused by the pollution, like leaving windows open. B will choose the efficient level of such activities because, they must pay to reduce A's drycleaning. This rule leads to an efficient outcome.

(g) Under the "Full Liability" rule, an efficient outcome will also be achieved. Person A will pay person B for any damage caused by the pollution. Person A will also pay person B to keep their windows shut on some days to reduce the damage caused by pollution.

(h) Both rules lead to an efficient outcome when costless bargaining is possible. Legal rule 1 is more beneficial to person A. Legal rule 2 is more beneficial to person B.

(i) The activities of both person A and person B affect social efficiency. Person A's level of pollution harms B. Person B's level of activity affects how harmful the pollution is.

11. Other examples

    (a) Property rights can be defined for the right to smoke in a restaurant or to give people the right to a smoke free restaurant

    (b) Property rights to owners of historic houses can be defined to give the owner the right to freely alter or destroy the house. Thus, giving other people no rights over the house. Or, they can be defined so that the owner is free to alter the house subject ot restrictions that preserve the historic character. This gives other people the right to enjoy the beauty or historic character of the house.

    (c) Property rights for railroads could be defined using a "No liability" legal rule so that they are not liable for damages caused to neighboring farmland. Or, a "Full Liability" rule could be defined so that the railroads are fully liable for all damages. The railroad chooses how many trains to run. The trains might cause damage to neighbouring farms, perhaps because they cause fires. The farmers choose whether to farm the land closest to the railroad intensively or not. If they farm the land intensively, fires generated by the trains cause more damage.

5 Problems

1. When the conditions stated in the Coase theorem are not met, then the problem is to design a set of government, legal, and market policies and institutions to maximise social welfare subject to the constraint that the conditions of the theorem are not met.

2. Why might the conditions of the theorem not be met?

    (a) Transaction and bargaining costs.

        i. These can be large (500,000 motorists on a highway, 10,000 people live next to the dry cleaners, people move in and out). Simply getting people together to discuss the solution can be a problem. The problem is made worse by the presence of asymmetric information. Different people have different information about the costs and benefits of various policies and different people may not know what information others have.

        ii. When these costs are large, different legal rules can lead to different outcomes. In general these outcomes will not be efficient (though they may be efficient under some circumstances). If the fully efficient outcome is not possible, then a legal rule should

be sought that yields a "desirable" distribution of payoffs and is closest to being efficient.

(b) Costs to measuring and defining property rights.

i. For example, a fully efficient property rights system governing air pollution would have to monitor the pollution emissions of all land uses for every person and firm in the economy at every date and at every location. Such monitoring would be impossibly costly. Because of these costs, a compromise must be made that defines property rights in some cases and then seeks an outcome that is as close to the fully efficient outcome as possible, again taking into account concerns about the distribution of resources.

ii. As one indication of the size of the problem of measuring and defining property rights for land, consider the US. In the United States, there are 83,000 local governments each of which determines local laws governing land use and property rights. In a small US town with 8,000 people, the land use regulations run to 85 pages. Land use regulations in NYC are contained in several large volumes.

iii. Or, what are the costs of defining (and enforcing) property rights related to the emission of carbon dioxide? Virtually every sector of the economy including agriculture, industry, transportation, retail, household, mining and forestry emits carbon dioxide. Measuring the emissions (or storage) from every possible source is currently not technologically feasible.

iv. As a second indication, go to a book store, and scan the section on land law or property law. It is not a small section.

(c) Costs of enforcement.

i. Even in cases where rights are mostly clearly defined, the legal system must have some mechanism to enforce the rules and settle disputes. This enforcement mechanism involves police, inspectors, lawyers, economists, judges, the legal system, etc. All of these are costly and imperfect enforcement mechanisms.

6 Problem arising when bargaining costs are high: land assembly problem

1. 10 properties in a city. Current use each is worth £10. Suppose someone buys 5 of them spends £25 and converts into shopping mall and the new value of every property is £20. If $p < 10$, no one is willing to sell since p less than current value. If $10 \leq p < 20$, no one wants to sell since price is greater than current value but value afterwards is £20. If $p \geq 20$ no one wants to buy since can't make profit. Property owner 1 can't buy from 2-5 since would have to pay £105, value is only £100.

(a) Everyone benefits from investment. Private benefit is less than cost. Total benefit greater than total cost.

(b) If costly to bargain or cooperate, investment is not made.

(c) If relatively costless to bargain, 3 owners might reach agreement. If owners 1-3 do nothing, their properties have a combined value of £30. If they get together and buy properties 4-5 at a price of £20 per property and redevelop, the cost would be £25+£40=£65. The value of their combined propertes minus costs would be 5*20 - 65 = £35.

(d) In this example it seems like it might be easy for two people to reach agreement. In more complicated examples, there might be disagreement about value of project, cost of project, costly to reach agreement. If government has a way to determine the social costs and benefits, should step in and force project through. Should make the investment, compensate those who are made worse off, tax those who are made better off. Sometimes it is difficult to determine who is harmed and who is benefitted and the size of the subsidy and tax. But, government must have information about costs and benefits.

7 The Coase Theorem and bargaining

Suppose a firm maximises profits by choosing action a. Profits are

$$\pi(a)$$

subject to $a \leq \overline{a}$ with $\frac{\partial \pi}{\partial a} > 0$. Suppose further that action a produces pollution which lowers the utility of other people in the city. The utility of the n other people in the city is

$$-u(a)$$

per person with $\frac{\partial u}{\partial a} > 0$. With no bargaining, the firm will choose $a = \overline{a}$ produce too much pollution if it has the right to pollute. Now suppose the people can bargain at cost $b(n)$ per person and reach an agreement to pay the firm to reduce a. In this case, if the people pay the firm p or $\frac{p}{n}$ per person, the firms profits are

$$\pi(a) + p$$

and the total utility of the other residents is

$$-nu(a) - nb(n) - p.$$

Suppose the residents decide to pay the firm to reduce the level of pollution to $a_1 < \overline{a}$. Then the firm will accept the payment if

$$\pi(a_1) + p \geq \pi(\overline{a}).$$

Each resident will be better off if

$$-u\left(\overline{a}\right) \leq -u\left(a_1\right) - b\left(n\right) - \frac{p}{n}.$$

Thus the residents and the firm will reach an agreement if

$$p \geq \pi\left(\overline{a}\right) - \pi\left(a_1\right) \tag{1}$$

and

$$p \leq n\left(u\left(\overline{a}\right) - u\left(a_1\right)\right) - nb\left(n\right). \tag{2}$$

The firm will benefit if the payment is larger than their cost of reducing a. The residents will benefit as long as the payment is less than their gain from reducing a minus the bargaining costs. Note how the solution depends on the cost of reducing a, the benefit from reducing a, the number of people, and the bargaining costs.

How would the solution change if the firm had to pay the residents to be allowed to pollute?