Lecture # 6 -- Taxes and Subsidies

I. Output Taxes and Subsidies

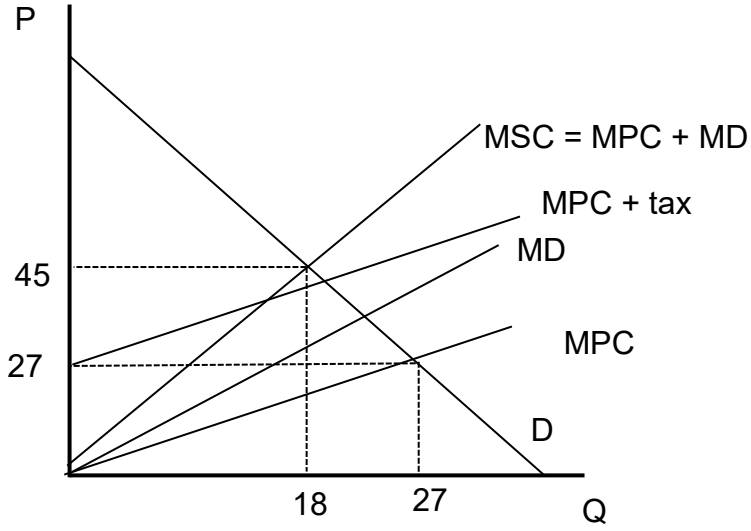
- *Goal:* to set prices so that the actor includes social costs in her decision.
  - Often referred to as Pigouvian Tax for the economist who first expressed this idea
  - A Pigouvian Tax is a tax equal to the marginal damage inflicted by an activity
- Economists prefer taxes over regulation because they achieve pollution reduction at the lowest possible cost.
  - This is because they encourage the cheapest reduction possibilities to be done first.
- Two types of taxes
  - A tax on output: a tax levied on each unit of output in an amount equal to the marginal damage that it inflicts at the efficient level of production.
    - Taxing output is a second-best solution. It would be better to tax the pollution directly.
    - Although the level of output is correct for the technology being used, the firm doesn't have the correct incentives to use the appropriate technology (e.g. pollution control, more efficient machines, etc.) because there is no price placed on pollution.
    - However, there may be times when this is the best we can do.
      - For example, we cannot measure the actual emissions from cars, so we instead tax gasoline consumption, since pollution is a by-product of gasoline consumption
  - Emissions fees -- a tax per unit of pollutant emitted
    - Emissions fees are more direct, and thus more desirable.
    - However, sometimes measuring emissions may be difficult (e.g. emissions from cars). In that case, a tax on output is a possible fallback.
- We look first at taxes and subsidies on output, and then turn to emission fees.

- Example: a tax on output

Demand:
P = 81-2Q

MPC = Q
MD = 1.5Q

In free market:
equate MPC = D
81 – 2*Q* = *Q*
81 = 3*Q*
Q = 81/3
***Q* = 27**



To find the price, plug this quantity into either supply or demand to get ***P* = $27:**
P = 81 – 2(27) = $27
or
P = (27) = $27

Now, add pollution
MSC = MD + MPC = 1.5Q + Q = 2.5Q

Efficient solution: equate MSC and D
2.5*Q* = 81 – 2*Q*
4.5*Q* = 81
Q = 81/4.5
***Q* = 18**

To get the price, plug the quantity of 18 into demand:
P = 81 – 2(18) = $**45**.

We can achieve the efficient solution with a Pigouvian tax:
MD @ Q = 18(1/.5) = 27
A $27 tax shifts the MPC curve up to MPC + tax:

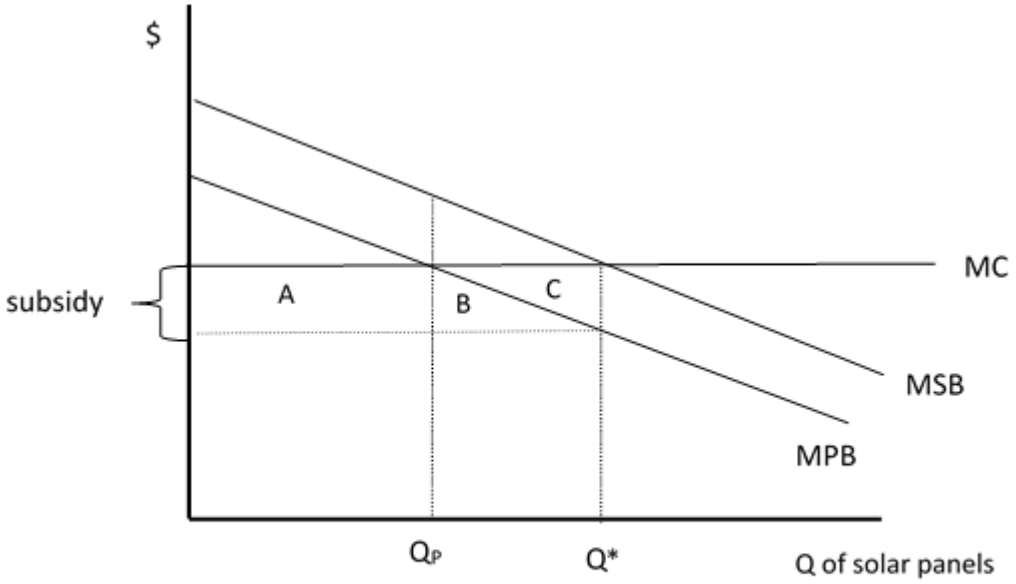
The private solution is now: MPC + tax = D
Q + 27 = 81 – 2*Q*
3Q = 54
Q = 18

Note that this is the efficient solution – the tax internalizes the externality!

