

ECO 203: Environmental and Resource Economics

Group-B: Resource Economics

Unit-2: Exhaustible Resources

Lecture-II

So long we make the unrealistic assumption that extraction is cost less. Thus the price in the ground is same as the price of the extracted resource (known as *wellhead price*). When extraction cost is positive the *wellhead price and the price in the ground will be different*. Let P be the wellhead price, then the price in the ground is $P-C(X)$ since it costs $C(X)$ to extract it. The price in the ground is known as *Royalty*.

Q. What happens to the Hotelling Rule when extraction costs are positive?

For convenience let us consider the extraction costs are constant for all units of extraction, i.e.,

$$C(X) = C$$

$$\therefore F'(X) - \frac{C'(X)F(X)}{P-C(X)} = s - \frac{\dot{P}}{P-C(X)} \quad (4)$$

We put $F(X) = F'(X) = 0$ and $C(X) = C$

$$\therefore \frac{\dot{P}}{P-C} = s \quad (5)$$

But $P-C$ is the royalty, i.e., $P-C = R$

Thus, equation (5) can be written as

$$\frac{\dot{P}}{R} = s \quad (6)$$

Equation (6) is the one formulation of the Hotelling rule when costs are positive and constant.

Now, Royalty in period $(t+1)$ – Royalty in period t = change in Royalty.

$$\text{i.e., } R_{t+1} - R_t = \dot{R}$$

$$\text{Or, } (P_{t+1} - C) - (P_t - C) = \dot{R}$$

$$\text{Or, } P_{t+1} - C - P_t + C = \dot{R}$$

$$\text{Or, } P_{t+1} - P_t = \dot{R}$$

$$\text{Or, } \dot{P} = \dot{R}$$

Thus equation (6) can be written as:

$$\frac{\dot{R}}{R} = s \quad (7)$$

Again, $P - C = R \Rightarrow P = C + R$. Since, C is assumed constant; it is both the AC and MC of extraction. In any period, t , we can therefore write

$$P_t = C_t + R_t \quad (8)$$

\therefore Price (P) = the Marginal Extraction Costs (MEC/ C) + the Royalty on the marginal unit of the resource

In literature **Royalty \equiv Resource Rent (or Rental) \equiv Depletion Premium \equiv Marginal User Cost**

We can therefore say,

Optimal Price = Marginal Extraction Cost+ Marginal User Cost

Note: Diagrammatic Exposition will be discussed in the class

Reference: Economics of Natural resources and the Environment- David W. Pearce and R. Kerry Turner