Modelling Proposal for Entry Stay Exit Behaviour

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GENERAL STRUCTURE

- INTRODUCTION
- THE RANDOM UTILITY MODEL FRAMEWORK
  - The multinomial logit
  - Data issue
  - Explanatory variables
    - Economic Variables
    - Owner characteristics
    - Vessel characteristics
    - Biological Variables
    - Fleet size
- OUR RESULTS
  - The application to the Basque inshore fleet
- DISCUSSION

INTRODUCCTION

- Early ESE models assumed that entry/exit were *unrestricted* and linked with *profitability* of the fishery
  - Adjustment mechanism: PROFITS $\Rightarrow \Pi=0$
  - i.e. vessels are free to move in and out of the fishery
    - Gordon (1954), Scott (1955), Smith (1959) Bjorndal and Conrad (1987), Berk and Perloff (1984) Mackinson et al (1997), Pascoe and Revill (2004)
- Fisheries management
  - Adjustment mechanism: *CAPACITY UTILISATION*
  - Entry: restricted /Exit: is more difficult
  - Non malleability of capital, irreversible investment
    - Clark, Clarke and Munro (1979), McKelvey (1985), Boyce (1995). Theoretic!
    - Empirical models: Placenti and Spagnohlo (1992) Ward and Sutinen (1994), Tomberlin (2001)
- Behavioural studies
  - Entry-exit / Fishery choices / Location choices
    - Bockstael and Opaluch (1983, 84), Ward (1991), Ward and Sutinen (1994), Ikiara and Odink (2000), Pradham and Leung (2004), Thebaud et al. (2005), del Valle et al (2006)

THE RANDOM UTILITY MAXIMISATION FRAMEWORK

- RUM hypothesis (McFadden, 1973)
  - the decision-maker faces a choice among a finite set Z
  - chooses an alternative j in Z if and only if $U_{ij} > U_{ik}$ for k≠j
  - the probability that a choice j within the choices Z is made:

$$\Pr_i(j)\big|_Z = \Pr\left[U_i(j) = Max U_i(k)\right] \forall k, j \in Z, k \neq j$$

- But utility is not directly observable
  - one has to examine variables associated with the utility attached to each choice.
  - typically a linear utility function is specified.
  - the utility function can be decomposed into a deterministic term (V) and a stochastic component (ε):

$$U_{ij} = V_{ij} + \varepsilon_{ij} = \beta_j X_i + \varepsilon_{ij}$$

- The probability that choice j is made:

$$Pr_{ij} = Pr(V_{ij} - V_{ik} > \varepsilon_{ik} - \varepsilon_{ij}) \text{ for } \forall k \neq j.$$

  - If (and only if) the J disturbances are idd with Weibull distribution as $F(\varepsilon_{ij}) = \exp(-e^{-\varepsilon ij})$ then the pr that the decision-maker will choose alternative j is given.

THE MULTINOMIAL LOGIT

- Probabilities

$$\Pr_{ij} = \frac{\exp(\beta_j X_i)}{\sum_{j=1}^{J} \exp(\beta_j X_i)}$$

- The logit:

$$\ln\left[\frac{P_{ij}}{P_{i0}}\right] = \beta_j X_i$$

- Marginal effects

$$\delta_{jk} = \frac{\partial \Pr_j}{\partial X_k} = \Pr_j\left[\beta_j - \sum_{j=1}^{J-1} P_{jk}\beta_{jk}\right]$$

- Estimating method: Maximum Likelihood
- Permits testing for:
  - Imperfect capital malleability, or resistance to change.

