

## Reading Reflections: Public Finance Economics

These are organized roughly by the categories and topics on Ted Bergstrom's site in the order presented in class. My goal is not to summarize the math and technical details of each paper, as the problem sets focused on these (and I can always go back and look up the math), but rather to tie together the big ideas of each topic and try to relate them to the general direction of my research, stakeholder preferences around marine conservation as a public good.

### Reflections on Public Goods Theory readings

- Bergstrom, T. C., & Cornes, R. C. (1983). Independence of allocative efficiency from distribution in the theory of public goods. *Econometrica: Journal of the Econometric Society*, 1753–1765.
- Lindahl, E. (1958). Just taxation—a positive solution. In *Classics in the theory of public finance* (pp. 168–176). Springer.
- Samuelson, P. A. (1954). The pure theory of public expenditure. *The Review of Economics and Statistics*, 387–389.
- Samuelson, P. A. (1958). Aspects of public expenditure theories. *The Review of Economics and Statistics*, 332–338.
- Samuelson, P. A. (1995). Diagrammatic exposition of a theory of public expenditure. In *Essential Readings in Economics* (pp. 159–171). Springer.

The Samuelson readings on public expenditures nicely derive the conditions for efficient allocation of public vs. private goods; the Diagrammatic Exposition clearly “widens the circle of economists who can understand and follow what is being said” - which apparently includes me. In both, he walks through a derivation of how to identify the share of public vs. private goods within a simple economy - some efficient provision of public goods and total private goods. Bergstrom and Cornes build upon these by greatly expanding the scope of instances in which an efficient allocation of public goods and distribution of private goods can be separately identified.

In both of these Samuelson papers, he brings up the challenge that is particularly interesting to me - once a locus of “efficient” solutions has been found, how does one determine the “best” distribution of goods among the parties, i.e. deciding how people are placed on more or less advantageous indifference levels? This is obviously a decision that falls more into politics and philosophy than science (and he points out as such), but economists cannot simply wash their hands of the question of “just” allocation. To determine a “best” allocation would require a social welfare function or set of norms, which is beyond the scope of these readings, but would help identify not simply an efficient, but a just, allocation among all possible solutions.

Lindahl's paper, 35 years prior to Samuelson's, lays out a way in which two distinct groups could come to an agreement on a distribution of the costs of providing a public good. This is complicated by the fact that the distribution of costs and the total amount of provision are not independent of one another. His derivation relies on the role of politics as a means of “defending one's interest” and starting from an assumption of even distribution of political power, two groups would argue until the efficient provision of goods and division of costs would be found. He expands this to multiple parties, saying “provided the taxpayers are all in an equal position to defend their economic interests when tax laws are passed, the financial process would result in each individual having to pay a tax amount corresponding to his valuation of public services.”

However, the more interesting cases are when this derivation breaks down. In one discussion, Lindahl describes how if the distribution starts at a non-optimal point (i.e., not starting from the point when tax laws are

passed, but some time after), one party is in a position where it is in their best interest to resist movement toward the optimal solution and retain the status quo. The differences in priority among a collection of public goods, if paid for in a lump-sum taxation policy, can lead to different parties feeling the marginal good is not worth the marginal taxation and push to reduce taxes, forcing cuts in those goods they see as marginal (e.g. Republican tax cuts for the well off that then lead to calls to cut Medicare and Social Security benefits to the less fortunate, i.e. less politically empowered). In his final point of discussion, he describes how an imbalance of power not only allows the powerful party to shift the equilibrium to its own advantage through exploiting ignorance or actively misleading others, or openly force undesirable taxes on the other party. Ignorance and misleading information can be corrected by a better informed public and more transparency and control over public authorities; and open wielding of political force bears political cost that can result in corrective strengthening of the opposing party, eventually leading to more “just” taxation solutions.

Samuelson’s *Aspects of Public Expenditure Theories* is an entertaining read (could a lesser economist get away with inventing an entire planet in such a paper today?) but I especially appreciated several points, which all seem to support a fairly active role of government in public policy, taxation, and provision of public goods. Briefly:

- Redistributive transfers are necessary (and sufficient by his account, with certain assumptions) to achieve a given social welfare function. Real incomes are not likely to be distributed in such a way to maximize a given social welfare function - “only by chance alone” would zero redistributions be the proper response.
- Building on this, Samuelson says, “If, as is more likely, incomes are distributed prior to taxation in a non-optimal manner [...], then the manner of taxing is very important even at the first level of approximation.” An undesirable level of inequality (according to a social welfare function) seems to demand redistributive tax policy to simultaneously achieve efficiency and justice.

## Reflections on Externality readings

Readings referenced in this discussion:

- Bergstrom, T. C. (1976). Regulation of externalities. *Journal of Public Economics*, 5(1–2), 131–138. [https://doi.org/10.1016/0047-2727\(76\)90064-5](https://doi.org/10.1016/0047-2727(76)90064-5)
- Bergstrom, T. C. (2010). The Uncommon Insight of Elinor Ostrom: The uncommon insight of Elinor Ostrom. *Scandinavian Journal of Economics*, 112(2), 245–261. <https://doi.org/10.1111/j.1467-9442.2010.01608.x>
- Coase, R. (1960). The Problem of Social Cost. *The Journal of Law and Economics*, 28.
- Demsetz, H. (1974). Toward a Theory of Property Rights. In C. Gopalakrishnan (Ed.), *Classic Papers in Natural Resource Economics* (pp. 163–177). London: Palgrave Macmillan UK. [https://doi.org/10.1057/9780230523210\\_9](https://doi.org/10.1057/9780230523210_9)
- Hardin, G. (1968). The Tragedy of the Commons, 162, 7.
- Schlager, E., & Ostrom, E. (1992). Property-Rights Regimes and Natural Resources: A Conceptual Analysis. *Land Economics*, 68(3), 249. <https://doi.org/10.2307/3146375>

Hardin’s classic Tragedy of the Commons (1968) describes the inevitable overexploitation of common pool resources due to the failings of human nature. It is always disturbing to reread the piece and recall the pessimism and darkness of Hardin’s worldview, and particularly the focus on overpopulation and the notion that breeding rights in a welfare society will doom us all in the long run. While his point may have some validity, his delivery seems a bit overly strident and lacking in awareness. Some of the insights I had not recalled from prior readings include:

