

# EC314-Fall 2010 Problem Set 3

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When you write up your answers, your goal should be to (1) be correct, and (2) convince your reader that your answer is correct. Answers which do not achieve these goals will not be awarded full credit. To accomplish the second objective, it is helpful if your work is legible and if all steps are presented, possibly with a line of explanation. **Please STAPLE pages together so that we do not lose them.** (This problem set updated: 18 August 2010).

## Problems

1. Suppose that the willingness to pay for seal products,  $y_t$ , at time  $t$ , is given by  $P(y_t) = 100 - y_t$ , and that the slope of the marginal cost of producing seal products is constant at one and fixed costs are zero (so that the supply curve is a line through the origin with slope one). The government is considering an increase in the quota on seal products from 25 to 50.
  - (a) Find the social surplus associated with both policies.
  - (b) Calculate the yearly benefits of switching from the smaller to the larger quota.
  - (c) Suppose that the change in policy will cost \$896 for the first two years, and zero in the third year. If the benefits of the policy switch are constant at the level you found in (a) for the first three years, and zero thereafter, is this policy switch desirable if the social rate of return is .09? What if the social rate of return is .11?
  - (d) What does this suggest to you about the role that social rates of return play in policy debates?
2. Suppose that the harvest of wheat,  $y$ , on a field of fixed size is given by  $y = L^{1/2}$  where  $L$  is the amount of labor devoted to farming. Let  $p$  and  $w$  denote the prices of wheat and labor respectively.
  - (a) Taking prices as given, solve for the profit maximizing choice of  $L$  and  $y$  if the field is privately owned. What is the rent generated by the field?
  - (b) Solve for the open access level of  $L$  and  $y$ . What is the rent generated by the field in open access.
  - (c) Draw a graph which illustrates the open access and private property equilibrium.
  - (d) What is the problem with the following statement: Since open access employs more people than private property, open access is desirable when, under private property, not everyone is employed in agriculture. Even though there are no rents under open access, fewer people are hungry.
3. Consider the same situation as we addressed in 2, but suppose now that there is an upward sloping labor supply curve,  $w(L) = L$ .

- (a) Taking prices as given, solve for the profit maximizing choice of  $L$  and  $y$  if the field is privately owned. What is the rent generated by the field?
- (b) Solve for the open access level of  $L$  and  $y$ . If the workers do not receive any of the resource rent generated under private property, are workers better off under open access or private property?
- (c) Draw a graph which illustrates the open access and private property equilibrium.
4. (This one is difficult and will not be marked. It is fair game for an exam though.) Suppose that there are  $i = 1, \dots, N$  farmers and one open access field. Each laborer supplies  $L_i$  units of labor and total labor supply  $L = \sum_{i=1}^N L_i$ . The opportunity cost of labor is one. Total harvest is  $L^{\frac{1}{2}}$ . Under open access, each laborer gets the average return to their labor, so each laborer would like to maximize

$$\frac{L_i}{\sum_{i=1}^N L_i} \left( \sum_{i=1}^N L_i \right)^{1/2} - L_i$$

- (a) Find the first order condition that determines farmer  $i$ 's optimal choice of labor.
- (b) Now assume symmetry (i.e.  $L_i = L_j$  and  $L_i = L/N$ ) and solve for the labor supply of any given farmer. Make this substitution in the first order conditions and take the limit as  $N \rightarrow \infty$ .
- (c) Let  $N = 1$  and find the first order conditions.
- (d) Explain the differences between the two sets of FOC's. Verify that "open access" equilibrium is equivalent to the  $N = \infty$  equilibrium.