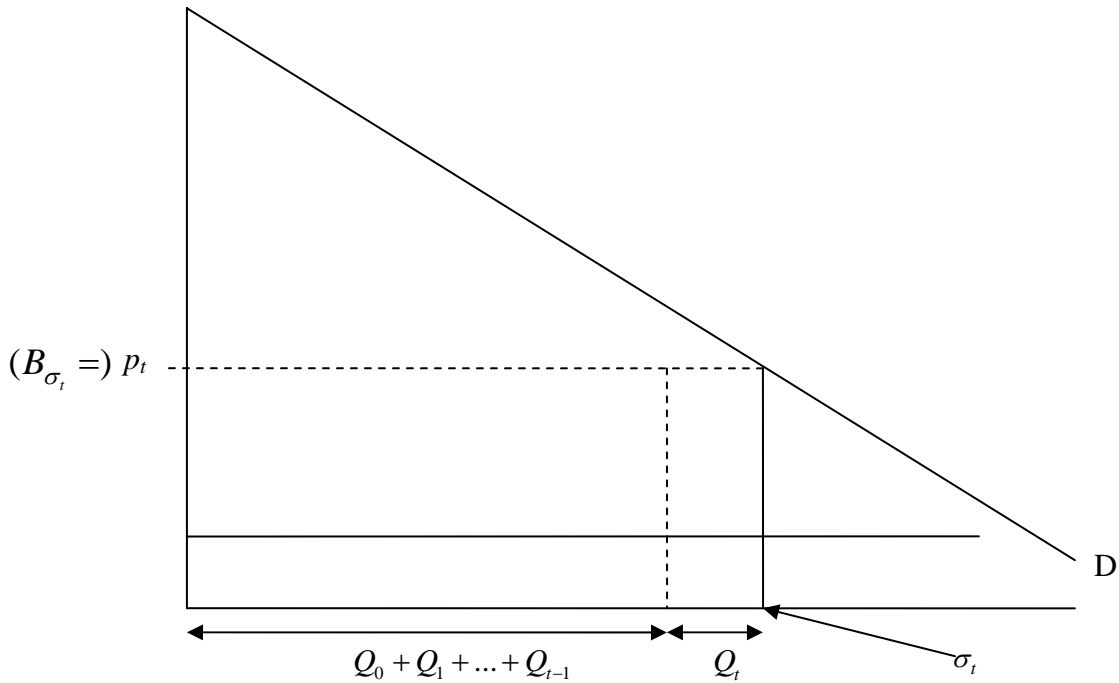


Durable Exhaustible Resource Extraction

Once extracted, Q_t accumulates above ground and continues to yield services (e.g. gold, copper, etc.)



No rusting assumption means every quantity extracted continues to yield services indefinitely.

$$\begin{aligned} \max W = & B(\overbrace{s_1 - s_0}^{Q_0}) - c(\overbrace{s_1 - s_0}^{Q_0}) + \frac{1}{1+r} \left[B(\overbrace{s_1 - s_0}^{Q_0} + \overbrace{s_2 - s_1}^{Q_1}) - c(\overbrace{s_2 - s_1}^{Q_1}) \right] \\ & + \left(\frac{1}{1+r} \right)^2 \left[B(\overbrace{s_1 - s_0}^{Q_0} + \overbrace{s_2 - s_1}^{Q_1} + \overbrace{s_3 - s_2}^{Q_2}) - c(\overbrace{s_3 - s_2}^{Q_2}) \right] + \dots \end{aligned}$$

$$\frac{\partial W}{\partial s_1} = 0 \Rightarrow B_{\sigma_t} - c + \left(\frac{1}{1+r} \right) c = 0 \quad \text{first order condition}$$

B_{σ_t} is a rental price (\$ per period use). Consider capital value prices.

$$Z_0 = B_{\sigma_0} + \left(\frac{1}{1+r}\right) B_{\sigma_1} + \left(\frac{1}{1+r}\right)^2 B_{\sigma_2} + \dots - c = V_0 - c$$

$$Z_1 = B_{\sigma_1} + \left(\frac{1}{1+r}\right) B_{\sigma_2} + \dots - c = V_1 - c$$

$$Z_0 - \left(\frac{1}{1+r}\right) Z_1 = B_{\sigma_0} - c + \left(\frac{1}{1+r}\right) c$$

which equals zero because of the first order condition. Hence, $r\%$ extraction rule in CAPITAL prices.