- An interesting “photograph” metaphor - the idea (taken from Fletcher, Situation Ethics, apparently) that “the morality of an act is a function of the state of the system at the time it is performed,” i.e. that judgment of harms inflicted by a person cannot be judged without knowing the situational context - i.e. cannot pass judgment of harm based on a photo (real or metaphorical, seen without the full context). This resonates as it seems to parallel ideas of judging based on different cultural value systems.
- Conscience as a self-eliminating state - the idea that those who voluntarily curtail breeding due to conscience will guarantee that such conscience is bred out of the gene pool in time.
- Reliance on conscience (and moral opprobrium) as a means of enforcing beneficial norms is doomed to failure as it communicates an intended message (you will be punished by society for non-compliance) as well as an unintended one (you will be seen as a fool and taken advantage of if you do comply). Which leads to discussion of mutual, compulsory coercive measures (laws and taxes) as the appropriate response.
- New enclosures of the commons are challenging as they infringe upon someone’s existing property rights, and thus create a stakeholder who loses out and thus opposes such changes. However, long-past enclosures are “baked in” to the system, as the people affected negatively by those changes are long since gone. This recalls ideas of land ownership: how can a person or entity claim legitimate ownership over land, as that land was almost certainly taken from someone in the distant past through violence or coercion. A current deed can only confer legitimacy to a particular point in time at which a victor claimed the spoils. Consider the Malheur bird refuge takeover in Oregon as an example of people making ridiculous claims to ownership.

In any case, these are secondary to the main idea for which this paper is usually cited (which is described quite clearly in Demsetz (1967) as well), which is that unregulated commons will be overexploited as each participant reaps the full rewards of non-cooperation while spreading the costs across all participants; and so each person will choose to not cooperate, thus driving the commons to an open access situation in which all rent is dissipated and the environment is depleted. Hardin offers little in the way of a solution other than curtailing of freedoms, essentially establishment of property rights.

Stepping back slightly, we can consider the “commons problem” in the broader sense of externalities - when costs or benefits of a particular transaction fall on those not involved in the transaction, due to the cost of bringing such costs and benefits into the transaction itself, resulting in inefficient provision of the good

(too little) or bad (too much). In the case of the Tragedy of the Commons, unrestricted access to a resource results in the actions of each person's exploitation affects the ability of others to exploit, imposing a negative production externality on all others. The issue of externalities is considered in all these papers from several directions.

In praising the "uncommon insight" of Elinor Ostrom, Bergstrom (2010) places Ostrom's work in relation to the two widely accepted schools of economic thought on dealing with the "commons problem": Pigouvian centralized approach, in which an authority regulates, taxes, or subsidizes a good such that incentives align with efficient provision, and property rights approaches such as those described by Coase (1960) and Demsetz (1967). Bergstrom places Ostrom in a third category, in which she studies examples of communities that have come up with novel institutions to manage the commons problem often through a combination of partially-private property rights and communal rights and responsibilities.

Coase's *The Problem of Social Cost* (1960) essentially describes the power of property rights in how the confer the ability to negotiate solutions favorable to each party potentially affected by the consequences of production of a good. In essence, he reframes a question of how should A, who inflicts harm on B, be regulated or restrained? - into a question of rights - should A be allowed to harm B or vice versa? In this reframing, he shows that government regulation (Pigou's favored solution) may not always be the best means (though he does not dismiss it entirely either) - but that in many cases, assigning private property rights to one side or the other in the A/B market allows the two parties to negotiate to an optimal outcome. He explores the ramifications of various assumptions and identifies minimization of transaction costs as a fundamental concern. He concludes with a few points:

- "If factors of production are thought of as rights, it becomes easier to understand that the right to do something which has a harmful effect (such as creation of smoke, noise, smells, etc) is also a factor of production..." and thus can be considered in optimization if carefully framed.
- "In choosing between social arrangements within the context of which individual decisions are made, we have to bear in mind that a change in the existing system which will lead to an improvement in some decisions may well lead to a worsening of others. Furthermore we have to take into account the costs involved in operating the various social arrangements as well as the costs involved in moving to a new system. In devising and choosing between social arrangements we should have regard for the total effect."

Demsetz (1967) defines a necessary condition to make a cost or benefit an externality: "the cost of a transaction in the rights between parties (internalization) must exceed the gains from internalization." He sees the ability to negotiate as fundamental to internalizing costs, and provides examples of slavery and military draft as instances where no negotiation is possible, thus large externalities occur. He posits that if negotiations are allowed and no transaction costs exist, the solution will be efficient and independent of who was originally assigned the property rights; I think of that as part of the Coase theorem but Demsetz states it more clearly.

Demsetz goes on to look at the emergence of property rights through this lens, claiming that new property rights emerge as a response to changes to the cost-benefit calculus of a transaction - for example, new markets appear, new technologies shift production costs, or preferences change. This seems very interesting as an avenue to explore in the development of property rights in small scale fisheries: was there a driving change that made a TURF (e.g.) more likely to successfully develop - changes in markets, technology, resource availability, or preferences over property rights? And if such changes occur within a system in which negotiation is not possible, what would be the outcome? He gives an example of emergence of property rights within American aboriginal groups as the fur trade developed. Increasing demand for furs ==> more money for furs ==> more hunting ==> more externalities ==> greater need to develop and enforce property rights.

Later in the piece, Demsetz discusses communal ownership and the tragedy of the commons (a year before Hardin, though he didn't give it a catchy name!). Communal property rights are more challenging due to much higher negotiating costs and organizing costs. Importantly, with no single broker to take into account competing claims of present and future, current claims will be weighted far more heavily creating intergenerational equity issues. Communal property also rules out both "pay to use" and "pay not to use" systems simultaneously.

He wraps up with discussions of how a publicly held firm, commonly owned among many shareholders, does not face the same problems as a typical commons - due largely to legal modifications including a concentrated effective control in management (rather than broad management rights), limited liability, and ability to easily exit if preferences no longer align. It seems as if a TURF style of commonly held activity is more active participation and management.

