Property Rights and Common Property Resources

1. This course is about market failures and the design of mechanisms and institutions to deal with these failures. The primary institution we deal with is the government, but there are many other arrangements. As many market failures can be traced to inefficient property right structures we begin with this issue.

2. An efficient property right structure has three main characteristics.
(a) Exclusivity — all benefits and costs of an economic action should accrue only to the owner, either directly or indirectly by sale to others.
(b) Transferability — All property rights should be transferable from one owner to another in a voluntary exchange.
(c) Enforceability — Property rights should be secure from involuntary seizure or encroachment by others.

A "minimal" state (see Robert Nozick, Anarchy State and Utopia) is limited to the narrow functions of protection against force, theft, fraud, enforcement of contracts, and so on. A dominant agency supplying protective services will emerge from a state of Anarchy (the initial position) in which these is limited recognition of the rights of others. All citizens gain from the move to peaceful co-existence. The government (the agency) has to impose coercive taxation to furnace its operations. If it relies on voluntary contributions some individuals will not contribute their fair share — they will free ride.

3. A unified approach to the protection of entitlements has been developed by G. Calabreeze and A.D. Melamed (Harvard Law Review, 1972). They point out that the fundamental thing that the law (the state) decides is the entitlement — which of the conflicting parties is to prevail? The entitlement to make noise versus the entitlement to have silence — the entitlement to pollute versus the entitlement to breath clear air, and so on. The entitlement is then protected by either a property rule i.e. if someone is to remove the entitlement from the holder — the buyer must pay a price agreed upon by the seller. Here the state does not try to decide its value. Property rules involve a collective decision who is given the initial entitlement but not its value.

In contrast an entitlement is protected by a liability rule when someone may destroy the initial entitlement if she/he is willing to pay an objectively determined value. Here the state determines the entitlement and the compensation.

An entitlement is inalienable to the extent that its transfer is not permitted between a buyer and seller. The state determines the compensation if the entitlement is taken or destroyed but it also forbids its sale under all or some circumstances. These rules limit or regulate the grant of the entitlement.

The right to vote is a non-transferable entitlement. Votes are not transferable; buying and selling of them is illegal, and the secret ballot makes such contracts unenforceable. Similarly, in some nations, military duty is a duty rather than a right. But the duty is not transferable — you cannot

buy your way out as you could during the American Civil War and as you can in countries that have volunteer armies.

Some reasons why an entitlement is protected by a liability rule are (1) the impossibility of prior negotiations between a "buyer" or "seller" – or injurer and victim as in the case of an auto accident. When I drive my car too fast I may not know who I will hit. (2) Situations in which there are either a large number of buyers or sellers and it is difficult for them to negotiate a mutually agreed upon price especially as some buyer and sellers may act strategically.

4. Pure Public Goods.

A pure public good (a Samuelson public good) has two characteristics (1) it is non-rival or congested. My benefits from the good depend only on the quantity supplied–not on the size of the consuming group–(2) Secondly it is not technologically feasible to ration or to restrict the use of this good. It is available in equal amounts to everyone. Note: This does not mean that everyone places the same value, total or marginal, on the good. Only that it is non-excludable. National defense is one of the few pure public goods. It is non-rival and non-excludable. Another classic example is lighthouses. An example of local pure public good is mosquito control – if a truck or an airplane sprays a given area — individual houses in the middle of the neighborhood cannot be excluded from the benefits. Also within a given area the benefits are non-rival. It is also apparent that air pollution within a given air shed is a pure public bad. Suppose the pollution is caused by automobile exhaust and that we all contribute to the creation of pollution which is evenly spread over the affected area. The bad of a given amount is non-rival, and is non-excludable. As the initial situation is a bad–to produce a public good in this environment is to reduce the original level of pollution–to engage in pollution abatement.

The impossibility of rationing non-excludable public goods by a price system implies that the market will not produce an efficient level of the pure public good. As each individual cannot be excluded from benefiting from the good he/she has no incentive to pay for the services voluntarily. Similarly, if one cannot be excluded from the benefits of environmental improvement (pollution abatement) one has no incentive to make voluntary contributions. These are examples of the free-rider problem.

Pure public goods can be characterized as an externality. Consider a small two-person community that has a common enemy. If each individual independently provides some amount of national defense that provides benefits to the other person— there are "spill-ins" and "spill-out" of benefits–the condition of exclusivity underlying an efficient property right system will not be satisfied. Each person in deciding how much national defense to produce will not take into account the benefits of his/her additional provision to the other person and too little national defense will be produced unless the two individuals co-ordinated their actions.

The problem of non-exclusion is a justification for the collective provision of a good or service. By public provision we mean the financing of the good by compulsory taxation. No user charge is imposed under public provision of the non-excludable public good.

