McPeak
Lecture 12
PAI 723

Externalities.

An externality occurs when an economic agent's consumption or production activities confer a benefit or impose a cost on other actors, and this benefit is conferred or this cost is imposed outside of a market.

(that is to say it takes place in a way other than through changing prices).

Alternatively, an externality occurs when a person's well-being or a firm's production capability is directly affected by the actions of other consumers or firms rather than indirectly through changes in prices.

A consumption externality is an externality generated by the consumption behavior of an economic actor.

- Smoke
- Drunken louts
- Loud music
- Vehicle exhaust.

A production externality is an externality generated by the production activity of a firm.

- Smokestacks
- Acid rain
- Noise and shaking houses
- Odors

Externalities can be positive or negative.

An externality that harms others by imposing a cost on them is a negative externality.

An externality that helps others by conferring a benefit to them is a positive externality.

What is a positive externality to one person can be a negative externality to another (wind chimes!!).

Positive externalities are sometimes called spillovers.

Positive externalities play a prominent role in growth theory and economic development. Also can be used to explain endogenous neighborhood formation and the persistence of poverty over time in specific areas.

We are going to focus mostly on negative externalities here. Private cost diverges from social cost in the presence of an externality, and in the presence of a negative externality SC is greater than PC.

Pareto optimality. An allocation of resources is Pareto optimal when it is not possible through any feasible changes in the resource allocation to benefit one person without making at least one other person worse off.

If an allocation is not Pareto optimal, it is not economically efficient. An allocation is inefficient when it is possible through some feasible change in the allocation of resources to make at least one person better off without making any other person worse off.

If an economy does not arrive at a Pareto optimal outcome, it has suffered from market failure.

In the presence of an externality, the harmed party is theoretically willing to pay the harming party to reduce the activity generating the externality, but no market exists for them to conduct such an exchange.

We may have moral objections here, but the idea is that I am made worse off by the externality, and there is some cash value I am willing to pay to eliminate the source of this reduction in my utility.

Market failure in a production setting occurs when firms equate private marginal cost with price rather than social marginal cost with price.

In a competitive market, more of the good and more of the externality will be produced than is socially optimal since private cost is less than social cost.

[show graph]

Welfare is maximized when price equals social marginal cost.

1) A competitive market may produce negative externalities thus making the market equilibrium not socially optimal.
2) The optimal amount of pollution is greater than zero.

Can address by regulation.

Government can control the size of the externality by imposing an emission standard that limits the quantity of the externality imposing byproduct of production.

Can also charge an emissions fee, that taxes the amount of the emission.

If such a tax is designed to fully internalize the externality, it is called a Pigovian tax.

[show graph]

Taxes on fuels:

	Externality as a % of price	Tax as % of price
Natural Gas	1.1	6.4
Gasoline	16.7	16.6
Diesel	50.4	12.9
Coal	528.0	35.9

Point source pollution is pollution that can be traced to a single point – there is an identifiable source of the pollution that can serve as the point of control. "It is coming from that smokestack over there"

Non-point source pollution is pollution that cannot be traced to a single point – multiple small sources make it hard to identify where it originated. "It is coming from all these burping cattle"

Market structure and externalities.

Remember that a monopoly producer selected an output level below the level that would be arrived at in a competitive market, thus leading to deadweight loss of monopoly.

Remember that a producer that generates negative externalities is producing more than is socially optimal, since MSC>MPC.

Can these offset?

Potentially, yes.

[show graphs]

The monopoly output may be less than the socially optimal level, equal to the socially optimal level, or greater than the socially optimal level. It will be less than would be generated in a perfectly competitive market.

The overall point is that in the absence of externalities, social welfare is maximized under perfect competition. This is not the case if externalities are present.

Coase Theorem:

In the absence of transactions costs, and with symmetric information, the initial assignment of property rights does not matter in determining the efficient allocation of resources. [though it may matter from a distributional standpoint]

Cattle owner and a crop grower.

1) Is the right to grow crops without bearing the costs of livestock damage?
2) Is the right to graze without facing limits imposed by individuals planting fields?

The rancher is liable to compensate the farmer for damage in case one, the farmer is liable to compensate the rancher in case two. From an efficiency standpoint, the outcome will be the same.

Boat owner rents boats to cruise about Onondaga Lake. Chemical firm dumps gunk in Onondaga Lake.

They choose levels of production, and have the following payoffs.

Initially, assume neither firm has the right to compensation.

Boat Company (boats used)				
		0	1	2
Chemical (tons dumped)	0	0 0	0 14	0 15
	1	10 0	10 10	10 5
	2	15 0	15 2	15 -3

Chemical firm has dominant strategy: BR to anything the boat firm does is 2
Boat firm knows this, chooses 1. 1 boat, 2 tons gunk.

Now assign right to boat firm that says they must be compensated at $7 per ton

Boat Company				
		0	1	2
Chemical	0	0 0	0 14	0 15
	1	3 7	3 17	3 12
	2	1 14	1 16	1 11

Chemical firm firm BR is always 1, boat knows this, picks 1 boat. 1 boat 1 ton gunk.

Now assign chemical firm the right to be compensated for any reduction in gunk emission from 2 tons at $6 per ton.

Boat Company				
		0	1	2
Chemical	0	12 -12	12 2	12 3
	1	16 -6	16 4	16 -1
	2	15 0	15 2	15 -3

Chemical firm firm BR is always 1, boat knows this, picks 1 boat. 1 boat 1 ton gunk.

Why might such compensation schemes not occur/ break down in reality?