Shlager and Ostrom (1992) lay out a more detailed schema for understanding property rights to better understand how they play out in common pool resource management, importantly distinguishing between de jure and de facto property rights (including combinations such as a de jure government concession managed by de facto rights internally). Briefly: rules create the rights; operational-level rules (such as access and withdrawal) are changed by collective-choice actions, which certain levels of property rights confer. (Constitutional-choice actions establish the initial institution.) They distinguish collective-choice property rights (rather than operational-level rules) to comprise management, exclusion, and alienation rights. Four classes of property rights holders bear one or more of these four right classes (operational-level plus three collective-choice level): see Table 1 in the paper:

**TABLE 1**  
**BUNDLES OF RIGHTS ASSOCIATED WITH POSITIONS**

	Owner	Proprietor	Claimant	Authorized User
<b>Access and Withdrawal</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>Management</b>	<b>X</b>	<b>X</b>	<b>X</b>	
<b>Exclusion</b>	<b>X</b>	<b>X</b>		
<b>Alienation</b>	<b>X</b>			

Importantly, each class of right creates specific incentives: alienation rights (ability to sell one's stake) incentivizes long-term investment, since improvements can be recouped; exclusion incentivizes current investment, since benefits can be secured; management incentivizes (to a lesser degree) investment in governance structures. They then apply these concepts to understand the collective management of different Maine lobster fisheries and the implications.

Finally, a brief connection of these externality readings to Leibbrandt and Lynham's 2018 paper on whether initial allocation of property rights matters. The earlier readings focus a lot of attention on the importance of transaction costs and who liability, and give casual mention to the assumption that allocation of rights shouldn't matter to the final outcome. To examine this, L&L set up an experiment in which four players can extract a resource with a private gain and a negative externality that is collectively shared. In the first five rounds, players were allowed to take up to 25 tokens each from a pool of 100 tokens; the optimal extraction would be everyone taking 12.5 tokens. For the second five rounds, players were assigned property rights based on extraction in the first five rounds - one of three treatments: a) "grandfathering," i.e. proportional to extraction history, b) equal allocation, c) inverse grandfathering, i.e. those who extracted least in the past get the largest allocation. The results showed that compliance for equal and inverse grandfathering was significantly higher than compliance in the grandfathering scheme, challenging the notion that equity does not matter in allocation of property rights.

## Reflections on Congestion Externalities readings

Readings referenced in this reflection:

- Arnott, R., de Palma, A., & Lindsey, R. (1993). A Structural Model of Peak-Period Congestion: A Traffic Bottleneck with Elastic Demand. *The American Economic Review*, 83(1), 20.
- Arnott, R., & Small, K. (1994). The economics of traffic congestion. *American Scientist*, 82(5), 446–455.
- MacKie-Mason, J. K., & Varian, H. R. (1994). Some economics of the Internet. Presented at the Tenth Michigan Public Utility Conference, Western Michigan University.
- Vickrey, W. (1963). Pricing and resource allocation in transportation and public utilities. *American Economic Review*, 53(2), 452–465.
- Vickrey, W. S. (1969). Congestion Theory and Transport Investment. *The American Economic Review*, 59(2), 11.

Bonus reading:

- Varian, H. R. (2016). How to Build an Economic Model in Your Spare Time. *The American Economist*, 61(1), 10.
  - I found this on Hal Varian’s page - fun, interesting, and enlightening.

While I am not particularly interested in the economics of transportation, it’s pretty easy to see connections to the fields I am more interested in. Also, as a long-time resident of the SF Bay Area, many of the issues discussed in these readings could readily be applied to problems with the SF Bay transportation network.

Vickrey’s 1963 Pricing and Resource Allocation piece provides a very readable and clear conceptual description of the problem of congestion and the potential for tolls, rather than expansion of capacity, for finding more efficient solutions to congested transportation networks:

If, under conditions similar to the above, the levying of congestion charges is either an actuality or an alternative under consideration, benefits from the expansion of capacity are likely to be both smaller and less capricious in their behavior than if no pricing is contemplated.

While most of the math is made clear in the 1969 followup, I did find one more quote in this paper to be particularly interesting: “The delusion still persists that the primary role of pricing should always be that of financing the service rather than that of promoting economy in its use.” This resonates because if I recall correctly, the tolls over the various SF Bay bridges were originally (ostensibly) put into place to fund the bridges’ construction (and perhaps maintenance). And yet, the tolls still exist nearly 80 years later, and only increase! The messaging of CalTrans may need some work to educate the public that those tolls are no longer for paying for past construction, but to drive efficiencies in Bay Area traffic. (One more choice quote: “It has been said that if nothing stops the growth of populations but misery and starvation, then the population will grow until it is miserable and starves.”)

Vickrey’s 1969 paper follows up with the mathematical derivations of his congestion model. Conceptually, seeing the math laid out here and in class, it seems quite intuitive that while expanding a congested road may be an obvious solution, that expansion is entirely wasted for the non-congested times of day, and thus shifting incentives to balance the traffic more efficiently on the existing infrastructure through judicious application of tolls should be a first consideration. The paper presents the benefits of variable tolls as not only creating no excess burden, but no burden at all! However, at the time of this publication, variable tolls must have been challenging.

Sticking with the traffic context, technology today creates huge opportunities for reducing congestion through Vickrey-style tolls. It is now feasible to create tolls that readily vary minute-by-minute or mile-by-mile according to road condition - electronic signs to communicate tolls to drivers, as well as EZ Pass transmitters to collect those tolls per small portions of a route, give immense flexibility to manage congestion (I’ve seen these between Boston and New York, though not in the Bay Area yet) (this advent of technology is noted in the 1994 Arnott et al paper as well). However, it might be even more effective if such tolls could be observed before deciding on a route or even a transportation method to get to work in the first place - e.g. Waze or Google Maps.

Which brings us to Arnott et al (1994). The 1993 Arnott et al. paper builds on Vickrey's model but I found this one more conceptually intuitive and entertaining (and the photos of the models are quite adorable). Here the authors describe three paradoxes of traffic network design that highlight some very counterintuitive results about highway expansion: "The traffic we see does not represent the full demand for peak travel at the prevailing monetary cost" since congestion deters some commuters; and "Because drivers do not pay for the time loss they impose on others, they make socially inefficient choices" about travel, a la Tragedy of the Commons. First, the Pigou-Knight-Downs paradox, which says that expansion of capacity may not reduce congestion because it will actually increase demand to soak up that new capacity. Second, the Downs-Thompson paradox, which shows that in some cases increasing capacity actually *increases* travel time - when considering alternate public transportation systems such as a train. Third, the Braess paradox, which shows that adding a new link between routes in a congested system can potentially increase overall congestion.

