

First Seven Econ. 6535 -Natural Resource Economics -Spring 00

Roads and the common property problem

1. (10 points) Consider two roads that go from Boulder to Longmont. The cost of traveling the wide road is always 60 minutes, and the wide road is a common property resource. Assume that the total amount of time it takes T trucks to travel from Boulder to Longmont on the narrow road is $C(T) = BT^2$. Assume that Bob owns the narrow road. Assume that there are 100 trucks that need to go to Longmont and that they are all owned by Fred. There are no other vehicles that want to go to Longmont (we have been assuming this in all of our "road" problems. From society's perspective, determine the magnitude of an efficient toll on the narrow road. Will Bob choose this toll? That is, will the market fail or achieve efficiency?

Zero is an efficient toll from society's perspective. That is, if Bob sets the toll at zero, Fred, who owns all of the trucks, will allocate them between the two roads so as to minimize the total amount of time it takes the 100 trucks to travel to Longmont.

Bob will not want to make his road common property (zero toll)

How will the toll be determined? By some negotiation between Bob and Fred. If they are clever, they will probably come up with a solution where Fred pays Bob some lump sum and Fred then gets to decide who many of his trucks will take each of the road. Exactly what the lump sum payment will be will depend on the bargaining skills of the two parties.

If the toll is zero. Fred will send $30/B$ trucks on Bob's narrow road, and the rest on the wide road. I determined this by minimizing total travel time for the 100 trucks, which is the criteria Fred will choose to allocated his trucks between the two roads. Efficiency in this world is the allocation that minimizes the total travel time for the 100 trucks.

Consider what would happen if Bob set his toll assuming that Fred is a price taker, which he is not.

Fred will minimize the total travel time for his 100 trucks, taking account of the toll on the narrow road. That is, he will minimize

$$\begin{aligned} C(T) + 60(100 - T) + T(30 / B) \\ = BT^2 + 60(100 - T) + T(30 / B) \end{aligned}$$

If one minimizes this wrt T , one gets $(30 / B) - (15 / B^2)$, which is the number of trucks Fred

will send on the narrow road if the toll is $(30/B)$. Note that this outcome has too few trucks on the narrow road.

E.G. if $B=1$, Fred will send 15 trucks on the narrow road when the efficient number is 30. Any positive toll will cause Fred to misallocate the trucks between the two roads from society's perspective.

What is going on? Even though there is monopoly power in the economy, the "market" outcome (not competitive market outcome) will likely be efficient because the two monopolists have an incentive to bargain with each other until efficiency is achieved. They will have no trouble finding each other.