The Role of Expectations in Modeling Fishing Fleet Capacity Changes

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To major approaches to adjust fleet size and composition within a political framework targeting excess capacity

- Direct intervention through buyback programs
- Economic incentives through ITQs

RESEARCH QUESTIONS:
1. How expectations with respect to future regulations are affecting the individual decision regarding activity in the fishery?
2. How exit incentives created by buyback programs vary depending on the expectations with respect to the introduction of transferable quotas?
Scenario 1

\[ \Omega_{IVQ} = \sum_{t=0}^{t=t_{ex}} \rho^t \left( \pi^r(t) \left( P^{-i}; q_{i,t} z_k \right) + p_i q_{i,t} + w_f z_k \right) \]

Scenario 2

\[ \Omega_{ITQ} = \sum_{t=0}^{t=t_{ex}} \rho^t \left( \pi^r(t) \left( P^{-i}; \alpha_{i,t} q_{i,t} z_k \right) + p_i \alpha_{i,t} q_{i,t} + w_f z_k \right. \]
\[ \left. + \tau_{i,t} (1 - \alpha_{i,t}) q_{i,t} \right) \]
\[ \Omega_{ITQ} = \sum_{t=0}^{t=t_{ex}} \rho^t \left( \tau_{i,t} q_{i,t} \right) \text{ (if selling quota in full)} \]

\[ \Omega_{IVQ/ITQ} > \psi(z_k) \] - insufficient payments available for attracting the vessel to join the decommissioning program

\[ \Omega_{IVQ/ITQ} < \psi(z_k) \] - positive exit incentives and vessel retirement

Legend:
\( \rho \) – discount factor
\( t \) – time
\( \pi^r \) – restricted profit
\( P \) – vector of prices
\( i \) – harvested species
\( q \) – quota size
\( z_k \) – capital
\( w_f \) – vessel fixed cost
\( \alpha \) – share of utilized quota \((\alpha \geq 0)\)
\( \tau \) – quota price
The Baltic Sea commercial fisheries

**Map 1:** The Baltic Sea with surrounding countries.

Source: ICES 2013.

**Cod (Gadus morhua)**
32% revenue

**Herring (Clupea harengus)**
26% revenue

**Sprat (Sprattus sprattus)**
19% revenue

Source: STECF 2013.

**Figure 1:** The Baltic Sea harvest.
2005-2007
- IVQs for cod, quotas not enforced

2008
- EU penalty for not enforcing quotas

2009-2011
- EU penalty for not enforcing quotas
- Three years plan: ~ 1/3 fleet allowed to fish
- Buyback program available
- ITQs suggested

2012
- Remaining fleet back to fishing

**Figure 2:** The timeline for Polish cod management.
\[ \pi^r(P; Z) = \sum_{i \in I} \alpha_i p_i + \frac{1}{2} \left( \sum_{i \in I} \theta_i p_i \right)^{-1} \sum_{i \in I} \sum_{i' \in I} \alpha_{ik} p_i p_{i'} + \frac{1}{2} \left( \sum_{i \in I} \theta_i p_i \right) \sum_{j \in J} \sum_{j' \in J} \alpha_{jj'}z_j z_{j'} + \sum_{i \in I} \sum_{j \in J} \alpha_{ij} p_i z_j + \frac{1}{2} \left( \sum_{i \in I} \theta_i p_i \right) \sum_{j \in J} \sum_{j' \in J_{out}} \alpha_{jj'} z_j z_{j'}^2 + \left( \sum_{i \in I} \theta_i p_i \right) \sum_{t \in T} \alpha_t D_t \]

Symmetric normalized quadratic profit function.

Parameters estimated from input demand and output supply equations (Hotelling’s Lemma). The additive errors, assumed contemporaneously correlated, are appended to each equation. The system is estimated through Seemingly Unrelated Regression (SUR).

Estimation based on logbook data available through the Polish Fisheries Monitoring Centre
Figure 3: Profit of vessel with initial quota allocation at two different quota prices and two alternative decisions: harvesting cod or selling full quota.

In the model, the quota price is determined at the industry level.
**Figure 4:** The minimum time horizon over which vessel has to be utilized so that the value of the firm is at least equal the available scrapping payment.
Figure 5: Comparison of initial trawler fleet (2008) with expected composition under different scenarios.
CONCLUSIONS

- Under the rationality assumption, the individual exit decision depends upon the expected sum of discounted profits in comparison with a single buyback payment
- The profits in turn depend upon expectations regarding the future management scheme
- The incentives created by the buyback scheme can be considerably shifted in the situation when the ITQ system is anticipated in the nearest future

- The empirical application on the Polish trawler fleet
- The fleet restructuring process is found considerably altered by the government’s speculations on the introduction of tradable quotas
THANK YOU