These paradoxes might be seen in the Bay Area in a few ways. Downs-Thompson may show itself in the interplay between auto traffic and CalTrain/BART traffic: increasing capacity may draw commuters away from these alternate methods, resulting in shorter or fewer trains, increasing wait time. However, the alternate system can also be flexible in terms of adding more trains at sporadic peak times (e.g. Giants games) as long as effective communication gets this information to the commuters. Another more recent example may be interesting to study - the authors describe that a third route (such as subsidized vanpools) may draw commuters away from the public transportation already in place. The advent of Google and Apple buses from SF and Oakland to Mountain View/Cupertino has raised the ire of people decrying gentrification, but these also steal people away from more plebian public transportation, either decreasing the quality/quantity of BART/CalTrain service or forcing those services to increase prices to make up for reduced revenue.

Braess' paradox seems particularly relevant to the Bay, with its parallel north-south highways connected by a limited number of (potentially congested) bridges that occasionally close for maintenance, construction, or occasionally earthquakes. I wonder if Braess' Paradox was observable in a few key cases? On days when the Bay Bridge was closed (e.g. certain weekends during the construction of the new east span, or during the long closure after the 1989 Loma Prieta quake), I wonder if by removing a congested causeway, it may create a sort of reverse Braess situation (or conversely, after reopening, a regular Braess situation). However, during the construction of the new eastern span of the Bay Bridge, periodic closures were announced well ahead of time - if any of these bled over into work weeks, perhaps commuters took extra effort to avoid commuting at all, opting for telecommuting or public transportation.

Finally, the Economics of the Internet paper by MacKie-Mason and Varian (1994) was interesting first off as a primer in how the internet functions (though I imagine things have changed in the past 25 years), but also in light of both the Net Neutrality debate and the way cable broadband ISPs have essentially been granted monopolies. ISPs already charge differentially based on general top upload/download speeds, but if they were to charge consumers or producers based on type of content or a congestion tax, this seems to violate the basic idea of net neutrality - so does adherence to principles of net neutrality necessarily result in an inefficient provision of the internet?

Tying all these concepts to something more applicable to my own interests, it seems like congestion externalities could be an important consideration when modeling such things as sense of place. This is mentioned in several of the above papers, with Arnott et al (1993) providing some concrete examples. Outdoor recreational activities are often valued for a sense of remoteness and separation from the crowd. A crowded beach or hiking path or patch of coral reef detracts from the experience of nature. When considering whether a community dependent on small-scale fisheries should consider tourism as an alternate source of income, those tourists may reduce that sense of place valued by the residents, and depending on the size and seasonality of the attributes of the community, are likely to adversely affect the experiences of the tourists themselves. It seems that seasonal pricing of hotels and similar amenities to capture value of increased demand, also creates a signal that reduces that demand - this is basic market economics. But if congestion were a problem of concern to the community, then perhaps an additional tax on hotel rates could serve a similar purpose as the road tolls to establish a more efficient solution.

## Reflections on Public Goods with Exclusion readings

Readings referenced in this reflection:

- Bergstrom, C. T., & Bergstrom, T. C. (2004). The costs and benefits of library site licenses to academic journals. *Proceedings of the National Academy of Sciences*, 101(3), 897–902. <https://doi.org/10.1073/pnas.0305628101>
- Bergstrom, T. C. (2001). Free Labor for Costly Journals? *Journal of Economic Perspectives*, 15(4), 183–198. <https://doi.org/10.1257/jep.15.4.183>
- Minasian, J. R. (1964). Television Pricing and the Theory of Public Goods. *The Journal of Law and Economics*, 7, 71–80. <https://doi.org/10.1086/466600>
- Oakland, W. H. (1974). Public Goods, Perfect Competition, and Underproduction. *Journal of Political Economy*, 82(5), 927–939. <https://doi.org/10.1086/260247>
- Samuelson, P. A. (1964). Public Goods and Subscription TV: Correction of the Record. *The Journal of Law and Economics*, 7, 81–83. <https://doi.org/10.1086/466601>

This unit was definitely the most challenging for me conceptually - both in the math and applying it to environmental contexts. In the Oakland (1974) reading (as well as Minasian's seeming straw man challenge of Samuelson and his rejoinder) the key seems to be the zero marginal cost of additional units of production or supply (e.g. from Demsetz 1970 once you've recorded your TV programming at constant cost of production  $c$  and set up a broadcasting system, transmission costs are zero and exclusion methods such as a scrambled signal/unscrambler device are costless). But then once a good has been produced, additional consumers are inclined to understate their preferences to achieve lower prices (since marginal costs are known to be zero), until no one wants to pay anything at all.

Oakland proceeds by assuming that the producer can determine some fixed price at which consumers can purchase full access to the good. This circumvents the ability of consumers to low-ball their bid, and thus circumvents the problem of a Prisoner's Dilemma style race to the bottom. As long as enough consumers value the good enough to pay the fixed price, the good will be produced. He also notes that different collective goods consumed at different intensity levels will necessarily be priced differently (assuming constant production cost  $c$  and based on price  $P = c/n$  for  $n$  consumers).

He notes that for a price greater than  $P = c/N < c/n$ , the producer could reduce the price to attract more consumers, but would then reduce revenue from existing consumers exactly equalling the increase in revenue from new consumers, so there is no incentive to do so; thus this is a stable equilibrium.

Minasian hints at a connection to the prior unit - in that the frequencies used to broadcast TV (and radio and cell and whatnot) have an opportunity cost. While the actual broadcasting to additional consumers may have no marginal cost, the provision of additional broadcasters might actually cause a congestion externality as when two radio stations with similar frequencies may interfere with each others' signals.

I wonder if this general concept of "excludable" public goods can be related to the concept of "access" - since what you're really paying for is a key of sorts to unlock your ability to consume the public good. This may just be restating the idea of a club good - while a nice state beach (at low visitor levels, prior to onset of congestion problems) is technically open to anyone from the public, it can also be made somewhat excludable by putting a ranger booth at the entrance requiring a constant price for access to the beach. Or more interestingly, you may have de jure property rights to benefit from some resource (such as harvesting some marine resource in a low impact manner) but conditions are such that, de facto, you cannot actually access the resource - e.g. it is prohibitively costly to get to the location.

The applications to academic journals in the various Bergstrom papers seems interesting - particularly since I hope to stick to an all-open-source-all-the-time philosophy in my work, which puts me into the "author pays" camp. But even more relevant is the recent decision by UC to not renew subscriptions with Elsevier - that could impose a big barrier on researchers. However, it seems, just as with Napster and free access to digital music, that there are a number of ways around Elsevier's pay wall particularly for articles that have been around a while - the internet seems to be littered with pdf versions of articles (as on Ted's Econ 230 website!).



