

EXTERNALITIES

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Externality: situations where an individual takes an action that affects the utility of others

Positive externalities vs. **negative externalities**

In presence of externalities, equilibrium outcomes

- ▶ are not utilitarian optima
- ▶ may not even be Pareto efficient

Opportunity for policies to lead to Pareto improvement

WHAT IS A PUBLIC GOOD?

Non-excludable: If I have access to the good, so do you

Non-rival: My use of the good does not diminish your access to it

EXAMPLES

Clean air

National defense

Protection from asteroids

Knowledge

Disease free air resulting from mask wearing

THE MODEL

2 people decide whether to exert high effort (H), medium effort (M), or low effort (L)

Each person who exerts medium effort

- ▶ Increases the value of the public good by \$100
- ▶ Bears a personal cost worth \$125

Each person who exerts high effort

- ▶ Increases the value of the public good by \$200
- ▶ Bears a personal cost worth \$300

		Player 2		
		<i>L</i>	<i>M</i>	<i>H</i>
Player 1	<i>L</i>	0, 0	100, -25	200, -100
	<i>M</i>	-25, 100	75, 75	175, 0
	<i>H</i>	-100, 200	0, 175	100, 100

PEOPLE CONTRIBUTE TOO LITTLE

		Player 2		
		<i>L</i>	<i>M</i>	<i>H</i>
Player 1	<i>L</i>	0✓, 0✓	100✓, -25	200✓, -100
	<i>M</i>	-25, 100✓	75, 75	175, 0
	<i>H</i>	-100, 200✓	0, 175	100, 100

- ▶ Individual benefit of effort smaller than individual cost
- ▶ Social benefit of effort larger than individual cost
- ▶ People don't internalize their externalities

SOCIAL DILEMMA: PARETO IMPROVEMENTS EXIST

		Player 2		
		<i>L</i>	<i>M</i>	<i>H</i>
Player 1	<i>L</i>	0✓, 0✓	100✓, -25	200✓, -100
	<i>M</i>	-25, 100✓	75, 75	175, 0
	<i>H</i>	-100, 200✓	0, 175	100, 100

THE UTILITARIAN OPTIMUM OR “FIRST BEST”

		Player 2		
		<i>L</i>	<i>M</i>	<i>H</i>
Player 1	<i>L</i>	0✓, 0✓	100✓, -25	200✓, -100
	<i>M</i>	-25, 100✓	75, 75	175, 0
	<i>H</i>	-100, 200✓	0, 175	100, 100

THE SOCIAL DILEMMA

People do not *internalize* their externalities

- ▶ Externalities do not influence decision making

People do

- ▶ too little of actions with positive externalities
- ▶ too much of actions with negative externalities

POLICY RESPONSES

Policy makers must look for instruments to get people to internalize externalities

They must also pay attention to any unintended consequences of using those instruments

FREE RIDING

		Player 2		
		<i>L</i>	<i>M</i>	<i>H</i>
Player 1	<i>L</i>	0, 0	100, -25	200, -100
	<i>M</i>	-25, 100	75, 75	175, 0
	<i>H</i>	-100, 200	0, 175	100, 100

Even though payoffs are higher if everyone exerts high effort, no individual has an incentive to behave in this way

Each individual has an incentive to free ride, even if others behave in a socially minded way

PIGOVIAN SUBSIDIES AND TAXES

Use subsidies (taxes) to encourage (discourage) behavior that is socially beneficial (harmful)

Policy alternative to direct regulation

“To many economists, the basic argument for increased use of Pigovian taxes is so straightforward as to be obvious.”

– N. Gregory Mankiw

SUBSIDIES IN PUBLIC GOODS GAME

Suppose provide a subsidy, σ , for each increment of effort

Subsidy must be funded with socially costly taxation

It costs tax payers $\tau > 1$ dollars for each dollar of revenue the government collects

Each member of society pays the tax burden to fund subsidy for other player

THE GAME WITH SUBSIDIES AND TAXES

		P 2		
		<i>L</i>	<i>M</i>	<i>H</i>
P 1	<i>L</i>	$0, 0$	$100 - \tau\sigma, -25 + \sigma$	$200 - 2\tau\sigma, -100 + 2\sigma$
	<i>M</i>	$-25 + \sigma, 100 - \tau\sigma$	$75 + \sigma - \tau\sigma, 75 + \sigma - \tau\sigma$	$175 + \sigma - 2\tau\sigma, 0 + 2\sigma - \tau\sigma$
	<i>H</i>	$-100 + 2\sigma, 200 - 2\tau\sigma$	$0 + 2\sigma - \tau\sigma, 175 + \sigma - 2\tau\sigma$	$100 + 2\sigma - 2\tau\sigma, 100 + 2\sigma - 2\tau\sigma$