1) Transactions costs may be high. How to bargain on behalf of one party if they are many?
2) Lack of information. What are the costs? Do both sides know and agree on the MC of the externality? Is the profit matrix agreed upon?

Tragedy of the commons.

Where do we have common property resources?

When a good is rival and has no exclusion.

Rival means one actor's consumption of the good in question precludes another actor's consumption of the good – the good is depletable.

Exclusion means that others can be prevented from consuming the good.

The fish in the ocean, the grass in a pasture, the water in a river, the oil under the ground, a seat in the lounge, a quick trip down a road, a quick download from the internet…

There is a distinction between a commons and an open access resource. In a commons, the number of users is defined, leading to greater cooperative potential. In an open access situation, there is no restriction on the number of users.

Commons – the academic village.
Open access – Marshall street.

Hardin provided the example of a village commons where multiple users have the right to graze animals. There is an incentive problem in the commons. Each user has an incentive to add animals and does not take into account the

externality imposed on others brought about by adding this animal, only the direct costs they bear.

Note the distinction between an appropriation externality and a provision externality.

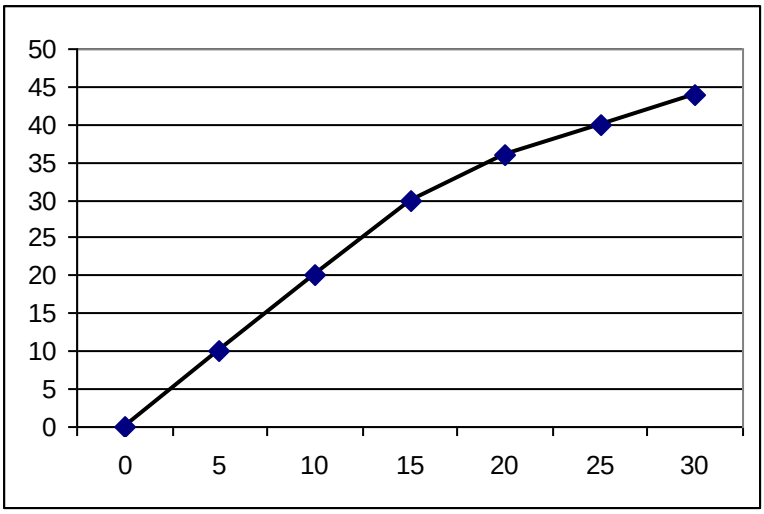
An appropriation externality is a static externality, and it is either your animals or my animals get the grass to produce milk in this setting.

A provision externality is a dynamic externality, and it is that together our animals impose a cost on the future provision of the good produced in the commons, that is we can cause environmental damage through overgrazing.

There is one pasture we share in common, and let's keep it simple and have it be just the two of us using this.

On this pasture, milk production as a function of total herd size is as follows:

# of animals	Liters of milk produced
0	0
5	10
10	20
15	30
20	36
25	40
30	44



For each livestock owner, the share of this total milk produced they receive is a function of your share of the total herd. The cash value of milk is $1 per liter.

For each animal put on the pasture, it costs $1 in private labor costs. (5 animals costs $5, 10 animals costs $10,…)

So if I have 5 animals and you have 5 animals, my payoff is (5/10)*20-5, or 5. If you had 15 animals and I had 5, then it is (5/20)*36-5, or 4. We can develop the following matrix of payoffs.

$\Pi_1 = \left(\frac{h_1}{h_1 + h_2} \right) * f(h_1 + h_2) - c(h_1)$, to give the general form.

	0		5		10		15	
0	0	0	0	5	0	10	0	15
5	5	0	5	5	5	10	4	12
10	10	0	10	5	8	8	6	9
15	15	0	12	4	9	6	7	7

(can extend down here to 20 (16,0); 25 (15,0); 30 (14,0))

Can go through and identify best response strategy. There is a Nash equilibrium in pure strategies of 15, 15 with a payoff of 7 to each. Note however that if they could restrain their stocking levels to 10, they would arrive at a Pareto improving outcome.

What if I privatize, and assign exclusive rights to one of the individuals?

	0	
0	0	0
5	5	0
10	10	0
15	15	0
20	16	0
25	15	0
30	14	0

I arrive at the efficient stocking level, as profit is maximized where total herd size for one individual is equal to 20 and the total payoff is 16.

Not really very fair though, is it!

What about if we give the exclusive land right to one of the herders on the condition that the other herder is allowed to use the land if he pays 80 cents per animal to herder one?

Herder one puts ten animals on, gets 16 [(10/20)*36-10+8] while herder two puts ten animals on and gets zero [(10/20)*36-10-8]. So this is an alternative that takes you to the efficient (though not very fair) outcome.

Also consider the possibility that we develop an outside agency, say the state. This agency is able to impose a herd size limit of 10 animals per person and is capable of enforcing this.

Finally, consider the state charging a user fee of 50 cents per animal in addition to the one dollar per animal labor cost. The following payoff matrix results.

	0		5		10		15	
0	0	0	0	2.5	0	5	0	7.5
5	2.5	0	2.5	2.5	2.5	5	1.5	4.5
10	5	0	5	2.5	3	3	1	1.5
15	7.5	0	4.5	1.5	1.5	1	-0.5	-0.5

This also takes us to the socially efficient stocking level of 10, 10. Now the state gets 10 in tax revenue as well.

[localized degradation paper]

Responses to the commons:

1) Land tenure reform (assign rights – think Coase)
2) Limit use (restrict quantity – think emissions standard)
3) Charge fee that internalizes the negative externality (think emissions fee).