## Reflections on Public Choice Theory readings

Readings referenced in this reflection:

- Bergstrom, T. (1979). When Does Majority Rule Supply Public Goods Efficiently?, 12.
- Bowen, H. R. (1943). The Interpretation of Voting in the Allocation of Economic Resources. *The Quarterly Journal of Economics*, 58(1), 27. <https://doi.org/10.2307/1885754>
- Young, H. P. (1988). Condorcet's Theory of Voting. *The American Political Science Review*, 82(4), 1231. <https://doi.org/10.2307/1961757>

I think the initial quote from the Condorcet reading (Young 1988) is a great way to begin this reflection: "A central problem in democratic theory is to justify the principle of majority rule." Perhaps it's just because we are so used to majority rule voting as a norm for making social decisions that it seems jarring to consider a need to justify it.

Previous readings sometimes referred to a "correct" or "ideal" distribution of private goods or costs with respect to some ideal provision of public good; here the author brings together ideas from Rousseau and Condorcet to provide a little bit more definition to that idea. Rousseau stated that voters provide their opinion (in vote form) to determine, for a given proposition, "whether it is in conformity with the general will." Condorcet made the argument that enlightened voters will attempt to make the decision that best serves society, and if they are right more often than they are wrong, then the majority vote will be more often the "correct" decision. But things get more complicated and less intuitive as more than two options are offered, including cycles of outcomes depending on how different people rank the multiple options.

I found it interesting to see the probabilistic treatment of how Condorcet's voting system works to identify choices that most closely match the general will. More importantly it seems like this kind of system is forming the foundation for better voting systems that allow for more diverse candidate choices while avoiding the whole third party candidate "spoiler" problem. Ranked-choice voting in San Francisco's mayoral race and Maine's statewide elections seem to be popular and effective at providing representation that is in general accordance with the populace. From this New York Times editorial (June 2018): "When voters can express their political preferences more fully, the politicians they elect will be more likely to represent them more fully."

The Bowen (1943) paper was quite easy to follow, starting with a very simplified model and then relaxing particular assumptions (e.g. equal distribution of costs/taxes, equal access to the benefits of the public good, constant or decreasing marginal cost of the public good) one at a time to examine the implications. A few key points I found interesting:

- Quantities of public goods often cannot be measured in simple physical units (e.g. education) - two methods to deal with this.
  - treat separately each element of a complex public good (e.g. school buildings, teachers, etc)
  - measure quantity in terms of money cost - this involves two aspects: 1) determine priorities among different aspects of public good, 2) determine total allocation for overall increase or decrease
- conditions required for reliability of a sample poll (instead of population voting)
  - informed voters
  - sense of responsibility and agency

Another point Bowen makes is that we should separate redistributive taxes from taxes used to fund public goods. This echoes (or presages, I guess) ideas in Samuelson (1958) and elsewhere in our readings - while taxes can be valuable both for raising revenue for public goods and for evening out perceived inequities in distribution, it is perhaps more transparent to consider these functions through separate votes.

One ramification of Bowen's argument seems to be (I need to look into this further to check my logic) that, if the optimal public good provision is based on preferences of a median voter, then for a single up/down vote on a proposal (e.g. a school funding bond), any vote result that deviates significantly from 50% is non-optimal. So a million-dollar school bond that wins 60/40 should probably have been proposed for some amount more than a million dollars, up to the point where it would win 51/49 (ish). Though of course, without the vote,

it is difficult to predict the margin, and the new proposal could actually end up failing with a 49/51 vote instead.

I think the key to Ted's paper (Bergstrom, 1979) is:

A Lindahl equilibrium, though Pareto efficient, requires unobtainable information to be implemented. A Bowen equilibrium, while practically implementable, is in general not Pareto efficient.

So how can we find an efficient equilibrium using a practical method that does not rely on unobservable information? Ted introduces the idea of pseudo-Lindahl equilibrium, identifying conditions under which a Bowen equilibrium can be Pareto optimal and a Lindahl equilibrium matches a Bowen outcome:

If preferences are all log linear and appropriately symmetric, then a Bowen equilibrium with proportional wealth taxation is Pareto optimal. It is also true that if all individual preferences were identical and representable by the "average" utility function  $U(X_i, Y) = \ln X_i + a \ln Y$ , then the Lindahl tax would be a proportional wealth tax and the Lindahl quantity of public goods would be the same as the Bowen quantity  $Y^*$  found in the previous section. This suggests more generally we could compute Lindahl equilibrium for a hypothetical community in which preferences are "averaged", ignoring individual eccentricities of tastes that are not easily observable. Under certain circumstances, the Lindahl equilibria are Pareto efficient for the actual community and may also be Bowen equilibria.

By bringing together these concepts, we can under certain conditions use observable information (e.g. via voting or sampling to identify the median preferences within each subgroup type) to approximate a Pareto efficient allocation of public goods and the taxes to pay for them.

## Reflections on Preference Revelation readings

Readings referenced in this reflection:

- Chen, Y., & Plott, C. R. (1996). The Groves-Ledyard mechanism: An experimental study of institutional design. *Journal of Public Economics*, 59(3), 335–364. [https://doi.org/10.1016/0047-2727\(95\)01506-X](https://doi.org/10.1016/0047-2727(95)01506-X)
- Groves, T., & Ledyard, J. (1977). Optimal Allocation of Public Goods: A Solution to the “Free Rider” Problem. *Econometrica*, 45(4), 783. <https://doi.org/10.2307/1912672>
- Ledyard, J. (2009). Voting and Efficient Public Good Mechanisms. (D. A. Wittman & B. R. Weingast, Eds.) (Vol. 1). Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780199548477.003.0027>
- Polasky, S., Lewis, D. J., Plantinga, A. J., & Nelson, E. (2014). Implementing the optimal provision of ecosystem services. *Proceedings of the National Academy of Sciences*, 111(17), 6248–6253. <https://doi.org/10.1073/pnas.1404484111>

Here the main idea is to investigate potential mechanisms that can elicit preferences about public goods while avoiding the pitfalls of free-riding and situations where the dominant strategy is to be untruthful in reporting preference. In Groves and Ledyard (1977), the authors first posit two types of governments trying to determine an efficient level of public goods based on the preferences of all the citizens. In a “naive government” situation, the government treats public goods as if they were private - each consumer is asked about how much he or she wishes to provide (and will be responsible for paying), and then provides the aggregate amount, which is enjoyed by all equally. However, this obviously results in free riders who claim to want no public good (and thus don’t pay) but will enjoy the public good paid for by all others. This results in an inefficient public good provision (and at the limit, no public good provision). In a Lindahl government, consumers report their marginal willingness to pay for the public good (as opposed to their total desired amount), and a Lindahl equilibrium is found at which each consumer pays a tax related to the total good at their reported marginal rate. This government depends critically on truthful reporting to reach that Pareto-efficient level of public goods provision, but this mechanism too suffers from the incentive to under-report willingness to pay - resulting again in an inefficient underprovision.