NASH EQUILIBRIUM WITH SUBSIDIES

If $\sigma < 25$, both players choose Low

If $25 < \sigma < 75$, both players choose Medium

If $\sigma > 75$, both players choose High

THREE SUBSIDIES TO CONSIDER

Don't subsidize at all: $\sigma = 0$, both players choose Low effort

Subsidize moderately: $\sigma = 25(+\epsilon)$, both players choose Medium effort

Subsidize a lot: $\sigma = 75(+\epsilon)$, both players choose High effort

COMPARING WELFARE

If don't subsidize at all, each player makes 0

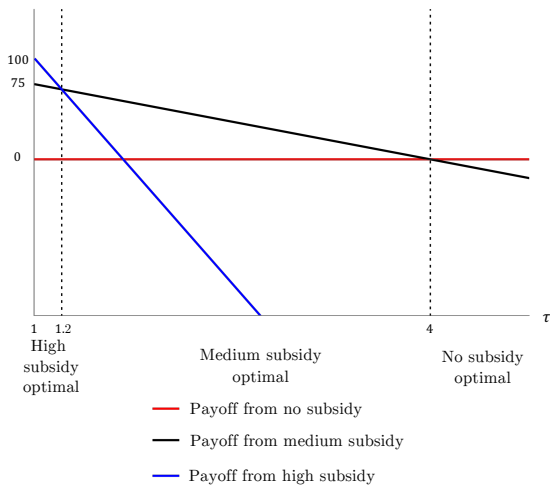
If subsidize moderately, each player makes:

$$\begin{array}{cccc} \text{public good} & \text{subsidy} & \text{cost} & \text{taxes} \\ \underbrace{100 + 100} & + \underbrace{(25 + \epsilon)} & - \underbrace{125} & - \underbrace{\tau(25 + \epsilon)} \\ & & & = 100 + \epsilon - \tau(25 + \epsilon) \\ & & & \approx 100 - 25\tau \end{array}$$

If subsidize a lot, each player makes:

$$\begin{array}{cccc} \text{public good} & \text{subsidy} & \text{cost} & \text{taxes} \\ \underbrace{200 + 200} & + \underbrace{2(75 + \epsilon)} & - \underbrace{300} & - \underbrace{\tau 2(75 + \epsilon)} \\ & & & = 250 + 2\epsilon - \tau 2(75 + \epsilon) \\ & & & \approx 250 - 150\tau \end{array}$$

THE SECOND BEST POLICY



Optimal subsidy depends on how costly funding is

SOME IMPLICATIONS

The utilitarian optimal (or second best) subsidy depends on how costly taxation is

The larger is τ , the smaller is the utilitarian optimal subsidy

THE IDEA

We may not want to induce the first-best outcome because it's very expensive ($\sigma > 75$)

Any policy lever government pulls to address one issue has spillover effects in another domain

Good policy balances these benefits and costs

The *second best* policy is the utilitarian optimal intervention, given all the constraints and effects

When policy affects other domains, it is rarely socially optimal to achieve the first best in the given domain

AN EXAMPLE

Monopolist in a polluting industry

Break monopoly to improve consumer surplus

Also increases production, which imposes externalities

Optimal policy with respect to market power may not be perfect competition because of constraint from the pollution domain

DIRECT REGULATION VS. PIGOVIAN INTERVENTION

Informational requirements

Monitoring

Flexibility

IMPORTANT UTILITARIAN CONCEPTS

First best: Maximizing total utility, unconstrained

- ▶ First-best outcome

Second best: Maximizing total utility given all the constraints the policy-maker faces

- ▶ Second-best policy (optimal policy from utilitarian point of view)
- ▶ Second-best outcome (outcome induced by that policy)

TAKE AWAYS

Externalities create inefficiency

Policy can improve situation by incentivizing people to (partially) internalize their externalities

Policy intervention must be active and ongoing

If policy has other costs, the utilitarian optimal policy (second best) does not achieve complete internalization of externalities

Pigovian approach is often an elegant solution, but it has limits