Two period model of a non-renewable resource

Consider extraction of a non-renewable natural resource. The inverse demand function for the depletable resource is $P = 12 - Q$ in both periods 1 and 2 and the marginal cost of supplying it is \$3. The discount rate is 10%. There are 7.5 units total.

1. Find the equilibrium allocation in each period for resource extraction
2. Describe using the concept of marignal user cost why $Q_1 = 3$ and $Q_2 = 4.5$ is not optimal
3. What is the marginal user cost? Interpret this number.
4. Now assume $r = 0$. What is the optimal allocation now? Why did it change in the direction that it did?

Two period model of a non-renewable resource

Consider extraction of a non-renewable natural resource. The inverse demand function for the depletable resource is $P = 12 - Q$ in both periods 1 and 2 and the marginal cost of supplying it is $2 + Q/2$. The discount rate is 6%. There are 15\$ units total.

1. Find the equilibrium allocation in each period for resource extraction
2. What is the marginal user cost? Interpret this number.

Tradable Permits

Two firms can control emissions at the following marginal costs: $MC_1 = 200a_x$ and $MC_2 = 100a_y$ where a_x and a_y are, respectively, the amount of emissions reduced by the first and second firms. Assume that with no control at all, each firm would be emitting 20 units of emissions or a total of 40 units for both firms.

1. Consider a cap-and-trade system that aims for a total reduction of 21 units of emissions is necessary.
   (a) What is the equilibrium allocation of permits to each firm?
   (b) At what price would these permits sell for at an auction
2. Assume that the control authority wanted to reach its objective by using an emissions charge system instead.
   (a) What tax amount should them impose to reach this equilibrium?
   (b) How much revenue would the government collect?
3. Why is cap-and-trade more cost-effective than a uniform standard where each firm reduces pollution by 10.5 units?

Tradable Permits

Two firms can control emissions at the following marginal costs: $MC_1 = 5 + 10a_x$ and $MC_2 = 11a_y$ where a_x and a_y are, respectively, the amount of emissions reduced by the first and second firms. Assume that with no control at all, each firm would be emitting 20 units of emissions or a total of 10 units for both firms.

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