In both these cases, the consumer’s tax is related to their message about their desired level of public good. The Groves-Ledyard (GL) mechanism cleverly decouples the consumer’s message from the tax they are then required to pay - instead their tax is based on reported demand from all other consumers, excluding their own message. Thus, over- or under-reporting do not benefit them, but rather distort the overall provision, so their dominant strategy is to report an accurate message.

GL is crafted to be Pareto optimal as well - the formula for each consumer’s tax includes a term that in aggregate balances out any excess of tax collected; the resulting balanced budget is a necessary condition for Pareto optimality (e.g. if excess funds collected, then someone could be made better off by giving them those funds; if insufficient funds collected, too little public good is created).

GL is proposed as an “Optimal” government with these conditions (among others):

- $y(m) \equiv \sum_i m^i$
- $C^i(m, s) = a^i q \cdot \sum_h m^h + \frac{\gamma}{2} \left[ \frac{I-1}{I} [m^i - \mu m^{\sim i}]^2 - \sigma (m^{\sim i})^2 \right]$
- (see eqns 4.3 and 4.4 for details)

The Groves and Ledyard (1977) paper concludes with some commentary on literature - particularly on differentiating their mechanism from the Vickery Clarke Groves (VCG) mechanism. One of the main points they make is that the VCG mechanism does not generally result in a balanced budget, so therefore cannot be Pareto efficient. The GL mechanism results in a balanced budget (and Pareto optimality) for a general equilibrium model in which income effects can be accounted for.

The Chen and Plott (1996) paper takes the GL mechanism, which is essentially a theoretical construct (“Now the example produced by Groves and Ledyard is definitely a paper process. It exists only on the pages of a journal. . .”), and creates an experimental framework in which they can test the ability of the mechanism to determine optimal outcomes; in particular they focus on the penalty term  $\gamma$ , looking at cases where  $\gamma = 1$  and  $\gamma = 100$ . It seems unsurprising that the higher the penalty term, the more frequently the mechanism chooses the efficient and optimal level of public goods - the higher penalty pushes people toward being more

truthful in their messaging. Interesting, however, is later in the paper when they discuss the limits of this punishment parameter. If 100 is better than 1, is 1000 better than 100? etc. With a little mathemagic, they show that as  $\gamma \rightarrow \infty$ , the performance of the model declines. So somewhere there is potentially a “best” punishment parameter (though likely varies widely based on context and setup).

Ledyard’s chapter on Voting and Efficient Public Good Mechanisms (Ledyard, 2009) provides a great overview of the issues of creating efficient and incentive compatible mechanisms for determining distributions of public and private goods. He frames it around a general problem, framed in parallel to markets and private goods: markets are the preferred option for many types of goods, because theory and practice show that “markets work” - but for public goods, we typically rely on voting processes, though the theory and practice is less clear. So: Ledyard sets out “to look for conditions under which we can say ‘voting works.’”

Ledyard focuses on two factors that determine if a thing (market, voting process, etc) “works” - efficiency “in the sense that it select[s] allocations that are Pareto optimal”, and incentive compatibility “in the sense that individuals will be willing to follow the prescribed behavior.” He then acknowledges that, based on Hurwitz and Walker (1990), there is no such thing as a mechanism that is simultaneously both efficient and incentive compatible. Therefore his criteria for whether a mechanism “works” is whether it “approximately efficient and approximately incentive compatible in large economies”, which is true of markets.

To narrow the scope his investigation, he focuses on two commonly used processes, majority rule and demand revelation. Majority rule is incentive compatible but does not produce Pareto optimal allocations - because the median voter (who determines the allocation) holds the median “ideal point” (preferred allocation), whereas output efficiency must be based on the mean ideal point. As a demand-revealing mechanism, Ledyard focuses on VCG mechanism - which he shows is incentive compatible and output efficient, but (generally) not resource efficient. While both mechanisms are “good” though not perfect, he then goes to show that neither mechanism is universally better than the other - depending on the situation and the size of the economy.

Two important caveats crop up in Ledyard’s (2009) chapter: first, that in increasingly larger economies, the “incentive” for truthfulness approaches zero, so “my report has virtually no effect on my utility” - therefore, incentive compatibility can basically include any behavior (i.e. reported message). Second, allocation of multiple public goods poses a more challenging problem, as does a situation in which the “tax functions” are under consideration - a unique median voter will be difficult to determine since multiple preferences are on the line.

Ledyard concludes that “in large economies, if we dispense with the individual rationality constraint, ‘Voting Works.’”

Particularly relevant to my area of interest is the Polasky et al. (2014) paper in which the authors apply a Vickery-Clarke-Groves style of auction to the problem of figuring out a spatially explicit conservation management problem. “Because the opportunity cost of conservation will almost always depend on landowner characteristics that are privately known, such as landowner skills and preferences, asymmetric information is an important feature of most voluntary conservation programs.” The auction mechanism incentivizes landowners to submit accurate information about their value of their own land; the landowner’s bid determines whether her plot will be included in a purchase, but not the price - which is determined by the calculation of the ecosystem services provided by the plot (independent of the bid). Thus, the bid is effectively decoupled from the payout.

The authors show that such a mechanism can work equally well for both a PES scheme and a development tax scheme. However, the tax scheme does not require the regulator to pay out a large sum of money but rather uses the tax to disincentivize development on plots with large ecosystem service values, avoiding the budget constraint problem. However, this depends on the regulator having the property rights to allow them to impose such a tax. . . I will need to dig into this model a bit further and examine the referenced papers on VCG methods applied to environmental public goods:

15. Kwerel E (1977) To tell the truth: Imperfect information and optimal pollution control. *Rev Econ Stud* 44(3):595–601.
16. Dasgupta P, Hammond P, Maskin E (1980) On imperfect information and optimal pollution control. *Rev Econ Stud* 47(5):857–860.