Also notice that the price does not increase by the full $27. That is because the producer price falls – both consumers and producers bear the burden of the tax. At Q= 18, the marginal private cost equals $18. Thus, the price received by producers falls from $27 to $18. The difference between the consumer price ($45) and producer price ($18) equals the Pigouvian tax of $27.

- The Pigouvian tax works by internalizing the cost of the externality. We can do the same thing with a subsidy.
    - In this case, the opportunity cost of polluting is losing the subsidy.
    - Types of subsidies:
        - An abatement equipment subsidy would pay a firm for adopting a specific abatement technology.
        - A per unit subsidy pays a firm for each unit of pollution reduced below some predetermined level.
            - Most environmental subsidies are the first, encouraging consumption of an environmentally friendly good (e.g. solar panels, EV's)
    - Problems with subsidies
        - Firms may enter market, so that total pollution increases
        - Need to raise taxes to pay for subsidies
        - Subsidies are often politically motivated and can be difficult to remove when no longer needed.
        - Very different distributional effects
            - The polluter receives money from the government, rather than paying
            - Benefits often go to higher income households, as they are more likely to invest in new equipment (e.g. hybrid vehicle, solar panels)

- Payments typically more than necessary to induce adoption of the technology



- In the graph above, MPB represents the marginal private benefits of solar panels, and MSB the marginal social benefits.
- Without a subsidy, consumers compare MPB to marginal cost and choose Q_P. The optimal level is Q*.
- A subsidy equal to the difference between MSB and MPB will induce the correct quantity of solar panels.
- However, much of the money spend does not directly change behavior.
    - Area A represents payments to people who would have purchased solar panels even without the subsidy
    - Area B is a payment to new adopters above and beyond the minimum necessary to get them to buy the solar panels (since their MPB is higher than the MC + subsidy)
    - Only area C is required to get these extra adopters to choose Q*.

- Advantages of subsidies
    - Politically more feasible than raising taxes or increasing regulation
    - Targeted subsidies could help low-income families
    - Provides support for new or emerging technologies

II. Emission Fees

- Recall that the problem with externalities is that they are not reflected in prices.
    - The government can rectify the problem by setting a price for pollution.
    - The goal is to set the fee so that the polluter incorporates the social cost.
- If MAC is known, simply set the fee equal to MAC at the optimal level of pollution.
    - The firm will find it beneficial to abate up to this point, since abating is cheaper than paying the fee.
    - After this point, paying the tax is cheaper than abatement, so no further abatement occurs.
    - Note that since MAC = MD at the optimal level, the firm is taking into account the value of the damage it is doing.
    - If MAC is unknown, the fee should be based on the expected value (the "best guess" of MAC).
- The main advantage of emissions fees is that, when there is more than one polluter, they achieve a given level of pollution control at the lowest possible cost.
    - Thus, economists say that emissions fees are an efficient environmental policy.
    - An efficient solution is found when the marginal abatement costs are equal across all firms.
        - At this point, there is no way to shift abatement responsibilities among the firms and achieve a lower total cost.
        - However, the cost to each individual firm is greater, since the firms pay both abatement costs and the fees.
        - Thus, emissions fees are politically unpopular.

Source A				*Source B*			
Emissions	Abatement	MC	TC	Emissions	Abatement	MC	TC
12	0	0	0	12	0	0	0
11	1	1,000	1,000	11	1	2,000	2,000
10	2	2,000	3,000	10	2	4,000	6,000
9	3	3,000	6,000	9	3	6,000	12,000
8	4	4,000	10,000	8	4	10,000	22,000
7	5	5,000	15,000	7	5	14,000	36,000
6	6	6,000	21,000	6	6	20,000	56,000
5	7	8,000	29,000	5	7	25,000	81,000
4	8	10,000	39,000	4	8	31,000	112,000
3	9	14,000	53,000	3	9	38,000	150,000
2	10	24,000	77,000	2	10	58,000	208,000
1	11	38,000	115,000	1	11	94,000	302,000
0	12	70,000	185,000	0	12	160,000	462,000

Goal: Reduce pollution by 12 units

Command and Control: Each firm reduces by 6 units

	Abatement Costs
Source A	21,000
Source B	56,000
Total Cost:	77,000

Emissions Fee: $10,000 per ton

	Abatement Costs	Tax bill	Total Payments
Source A	39,000	40,000	79,000
Source B	22,000	80,000	102,000
Total Cost:	61,000	120,000	181,000

LESSON: ***Tax equates MAC across firms. Therefore, it achieves the pollution control target at minimum cost.***