

1. In his TED talk (Pavan Sukhdev: Put a value on nature!), Dr. Sukhdev gives an example of the cash value of a shrimp farm in Vietnam being much higher than its cash value as a mangrove swamp. (Mangroves are trees that live in brackish – fresh-salt – coastal waters.) Explain why shrimp farms are more valuable from a private perspective and mangroves are more valuable from a public perspective (as discussed in the video AND class lecture).

**Answer:** Shrimp farms produce private profits, but negative externalities (pollution, loss of flood protection and water cleaning). Mangroves produce social benefits as common pool goods, i.e., flood protection, water cleaning, habitat for baby fishes, etc.

2. Pro-democracy protests in Tiananmen Square reflected popular frustration with corruption and inequality that arrived with economic liberalization in the 1980s. The Chinese government responded by promoting growth “for the masses.” What negative externalities have resulted from pro-growth policies? How could popular anger with these problems turn into a challenge to the power of the communist party?

**Answer:** Growth has brought local air and water pollution that harms Chinese people (global pollution is not important in this question). The CPC worries that environmentalists may organize into groups that can challenge its authority. Note that we are NOT talking about income inequality here. First (academic reason) is that inequality is a pecuniary externality. The *better* reason is that “growth for the masses” implies growth for the poor as well.

3. The “Environmental Kuznets Curve” (EKC) describes how pollution starts off low (when people are poor and underdeveloped), then rises and then falls (when people are richer and developed). Why does the EKC describe local pollution trends better than global pollution trends? Give examples of local pollution that has followed an EKC and global pollution that has not (using costs and benefits).

**Answer:** The EKC works with local pollution because richer people experience and want to reduce dirty air/water. The people act to change local air from a CPR to a club good. It’s harder to address global pollution (CO<sub>2</sub>) because free riding makes it harder to take collective action to move from CPR to public good. Local example: Cleaning the air in Los Angeles after smog got bad in the 1970s was easier because additional local costs brought local benefits. Global: CO<sub>2</sub> mitigation, where costs in one place create benefits elsewhere. No credit for explaining what a EKC is.

4. In his guest lecture, Chris Joseph compared Economic Impact Analysis (EIA) to Cost Benefit Analysis (CBA). EIA (often) focuses on a project’s immediate impact while CBA (often) focuses on its total social impact.

- (a) Are jobs a cost or benefit in an EIA? Why?

**Answer:** They are a benefit because EIA does not consider opportunity costs. A factory creates local benefits compared to an empty field.

- (b) In his example of an oil sands project in Alberta, Chris showed that it had positive net benefits under an EIA analysis but negative net benefits under a CBA analysis. Why?

**Answer:** EIA compares local revenue from oil rents to local costs (labor, energy, materials), and the net is positive because oil is so profitable *if you exclude* externality costs. The CBA included costs from global climate change that are larger than EIA profits, thus negative result.

5. In Briefing 2, you suggested policies that would reduce resource consumption. Give an example of a pure economic policy that incentivizes a reduction in resource use. Give a different example of an economic instrument that depends on a regulation (e.g., creation of a property right) to reduce resource consumption.

**Answer:** A pure policy would be a tax on the good, e.g., a tax on water consumption. A regulation/economic policy would use a regulation to limit total water withdrawals/allow trading of extraction permits. (A regulation that tells people to use low flush toilets or limits individual water use is NOT economic.)

6. In HW#3, you looked up water prices in California. I mentioned that these prices are often designed to recover the cost of delivering water. I discussed how these prices may be TOO LOW, such that people who “pay for what they use” cause water shortages. Why would prices be too low?

**Answer:** Prices will be too low because they do not include a cost of water scarcity (or value of scarce water). The solution – a scarcity surcharge per unit of water – will balance supply and demand and prevent shortage.

7. In HW#3, you discussed temperature, precipitation, supply and demand. Describe the impact of an **increase** in temperature on demand and/or supply of residential drinking water. Describe the impact of an **increase** in precipitation on demand and/or supply of water.

**Answer:** An increase in temp will increase demand for water (hot people want to cool off) and decrease supply (evaporation from ground and reservoirs). An increase in precip will decrease demand (people don't need to water their lawns) and increase supply (more water to use). Note that we are talking about ALL residential demand from BOTH apartments AND houses.

8. In HW#4, you calculated Pigouvian taxes that would reduce carbon emissions in Canada and China. Those taxes – and the refund of revenue to citizens – make the policy seem like a good idea, but most countries do not use such taxes (some subsidize energy use). Name two groups that benefit from energy subsidies. Why do they benefit?