17. Montero JP (2008) A simple auction mechanism for the optimal allocation of the commons. *Am Econ Rev* 98(1):496–518.

## Reflections on Anticommons and Holdouts readings

Readings referenced in this reflection:

- Buchanan, J. M., & Yoon, Y. J. (2000). Symmetric Tragedies: Commons and Anticommons. *The Journal of Law and Economics*, XLIII, 13.
- Heller, M. A. (1998). The Tragedy of the Anticommons: Property in the Transition from Marx to Markets. *Harvard Law Review*, 111(3), 621. <https://doi.org/10.2307/1342203>
- Kominers, S. D., & Weyl, E. G. (2011). Concordance Among Holdouts. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.1591466>
- Polasky, S., Lewis, D. J., Plantinga, A. J., & Nelson, E. (2014). Implementing the optimal provision of ecosystem services. *Proceedings of the National Academy of Sciences*, 111(17), 6248–6253. <https://doi.org/10.1073/pnas.1404484111>

I started with the Buchanan and Yoon (2000) paper, since it was a little less hefty than Heller’s (1998) tome. This concept of “anticommons” is an interesting callback to the property rights papers from earlier in the course, and their summary is conceptually pretty straightforward - mirroring the more familiar Tragedy of the Commons (TotC). TotC arises basically because of too little exclusion (or too much access) - the absence of well-defined *and well-enforced* property rights to exclude those who would otherwise exploit without considering the impacts of their exploitation on the overall public good. TotC results in overuse or overextraction, beyond the socially optimal amount, and dissipates rents to zero as profits and costs converge.

Tragedy of the Anticommons (TotA), conversely, occurs when there are too many people with rights to exclude - and access requires obtaining permission from multiple potential excluders. The Danube River example discussed in class, as well as the parking lot example discussed here and in class, help make the problem reasonably concrete. And the correlation to the TotC is a nice mirror image:

The basic logic is equivalent in the two cases. The inefficiency arises because the separate decision makers, each of whom acts in exercise of assigned rights, impose external diseconomies on others who hold similar rights. In the commons or usage side of the model, persons (or firms) may, by adding a unit of input to the common resource, reduce the productivity of all other inputs and the rents of each person. In the anticommons or exclusion side of the model, persons (or firms) may, by reducing inputs to the common facility (via price), reduce the rents available to others who also exercise potential exclusion rights.

The “Geometric-Algebraic Illustration” in Buchanan and Yoon (2000) is quite clear to follow (and as we walked through it in class).

The Applications section describes some instances in which this kind of behavior might be observed. The authors note that Heller (1998) looks at empty buildings in Moscow that are due to the need for any potential user to secure permission from multiple agents each of whom can singlehandedly bar the use. To jump over to Heller (1998) briefly, even if corruption and confusion were eliminated, such a system can emerge:

Instead, those regimes have ratified the expectations of powerful socialist-era stakeholders by making them rights-holders in the new economy. Rights were made alienable in the hope that new owners would trade them to more productive users. In a typical Moscow storefront, one owner may be endowed initially with the right to sell, another to receive sale revenue, and still others to lease, receive lease revenue, occupy, and determine use. Each owner can block the others from using the space as a storefront. No one can set up shop without collecting the consent of all of the other owners.

I think the idea of corruption is an interesting one to follow up, but even disregarding that, Buchanan and Yoon (2000) highlight several other examples - a developer of a new technology prevented from taking advantage of this technology due to a thicket of patents on basic research findings, all of which must be observed; development projects inhibited by the necessity of receiving acquiescence from multiple agencies with overlapping rights to exclude; and similarly with residential housing construction requiring permits from multiple agencies.

Finally, the authors point out that users and rights-holders may not necessarily be driven by financial incentives, though it is a convenient way to consider the problem. They provide two examples that seem particularly interesting: rights assigned to agents who cannot or may not desire pecuniary gains, such as environmental agents whose responsibility lies in a mandate to protect the environment and who may deny permission on those grounds; and the “genuine zealot” whose desire to exclude (or use, in a TotC case) may not be convinced by any amount of compensation to allow the use (or exclusion) of a resource.

This leads into the “holdout problem” in which a single property-right holder can put a kibosh on some proposed project either by demanding an unreasonably high compensation or refusing any compensation entirely. Depending on the situation, the government may invoke Eminent Domain to force a sale by an unwilling rights-holder. In class we spoke about this with respect to the CA High Speed Rail project; I imagine the Dakota Access Pipeline project is similar.

It seems like this problem could crop up in other cases such as a trial by jury in which unanimity is required; a single juror can throw things off and result in a mistrial. In politics, the Senate Hold rule allows a single senator to prevent a bill from reaching the floor for a vote; and even when votes occur, if a vote will be close, the median senator or representative holds extraordinary power to sway the outcome - and the same could be said of a swing voter on the Supreme Court.

Kominers and Weil (2011) discuss holdout problems and propose a potential solution that seems to echo VCG auctions and includes a pivotal mechanism. present the problem with respect to Cournot’s “collaboration problem” in which Cournot suggested that when many firms hold monopolies over the bits and pieces that go into a composite good, each firm’s choices to limit production to drive up prices affects all other firms, eventually leading to inefficient overall production. The authors connect this to free riding described in Samuelson (1954) and Hardin’s (1968) Tragedy of the Commons. They propose a “Concordance Principle” consisting of these elements:

1. Sellers are asked to report their values truthfully and buyers are asked to make the monopsonist-optimal offer to the aggregate seller.
2. The buyer’s offer is accepted when it exceeds the total reported reserve.
3. Each seller has the option to exert no influence in which case the share- scaled-up reserve of all other sellers determines whether a sale occurs. If no seller exerts influence the sale proceeds.
4. Sellers exerting no influence, and lone sellers exerting influence, receive at least their share of the offer if a sale occurs and never pay anything.
5. In order to encourage truthful reporting, sellers exerting influence may be required to pay a Pigouvian tax.

I did not go very far into this paper but the authors use their framework to look at holdout problems in land use; this would be interesting to revisit. They also refine their basic idea into a few special cases which may again be interesting to revisit when I am looking at specific land-use problems.

