Problem Free access, property rights, and transaction costs in a sardine fishery

Suppose that the decreasing returns production function of a fictitious sardine fishery can be represented by the data in table 1. It indicates, for instance, that with four boats, the total catch is equal to 320 tons, thus yielding an average product of 80 tons per boat. If we add a fifth boat, total production increases to 375 tons; hence, the marginal product associated with the *fifth* boat is 55 tons. Fill out the missing data about marginal and average products and then answer the following questions. You must, of course, briefly explain your reasoning.

TABLE 1. Production technology on a sardine fishery

x	1	2	3	4	5	6	7	8	9	10
y	95	180	255	320	375	420	455	480	495	500
\bar{y}	95	90		80		70		60	55	50
y'	95	85			55				15	5

^a x, y and \bar{y} respectively represent total number of boats, total sardine catch in tons, and average catch per boat in tons.

^b y' denotes the marginal products in tons associated with the *last* boat (as opposed to an additional boat).

- a) Suppose that each ton of sardines fetches a fixed price p and that the unit cost of operating each boat is c. Let p = \$100 and c=\$7000. For $x \in (1, 2, ..., 10)$, illustrate on a graph the points of marginal cost, marginal product value (py')and average product value $(p\bar{y})$. How do the marginal and average product values compare? Why?
- b) Find the (integer) number of boats x^* that maximizes rents. What are the total, marginal and average rents at x^* ? Show the main calculation steps and illustrate your solution on the graph in a).
- c) Suppose that the fishery is exploited under a *free access* regime, i.e., access is open to anyone in the surrounding community who wishes to go fishing, without any restriction. Prices and costs are the same as in a). Find the number of boats x^{LA} in this free-access regime. What are the total, marginal and average rents at x^{LA} ? Show the main calculation steps and illustrate your solution on the graph in a). Compare with x^* .
- d) Suppose now that local leaders decide to sell the fishery to a single firm, thereby according an absolute property right over the fishery. In particular, the firm can decide on the number of boats and receive all the net benefits. This choice is

automatically respected by all. Determine the number of boats that the firm will choose. Compare with x^* and x^{LA} .

- e) Based on your reasoning for the case of free access, explain why *automatic respect* of the property right may not be realistic in practice. In doing so, introduce the concepts of *transaction costs*, *de jure*, and *de facto* property rights.
- f) Suppose that the firm has to support the entire cost of enforcing its property right. What is its maximum willingness to pay?