DATA ISSUES

- The data choice is case study based
  - the general framework surrounding the fisheries is important.
- Pooled annual cross-sectional and time-series microdata.
  - Minimum 2 years.
    - Loogbook data. Catch and fishing effort.
    - Fish revenue (by species).
    - Socio-economic data.
    - Biological data
- Discrete dependent variables determines the framework
  - Multinomial (binomial) framework ⇒ (Entry)/Stay/Exit
  - Nested conditional framework ⇒ Entry/Exit/Stay (stay with/without reinvestments)
  - Nested repeated models
- Explanatory variables

EXPLANATORY VARIABLES:
A survey from the literature I

- Economic variables
  - Proxies for the annual earning potential
    - The previous period's annual revenue per gross ton vessel capacity
    - Ex vessel prices
    - Operating costs
  - Opportunity cost of exiting
    - Dayly/Monthly catch value
  - Level of investments
    - Estimated current value of the vessel and gear
    - The estimated price of the vessel in the second hand market
    - Dependency on credits
  - Interest rate of the economy
  - Economic incentives
    - Decommissioning grants

EXPLANATORY VARIABLES:
A survey from the literature II

- Owner's characteristics
  - Residency of the vessel owner (asymmetric information)
  - Captainship (vessel owner=vessel captain) (principal-agent philosophy)
  - Experience
    - Fishing experience
    - Experience being captain
  - Level of education
  - The existence/non existence of alternative source of income
    - Partial time fisher/complete time fisher
  - The effect of family tradition
    - Father fisher
  - Ownership
  - Succession
  - Years until retirement
  - Family business
    - Family fishing

EXPLANATORY VARIABLES: A survey from the literature III

- Vessel characteristics
  - Age
  - Material
  - Size
    - length, GRT, crew size
- Fleet size
  - ∑i GRTt (congestion effect or crowding externality)
- Biological variables
  - Stock conditions of major targeted species.
    - Annual stock abundance indexes (%),
    - CPUE
    - Species mortality
- Others

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OUR RESULTS (del Valle et al., 2006)

- Choice variables:
  - Stay
  - Exit
- Explanatory variables
  - Vessel age **
  - Vessel's material **
  - Succession **
  - Dependency on mortgage **
  - Owner's age **
  - Experience (being captain) **
  - Family fishing

OUR RESULTS (del Valle et al., 2006)

$$Odds(NS) = \frac{pr(NS)}{[1 - pr(NS)]} = e^{(-8,777 + 0,077 \cdot EDADBU - 2,025 \cdot SUCESION + 1,908 \cdot DEUPEN + 0,166 \cdot AÑOSJUB + 0,169 \cdot EXPPAT + 2,14 \cdot MAT - 1,673 \cdot FAPES)} \quad (10)$$

$$Logit = Ln(Odds(NS)) = -8,777 + 0,077 \cdot EDADBU - 2,025 \cdot SUCESION + 1,908 \cdot DEUPEN + 0,166 \cdot AÑOSJUB + 0,169 \cdot EXPPAT + 2,14 \cdot MAT - 1,673 \cdot FAPES \quad (11)$$

TABLA 2:
Los resultados: *Logits, odds y tests the significación*

VARIABLE	β	S.E.	Wald	Sig.	$-2LL_{(-Xi)}$	RV	Sig.	Exp(B)
EDADBU	,077	,039	3,922	,048**	51,809	4,412	0,035**	1,080
SUCESION(1)	-2,025	1,067	3,598	,058*	52,182	4,585	0,032**	,132
DEUPEN3(1)	1,908	,875	4,749	,029**	53,287	5,690	0,017**	6,737
EDADJUB	,166	,074	5,042	,025**	54,521	7,246	0,007**	1,181
EXPPAT	,169	,069	5,931	,015**	55,843	8,246	0,004**	1,184
MAT(1)	2,140	1,235	3,004	,083*	51,684	4,087	0,043**	8,503
FAPES(1)	-1,673	1,104	2,296	,130	50,149	2,552	0,110	,188
Constant	-8,777	2,685	10,685	,001**	-	-	-	,000

** significativo al 5%, * significativo al 10%

T ABLA 4:
Bondad del ajuste

	Wald test	LR	P test	H & L test	R^2 Cox & Snell	R^2 Nagel.	R^2 M.Fadden
χ^2 p- value	22,429 (0,000)	27,013 (0,000)	48,059 (0,953)	6,624 (0,575)	0,303	0,482	0,362

Discussion