Finally, revisiting Polasky et al (2014), the holdout problem is very relevant to the idea of identifying and assembling an optimal collection of land parcels for protection of ecosystem services. In that case, the holdout problem is less pronounced; assuming that all parcels hold some ecosystem service value, and that most parcels can be bought for some price, any specific landowner who tries to hold out can be circumvented easily by simply purchasing a similar plot from another, more pliable, landowner.

This whole holdout problem seems potentially relevant to the idea of Sense of Place (SoP). If SoP manifests as a landowner placing a particularly high value on a parcel they own, then they can easily become a holdout. If SoP manifests as a highly motivated opposition group, e.g. an environmental group opposed to a particular development, they may not have direct property rights but may be able to push for more stringent environmental impact assessments or file lawsuits that effectively create an exclusion that must be cleared before development can go through.

I wonder if this holdout concept, and potential solutions, can be applied to the idea of Rigs to Reefs: in which oil companies bear a responsibility for removing the SB Channel oil rigs, but the potential to leave them largely in place to enhance biodiversity (and extract an environmental fund concession from the oil companies) could be beneficial for both the environment and the companies. Apparently such a deal was

negotiated in the recent past. However, a vocal opposition group apparently scuttled the whole plan with demands that the companies adhere to the original contract requiring full removal. (Perhaps another similar circumstance has been playing out with Mauna Kea observatories and challenges of negotiations with different generations of native Hawaiians there?)



## Reflections on Cost-Benefit Analysis readings

Readings referenced in this reflection:

- Bergstrom, T. C. (2006). Benefit-Cost in a Benevolent Society. *American Economic Review*, 96(1), 339–351. <https://doi.org/10.1257/000282806776157623>
- Ressurreição, A., Zarzycki, T., Kaiser, M., Edwards-Jones, G., Ponce Dentinho, T., Santos, R., & Gibbons, J. (2012). Towards an ecosystem approach for understanding public values concerning marine biodiversity loss. *Marine Ecology Progress Series*, 467, 15–28. <https://doi.org/10.3354/meps09967>
- Ressurreição, Adriana, Gibbons, J., Kaiser, M., Dentinho, T. P., Zarzycki, T., Bentley, C., ... Edwards-Jones, G. (2012). Different cultures, different values: The role of cultural variation in public's WTP for marine species conservation. *Biological Conservation*, 145(1), 148–159. <https://doi.org/10.1016/j.biocon.2011.10.026>

Ted's 2006 paper, "Benefit-Cost in a Benevolent Society," begins with the dilemma he presented in class - Alice and Bob, wanting to rent an apartment, and each has some regard for the utility of the other - Alice wants Bob to have his den, while Bob wants Alice to have her study. However, as presented in class (and counter to my intuition), when examining the costs and benefits associated with the renting of a bigger apartment, the analysis should include only the *private* benefits to both Bob and Anne. The idea is that, if in calculating the total benefit and including each person's regard for the welfare of others, we would essentially be double counting (as noted in the North Carolina example).

In the paper (as in class) we considered a utility function for person  $i$  that accounted for the utilities of all others:

$$U_i(x, y) = U_i(v_1(x_1, y), v_2(x_2, y), \dots, v_n(x_n, y))$$

The terminology is fun: this kind of utility function is called "nonmalevolent" or "non-paternalistic." If  $U_i$  is constant for all  $j \neq i$ , then  $i$  is selfish; if both nonmalevolent and not selfish, then  $i$  is benevolent.

Again as seen in class, Figures 2 and 3 sketch out possible utility frontiers. Beyond this Ted presents a Private Values benefit-cost test: "A change in the amount of public goods from  $y$  to  $y'$  passes the private values benefit-cost test if the sum of all consumers' private values for this change exceeds the cost of this change,  $C(y') - C(y)$ ." Passing this tests indicates potential for private Pareto improvement (sufficient). Furthermore, Theorem 2 states: "In an economy where Assumptions A.1-A.4 are satisfied and where the initial allocation  $(x, y)$  is distributionally efficient: 1. if public good  $j$  fails the private values Samuelson test [equation 6, definition 10 in the text], then no increase in the amount of public good  $j$  can be potentially Pareto improving. 2. If public good  $j$  passes the private values Samuelson test, then no decrease in the amount of public good  $j$  can be potentially Pareto improving."

Perhaps the most important insight is how this idea of including only private goods in the cost-benefit analysis essentially is a problem of framing the question:

- Incorrect: "How much would you be willing to pay to have the larger apartment?"
- Correct: "If the cost of moving to the new apartment is split equally between you, what is the most that you yourself would be willing to pay for the larger apartment?" - or -
- Correct: "How much would you be willing to pay for the benefits that you yourself realize from the larger apartment, ignoring any benefits to the other person?"

Based on this I need to go back to the Ressurreição (2012a, b) papers, which used contingent valuation to calculate how much value is embedded in maintaining biodiversity, and see how they framed their questions. I was not satisfied with their framing of biodiversity loss in the first place, but potentially the large values they reported may also have been based on the error highlighted in Bergstrom (2006). Two references in Ted's paper relate to this as well, and I need to follow up with these:

- Coursey, D. L. (1997). Revealed demand for a public good: Evidence from endangered and threatened species, the. *NYU Envtl. LJ*, 6, 411.
- Loomis, J. B., & White, D. S. (1996). Economic benefits of rare and endangered species: summary and meta-analysis. *Ecological Economics*, 18(3), 197-206.

Finally, not so much a reflection as a challenge to myself to apply the ideas from this class to earlier courses and topics: Thinking back to the cost-benefit analysis course I took during my Master's program, taught by Gary Libecap - in that course, we used the OECD text on cost benefit analysis:

- Pearce, D. W., Atkinson, G., & Mourato, S. (2006). Cost-benefit analysis and the environment: recent developments. Paris: Organisation for Economic Co-operation and Development.

The course was generally oriented around performing cost-benefit analysis by calculating net present values of various proposals, though we spent quite a bit of time as well on the benefits and drawbacks of valuation methods such as contingent valuation and hedonic valuation. While we didn't cover it in class, I read through the chapter on equity (chapter 15) and found some interesting information about using different weights on costs and benefits to different groups. While those weights are a normative question, it would be interesting to go back and reread that chapter (as well as a number of others: chapter 12, value of ecosystem services; chapter 16, sustainability; and chapter 19, political economy) with an eye toward the concepts we've learned in this class.