Economics 5250 Dr. Lozada
Fall 2007 Final Exam

This exam has 67 points. There are eight questions on the exam; you should work all of them. Most of the questions are are worth 8 points each, but Questions 1, 2, and 7 are worth 9 points each.

Put your answers to the exam in the blue books you have brought (if you remembered to bring blue books).

Answer the questions using as much precision and detail as the time allows. Correct answers which are unsupported by explanations will not be awarded points. Therefore, even if you think something is "obvious," do not omit it. If you omit anything, you will not get credit for it. You get credit for nothing which does not explicitly appear in your answer. If you have questions about the adequacy of an explanation of yours during the exam, ask me.

You have two hours to finish this test.

Answer all of the following eight questions.

1. **[9 points]** In our handout on fisheries economics, the equation

$$r = \frac{-C_{X8}}{M\Pi_7} + F_8' \frac{M\Pi_8}{M\Pi_7} + \frac{M\Pi_8 - M\Pi_7}{M\Pi_7}$$

made an appearance (where r stands for the rate of time discount, not the intrinsic growth rate). Explain: (a) where this equation comes from; and (b) what it implies for a steady state, schooling fishery.

2. **[9 points]** Compare the competitive equilibrium price path for an exhaustible resource industry if the interest rate is low versus if the interest rate is higher. As usual, explain your answer fully.

3. **[8 points]** What is the connection in developing countries between deforestation and dung? What are the consequences of this connection?

4. **[8 points]** What reasonable alternative could there be to the assumption of "rational economic man?"

5. **[8 points]** Give two examples of the Second Law of Thermodynamics. Also, explain why that Law is not easy to understand intuitively.

6. **[8 points]** In what sense is most economic thought consequentialist (or "teleological") rather than being non-consequentialist (or "deontological")?

7. **[9 points]** Suppose that producing output also generates pollution. Draw a graph with "output" on the horizontal axis showing how an optimal (linear) "pollution reduction subsidy" (really an output reduction subsidy) would work.

8. **[8 points]** Give an example from environmental economics illustrating the Theory of the Second Best. (One example would be a polluting oligopoly.)

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① a) It comes from maximizing the present discounted value of profit of a privately-owned fishery, with logistic growth of the fish.

Optional: In other words, it comes from

$$\max \sum_{t=0}^{\infty} \frac{\pi_t}{(1+r)^t} \quad \text{s.t.} \quad X_{t+1} - X_t = F(X_t) - H_t$$

(t: time; r: discount rate; X_t: stock size; H_t: harvest; $F(X_t)$: births − natural deaths)

where profit $\pi_t = TR(H_t) - TC(H_t, X_t)$ (TR: total revenue; TC: total cost)

b) schooling $\Rightarrow -C_{X8} = -\frac{\partial TC_8}{\partial X_8}$ equals zero, because schooling fish are not more costly to catch as their stock size X goes down

steady state $\Rightarrow$ values at $t = 7$ are equal to values at $t = 8$ (so there's no need to index by time)

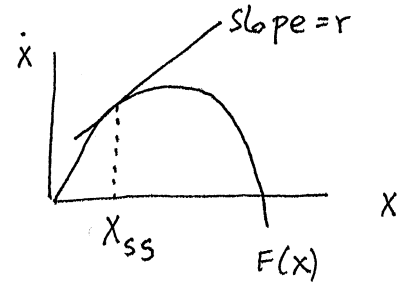
So the equation becomes

$$r = 0 + F'(1) + 0$$

$$r = F'(X_{ss})$$

(r: discount rate; X_{ss}: steady state)

Optional:



... shows how to find X_{ss}.

(2) Hotelling Rule: $MR_{t+1} = (1+r)\, MR_t$

(MR: marginal profit; r: discount rate)

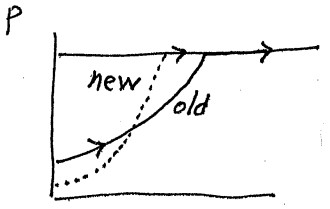
$MR = MR - MC$ (marginal revenue − marginal cost)

because profit = total revenue − total cost.

If $MC = 0$ and if $MR = P$ (the latter implies perfect competition) then the Hotelling Rule becomes

$$P_{t+1} = (1+r) P_t .$$

So $P_{t+1} / P_t = 1+r$. If $r \uparrow$, then $P_{t+1} / P_t \uparrow$, i.e., price rises more rapidly (more steeply on a graph).



The old path is solid, the new is dotted and steeper.

The paths need to cross because otherwise,

either $P_t^{new} > P_t^{old}$ for all t, which implies from the demand curve that $Q_t^{new} < Q_t^{old}$ for all t, so the new plan leaves stock in the ground forever, which is not optimal for the firm; or

$P_t^{new} < P_t^{old}$ for all t, so $Q_t^{new} > Q_t^{old}$ and the new plan is not feasible.

(3)

Deforestation ⇒ loss of wood for fuel (heating and cooking)

⇒ ↑ demand for alternative sources of fuel, such as dung

⇒ ↓ use of dung as fertilizer*

⇒ ↓ crop yields or ↑ use of chemical fertilizer, which is expensive and made from exhaustible resources

*Dung's price goes up; more of it is diverted to use as a fuel.

(4)

An alternative is the "cultural person," where, to quote Pearce & Turner, "culture is an on-going complex of ideas, attitudes and beliefs that is absorbed by individuals ... in a habitual manner through institutional arrangements." (pp. 15-16)

Another alternative would be that a person's consciousness is determined by his class, as Marx taught.

Another alternative would be a person in a novel economic environment who is unfamiliar with the alternatives between which he must pick.