Some goods are non-rival (zero-marginal cost of adding people to the consuming group) but are excludable. Uncongested bridges and highways are non-rival but these services are excludable by tolls. If tolls are imposed the usage of the bridge is reduced and some trips, which exceed the

social cost, will not be undertaken. This is a social loss that is called a dead-weight loss. For this reason most highways and bridges in most countries are provided by governments and are financed by taxes — not user charges.

5. Externalities.

As we have seen, the private production of pure public good results in a positive externality for others in the community. An externality exists when the consumption or production choice of one person or firms enters the utility or production function of another person without that person's permission or compensation. One should not confuse this type of externality—at times referred to as a technological externality with pecuniary externalities which do not have efficiency implications.

Pecuniary externalities mediate through prices. For example if I eat more strawberries and drive up the price of this food—other consumers are worse off. But there is no social loss associated with this action as the producers of the berries gain what other consumers lose. A more transparent example of the same point is that if I show up at an auction and bid up the price of a picture to double the price you would have had to pay in my absence the seller of the picture gains what you lose.

For technological externalities co-ordination between the parties affected result in a net-social-benefit. For example if a factory dumps toxic wastes into a river causing damages equal to $100,000—, and an alternative, safe disposal method existing which costs only $10,000—there would be a clear social gain from internalizing the externality. One way of giving the firm the incentive to chose the socially efficient system of disposal is to make it liable for any external damages it may cause in dumping.

The existence of externalities clearly violates the condition of exclusivity required by an efficient system of property rights.

6. Common Property Resources. (CPR)

These resources or facilities are "owned" in common by the general public or by a subset of the population, a community. When any has access to, or use of the facility, free of charge we talk of free or open access. The fact that a CPR is not priced suggests it will be mismanaged as there is a missing market. There will be a tendency to over utilize the CPR from a social (or coordinated) standpoint.

A. Congested Free During Rush Hour.

This facility is a CPR in virtually all parts of the world congestion tolls are not imposed. A free access equilibrium (FA) will be one in which the average cost of a trip (inclusive of congestion) will be equal to the marginal social benefit of a trip (as measured by the demand curve). As the marginal user creates or adds incrementally to congestion the marginal social cost of the marginal trip exceeds the marginal benefit—and so the CPR is over utilized—there are too many trips during rush hour.

One way of improving upon the FA is for the government or agency to impose a congestion toll—to price the congestion or to create a market where one did not exist. The optimal congestion toll is one which equates the marginal social cost (indusive of incremental congestion to marginal social benefit (demand).

B. The Pasture.

The steer (cow) example for the case where the fertile pasture has a fixed capacity (100 units of grass). Here all pastures are not equivalent and the CPR if properly managed will generate for society a surplus or rent. This surplus can be used for the general benefit of the public. However, with FA the rents will be dissipated because of over utilization. It is as if the superior pasture is destroyed, or more precisely, reduced to the "common denominator" or opportunity cost.

The rents disappear because of the limited capacity of the CPR. As steers beyond the optimum number are added the limitation of feeding capacity will impose a cost on the animals already grazing on the pasture. The gains to the owner of the "newly arrived steer" will be more than offset by the losses to the owner of the "old" steer. Total rents fall as more steers are added until rents are fully dissipated and an equilibrium is established.

C. Fishing.

The Fish Stock is a CPR. In fishing the production function consists of fishing effort (boats, fishers, nets,) and the stock of fish. In explaining situations, Effort and Fish Stock are controls.

As the fish stock is a CPR and there is open access to this resource we expect that too much effort will flow into the industry. Rents will be dissipated.

Again the problem is that resources will enter as long as the average product of effort exceeds the opportunity cost of effort. When the average product of effort is equal to its opportunity cost the value of the gross marginal product of effort could be well below its opportunity cost—or could even be zero as it is for the cattle example.

The fact that the marginal product of effort in fishing is below its opportunity cost is an indication that resources are misallocated between fisheries and the alternative sector.

The Pasture example.

The pasture has 100 unites of grass per season. One cow eats 1 unit of grass per season and yields 1 unit of meat that is worth \$1.

The opportunity cost of a cow is \$0.5. What this means is that there is an alternative pasture that the cow could graze on. But the cow would be worth only \$0.5 after grazing on the alternative sector. If n, the number of cows <100 the benefit or profit of an individual who owns a herd ni is $\frac{ni}{2}$. When n the total number of cows is greater than 100 the individual profit is $100\frac{ni}{n}-\frac{ni}{2}$ and whether the individual adds to his/her herd is whether $100\frac{ni}{n}-\frac{ni}{n}\geq 100\frac{ni+1}{n+1}-\frac{n+1}{2}$ cows will be added to a level just under 200 cows. In contrast total profits are maximized for a total herd of 100. The surplus that could have been earned is dispatch. The key to the tragedy is that the herder bears only a fraction of the cost imposed by the whole group by the presence of their cows. In deciding whether to add one more cow the individual does not take into account the costs of his action imposed on others.

