trade

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The vessel-day price for parcels that do not implement a reserve ($j = c(2, 10)$) is given by:

$$\pi(E_j) = pqX_j - \beta c E_j^{\beta-1}$$

We can solve for E_j:

$$\begin{aligned}
\pi_j + \beta c E_j^{\beta-1} &= pqX_j \\
\beta c E_j^{\beta-1} &= pqX_j - \pi_j \\
E_j^{\beta-1} &= \frac{pqX_j - \pi_j}{\beta c} \\
E_j &= \left(\frac{pqX_j - \pi_j}{\beta c}\right)^{\frac{1}{\beta-1}}
\end{aligned}$$

For the parcel that implements the reserve ($i = 1$) the same equations are given by:

$$\pi_1(E_1) = pqX_1(\theta + (1-\theta)(1-R)) - \beta c E_1^{\beta-1}$$

For simplicity, we can write $\Omega = (\theta + (1-\theta)(1-R))$, and the baove becomes

$$\pi_1(E_1) = pqX_1\Omega - \beta c E_1^{\beta-1}$$

We can solve for E_i as in the previous casse:

$$\begin{aligned}
\pi_1 + \beta c E_1^{\beta-1} &= pqX_1\Omega \\
\beta c E_1^{\beta-1} &= pqX_1\Omega - \pi_1 \\
E_1^{\beta-1} &= \frac{pqX_1\Omega - \pi_1}{\beta c} \\
E_1 &= \left(\frac{pqX_1\Omega - \pi_1}{\beta c}\right)^{\frac{1}{\beta-1}}
\end{aligned}$$

The total vessel-days for cells that belong to PNA countries (*i.e.* i = (1, 9)) are constrained at 45,000, which we term $\bar{E}$. Therefore, total effort can be expressed as:

$$\bar{E} = \left(\frac{pqX_1(\theta + (1-\theta)(1-R)) - \pi_1}{\beta c}\right)^{\frac{1}{\beta-1}} + \sum_{j=2}^{9}\left(\frac{pqX_j - \pi_j}{\beta c}\right)^{\frac{1}{\beta-1}}$$

This parameterization shows that the cell-level effort is determined by the combination of stock size (X_j) and the price π. Trading between country will continue until all π_i reach an equilibrium price of $\bar{\pi}$.