**Answer:** Companies selling energy and consumers using lots of energy. They do not want taxes on energy. Governments don't benefit from subsidies EXCEPT if they are corrupt and want bribes from subsidized businesses, but that makes no sense because they can steal direct if they are corrupt. I wanted DIRECT beneficiaries. (Many of you missed this question because you confused energy subsidies with energy taxes.)

9. Cap and Trade (CT) pollution policies use trade to reallocate permits efficiently. Give two examples of how mismanaged permits can weaken a CT system.

**Answer:** Poor accounting (or fraud) in counting permits, setting them too low to hit targets, distributing them according to some political calculation that requires heavy redistribution, which may not happen if transaction costs are high, and giving away permits (instead of selling them), such that too few are traded.

10. Explain two ways in which resources can “curse” a country by slowing development and social progress.

**Answer:** Government pays attention to resource sector (revenue), corruption/fight over resources, and/or specialization in resource reduces diversification (increases risk). Answers that described “pollution from overuse” did not get full points, as the curse is associated with over-reliance on production.

11. In Chapter 8, Dolan describes how private parks may protect resources and the environment better than public (owned by the state) parks. Explain – using prices – why private parks may succeed while public parks fail.

**Answer:** A public park may set prices too low or fail to profit from the reserve’s sustainable production (e.g., hunting animals, resources under ground, etc.). A private park that can make profits on conservation (or is supported by private donations, or represents the interests of environmental groups) will set prices high enough to keep the park healthy and intact. Government employees who cannot profit may not care about the right price (or allow poachers to kill animals for bribes) and thus destroy the park. Answers that clarified that private parks were club or private goods while public parks were open access goods got partial/total credit.

12. Explain how “normal” taxes on income or property create deadweight losses but Pigouvian taxes on negative externalities do not.

**Answer:** Taxes create deadweight losses by preventing mutually agreeable trades that increase total surplus. Pigouvian taxes internalize the externality, to reduce harmful activities in which private benefits are smaller than social costs; they thereby increase surplus. Note that a Pigouvian tax does NOT imply rebates of revenue to citizens (as with BC’s carbon tax or HW#4), so those answers were not accepted if they missed the part of externalities.

13. In lecture, I said that humanity’s environmental footprint was a function of P, T and C.

- (a) What do P, T, and C stand for?

**Answer:** Population, technology, consumption

- (b) Does a  $\uparrow$  or  $\downarrow$  in P *increase* our footprint (circle one arrow)? Draw arrows next to T ( ) and C ( ) for the direction that an increase of one increases our footprint.

**Answer:** Footprint rises with P and C; it falls with T (technological innovation)

(c) Which of these factors is easiest to affect with economic policy? Why?

**Answer:** Consumption is easiest, via taxes. Population is hard to influence; technology requires discovery AND development

14. In my paper, “Economists owe ecology an apology,” I discussed how GDP growth can be BAD for society. Given an example of an activity that increases GDP but harms the environment.

**Answer:** GDP rises when trees are cut down that may be more valuable, alive, in the environment. There were many good examples given.

15. Julian Simon and Paul Ehrlich made a bet about sustainability in which Simon would win if the cost of five metals fell over ten years. Why did Ehrlich lose? (Hint: they were betting on different types of goods)

**Answer:** Ehrlich (the ecologist) lost to Simon (the economist) because he was betting on the environment – a common pool good that is NOT owned or priced. Simon won because resources (private goods) are priced. Higher prices send signals to conserve (reduce demand) or find more resources (increase supply) when they are scarce. Metals are resources, so Simon won, because the market could respond to scarcity. Ehrlich should have bet on the environment or an indicator of environmental health (e.g., CO2 emissions or biodiversity).

16. The government has to choose between two projects. Project A produces \$100 of social surplus and employs 100 people. Project B produces \$100 of social surplus and employs 50 people. Which is better? Why?

**Answer:** Neither. Social surplus is the same. Jobs are one input of many, so more/less jobs does not tell you which is better. Social surplus is a good thing (some students said it wasn’t!), and it includes ALL costs, internalized or not. I did not give many partial points to people on this question, since it was already on the midterm and the answer is “neither is better; social surplus is the same, and all that matters.”

17. Regulations are “command and control” methods of changing behavior because they specify a particular action, technology or target. Why do price incentives change behavior more efficiently than regulations with respect to resources (e.g., oil, water, land, etc.)

**Answer:** Price changes are visible. People have more response options, e.g., changing techniques (shorter showers) or technologies (low flow showerhead) if water’s price rises. Regulations do not match some situations, are invisible (not acted on), and require enforcement (transaction costs, corruption). China’s even-odd license plate regulation for reducing emissions is far less efficient than raising the price of fuel.