The problem of rent dissipation has been analyzed by a number of writers in discussing the common property resource nature of the fishery. Fishing areas are unpriced resources or inputs that are potentially accessible to anyone. These rents are profits attract entrants into the industry. In the limit the rents are dissipated and effort is paid it average product rather than is marginal product.

Henderson and Tugwell have developed and estimated the following model of a fishery

Biomass equation.

The growth and number of lobster in an area dependent on their environment. Some minimum population is needed for lobsters to exist due to predators, disease and ability to reproduce. A maximum to sustainable population exists due to the limits of a lobster area to provide sufficient food, as well as crowding conditions. Between maximum and minimum population growth a population maybe sustained at a variety of levels. The authors postulate a quadratic relationship between population and population growth or $\frac{dX}{dt} = AX - BX^2$ where $X$is the stock. They estimate biomass equations for two fishery areas in the Canadian Maritimes. Stock is estimated from catch and the percentage of lobster tagged at the beginning of the season that are caught. They assume that tagged and untagged lobsters are caught at the same rate.

$$dX + O_t = AX_t - BX_t^2 \qquad (1)$$

where x is the change in the stock excluding catch Q_t is catch and X_t is the stock at the beginning of the season.

The Production Function for Catch is estimated as a Cobb-Douglas

$$Q_{t=}\theta E_t^a X_t^b \qquad (2)$$

Where E_t is fishing effort measured in traps and X_t is the fish stock. In estimating this relationship the authors include variables for water temperature and number of days in the fishing season (the length is regulated by the government). For the optimal solution we assume that effort is paid the value of its social marginal product.

$$pe = a\theta E_t^{a-1} X_t^b \qquad (3)$$

This condition and equations 1 and 2 allow the and the steady assumption $dX = 0$ allows the calculation, E, X and Q in the steady state.

Similarly, the assumption that for the free entry equilibrium effort is paid the value of its average production allows the calculation of the same variables for this case. The main feature of the difference between the optimal and market solutions is characterized by a somewhat large catch for the free entry solution 167 and 108 percent for the two areas at the price of a tremendous increases in inputs of effort (347% and 225% respectively). The resource savings of moving to the optimum — the value of the reduction in effort net of the value of loss output — are tremendous, equal to 52% of the gross value of optimal output.

It is important to realize that exploitation of the common property fishery involves a non-optimal level of fishing stock not just of inputs or effort. Not to account for this change greatly underestimates the welfare loss and indicates a misunderstanding of the major problem exploitation of the fishery so the stock is well below it optimal level.

Questions on Common Property Resources

To see how the "crowding externality" works in the case of the pasture consider first the social optimum where 100 steer graze on the fertile pasture. Remember the pasture has a capacity of 100 units of grass and that if one steer eats 1 unit of grass it will yield one unit of meat. The opportunity cost of a cow is \$0.5 so each cow "earns" a profit of \$0.5 for a total profit or social surplus of 50.

Now if a "newcomer" adds one more steer the 100 units of grass is divided among 100 steer so each steer sells for $\frac{100}{101}$ so the total revenue remains equal to $100 \bullet (\frac{100}{101}) = 100$. But the total opportunity cost goes up from 50 to 50.5.

(1) What is the private profit earned by the "newcomer"?

(2) What is the value of the social marginal product earned by the additional cow"?

(3) Explain why newcomers have an incentive to enter the pasture up to the point where the total herd reaches just under 200.

There are several ways that the government or a coordinator might improve on the free entry equilibrium.

(a) One is to privatize the pasture, put it under the control of a single owner.

(b) To impose a tax or an entry fee.

What is the optimal tax?

(c) to establish quotas or transferable grazing rights on the pasture. Once these property rights are established they could be sold on the open market.

A key question is whether these grazing rights should be sold or auctioned off by the government or whether they should be assigned free in proportion to the size of an individual's initial herd. So if I owned 10 percent of the initial herd in the equilibrium where the total herd size is 200 steer I would get 10% of the restricted numbers.

(4) Discuss the advantages and disadvantages of the three approaches to restricting entry, grazing, selling the grazing rights, and giving their grazing rights away.

(5) The externality involved in the fisheries case is a bit more complicated. How does it work?

(6) Skim the newspaper story on the Two Fisheries. The Australian fishery seems more successful. Do you have any reservations about the Australian outcome? **Hint:** The answer is related to question number 4.