(5)

- Heat goes from warmer objects to cooler ones (e.g. an ice cube melting on a sidewalk on a hot summer day)
- Ink dissolves throughout a container of water (a drop)
- Oil gathers on top of water
- Heat engines cannot be 100% efficient
- Perpetual Motion machines are impossible

over →

- recycling energy always loses more energy than can be reconstituted
- the entropy of an isolated system is always increasing or constant
- two inert gases will mix together

It's not easy to explain intuitively because "entropy" has no intuitive interpretation accessible to laypeople (who haven't studied statistical mechanics). Entropy change ΔS is $\Delta Q/T$ along a "reversible" path.

(ΔQ: heat flow; T: temperature in Kelvin)

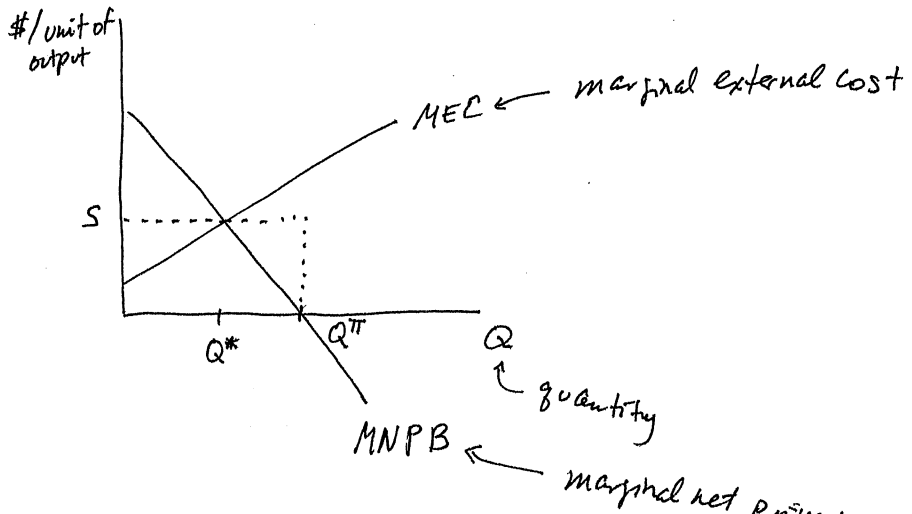
(6)

In most schools of economic thought, actions *per se* are neither good nor bad; they are judged by the consequences they bring about. Example: utilitarianism. (The consumer's utility depends on what consumption bundle he gets, not on how he got it.) * Another example: cost/benefit analysis of pollution.

Non-consequentialist thought can judge an action irrespective of its consequences. For example, someone saying "you should not kill another person," with no qualifications, is being non-consequentialist. So is someone saying "to pollute is bad, period."

* Another example: what matters to a firm is profit, not how profit is obtained, in neoclassical economics and in Marxist economics.

(7)



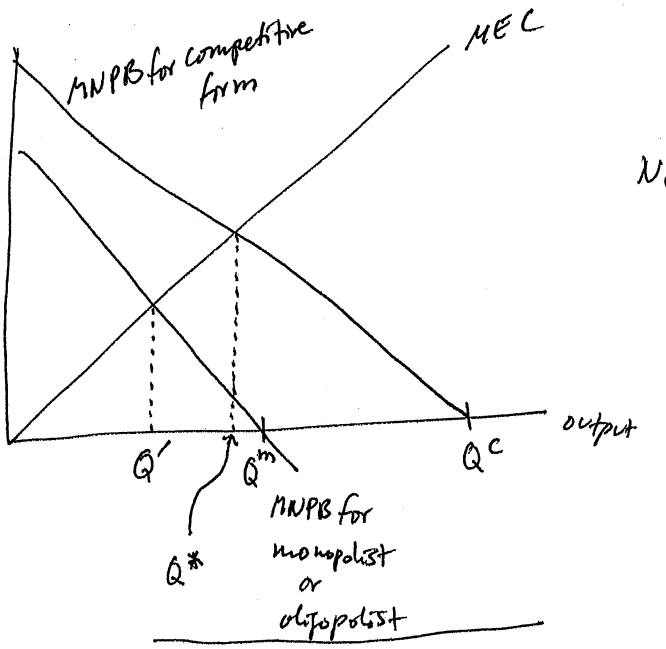
Suppose if the firm chooses Q to be less than Q^{π}, it will receive a (marginal) subsidy of S per unit below Q^{π} it is producing. If Q is between Q^* and Q^{π}, it's better for the firm to accept the subsidy S and give up the profit MNPB since $S > MNPB$. But once Q falls below Q^*, $S < MNPB$, so the firm will not give up those units of production. Hence the firm chooses $Q = Q^*$.

There are other possible subsidy schemes (think of Coasian bargaining to imagine the possibilities); the one above is the only one that is "linear" (= "constant marginal subsidy").

(8) The Theory of the Second Best says that if there is more than one market imperfection (such as an externality or tariff or imperfect competition), then welfare is guaranteed to improve only if every one of the imperfections is eliminated; eliminating less than all of the imperfections might make welfare worse.

For example, eliminating the pollution externality for a polluting oligopolist or monopolist (say, by imposing the appropriate tax) might lower society's welfare.

Optional:



Note: Q^* may also be $> Q^m$, just depending on how MEC and $MNPB_{comp}$ are drawn.

Polluting Monopolist or Oligopolist: Q^m

Monopolist or Oligopolist with Pollution internalized: Q'

Pollution with Monopoly or Oligopoly broken up: Q^m

No Pollution Externality (it's internalized), Monopoly or Oligopoly Broken Up: Q^*, social optimum

Fixing only pollution, $Q^m \rightarrow Q'$, overshoots Q^*

Fixing only imperfect competition, $Q^m \rightarrow Q^c$, opposite direction from Q^*