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< Modelling the adjustment of fishing fleets to regulatory controls : the case of South-Brittany trawlers (France), 1990-2003 >

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Modelling the adjustment of fishing fleets to regulatory controls: the case of South-Brittany trawlers (France), 1990-2003.

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1 Context

As part of the EU funded TECTAC research programme, data was compiled concerning the changes in size, structure and landings of the fleet of trawlers operating from the ports of South-Brittany (France), over the period 1991-2003. The analysis of these changes showed different trends depending on fleet segments: while the segment of larger vessels (20-25 meter length class) remained relatively stable in terms of vessel numbers, the number of medium and small-sized vessel has been strongly reduced over the study period, leading to a significant decline in the total production of these fleet segments. At the same time, there appears to have been an increasing trend in the average fishing capacity of the remaining vessels (as documented by the results of the survey on technical changes aboard these vessels carried out as part of the project. These changes took place in a changing economic environment, with a severe market crisis (general drop in prices) at national level in the early 1990ies, followed by a steady recovery since the mid-1990ies, with increasing average prices. Differences in fleet adjustments are due in part to the differences in regulatory measures applying to different sizes (as well as other characteristics) of fishing vessels, in particular decommissioning schemes and public support measures for the renewal of fishing fleets in France.

The aim of the analysis presented in this section is to understand the determinants of the observed changes in fleet size and characteristics, and in particular to assess the role of decommissioning schemes. The analysis is centred on the 16-20m fleet segment, which was particularly affected by these changes. A model of the probability for a vessel to exit from the fleet in the period 1991-1998 is developed, where most of the decommissioning effort took place. We present preliminary results of the analysis, and discuss methodological issues related to model development.

The presentation is structured as follows. First, the trends observed in the 16-20m fleet are described, as well as the key elements of regulatory measures applying to vessel exit during the study period. Second, the model tested is presented, and the data used for the analysis is described. Third, the results of the analysis are presented and discussed. The fourth section discusses perspectives for additional investigations.

2 Fleet evolution and regulatory context

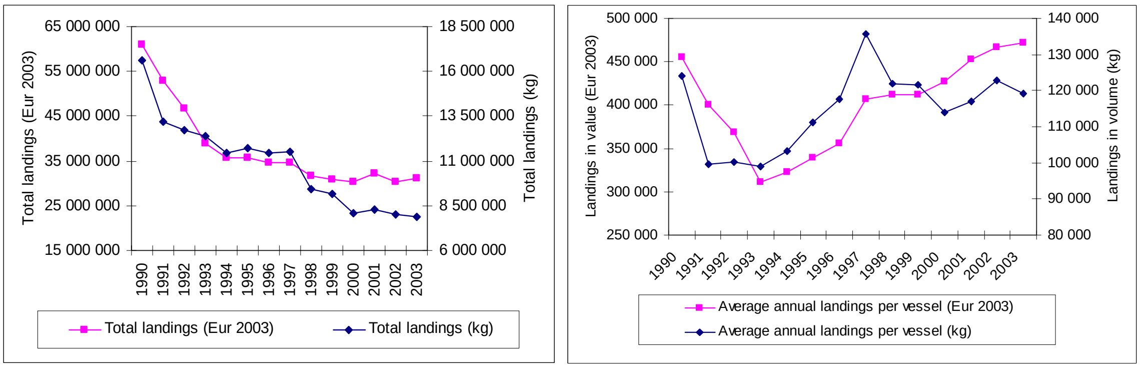
The 16-20m trawler fleet[1] based in ports of Southern Brittany (administrative districts from Camaret to the North, to Vannes to the South) operates mainly in the bay of Biscay (ICES

[1] As for other European countries, the population of French commercial fishing vessels is derived from the fleet register on a yearly basis. Identification of fleets by Ifremer is based on a methodology aimed at providing a stable stratification of the population of vessels in groups that are homogeneous in terms of both fishing activity and economic indicators (investment and gross earnings). Fleet definition uses both vessel characteristics, and

area VIII) and in the Celtic Sea (ICES area VIIh-k) . Key species targeted include anglerfish, nephrops, hake, megrim, cod, sole and seabass.

Trends observed in the evolution of the total landings of this fleet have been described in detail in other TECTAC reports. Total landings have been decreasing in volume over the period (figure 1). The decrease of total landings in volume has entailed a decrease in the value of total landings, although to a somewhat lesser extent after 1998, due to an increase in the average annual prices of landings. Average landings per vessel have fluctuated significantly over the period, both in volume and in value. After a marked drop in the early nineties, average quantities landed have increased to a peak in 1997, and decreased again since then. After reaching a minimum in 1993, average values of landings have known a regular increase, due from 1998 to the increase in average prices fetched by the species landed by the fleet on the first sale market.

Figure 1 – Evolution of total and average landings of the fleet, 1990-2003



Left quadrant = total landings (Constant euros, base 2003; kg); Right quadrant = average landings per vessel (Constant euros, base 2003; kg). Source : Ifremer – SIH, DPMA

An important part of the reduction of total production is due to the reduction of the fleet's size over the period. Between 1990 and 2003, the fleet was reduced by half, from 138 to 65 vessels (figure 2). It has been estimated that this reduction contributed to 90% of the total reduction in gross turnover of the fleet between 1990 and 2003.

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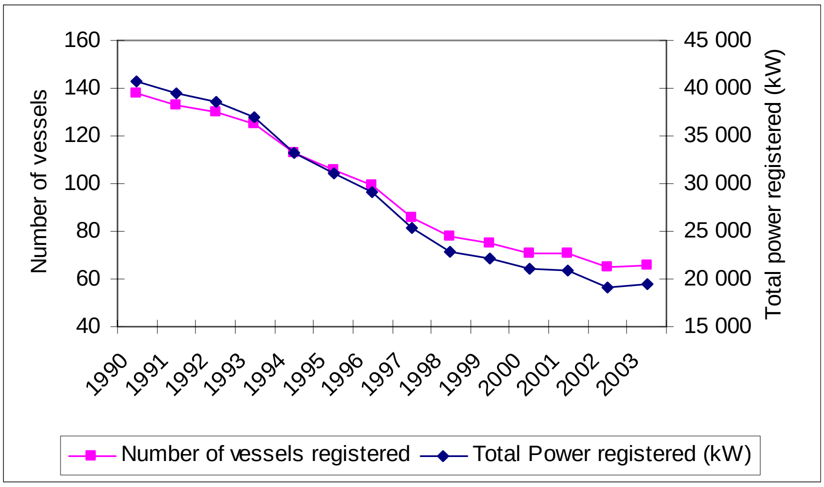
the information collected on the fishing activity of each vessel. The combination of gears used during a year (disregarding when and for how long they have been used) is considered as a proxy for fishing activity, and this combination is used as a stratification criterion (see Report of the Ad Hoc Meeting of independent experts on Fleet-Fishery based sampling Nantes, 23-27 May 2005. European Commission Staff Working Paper). For the present study, trawler fleets are defined as groups of vessels which have used trawls in the years considered.

Figure 2 – Evolution of fleet size



Source : Ifremer – SIH, DPMA

Approximately one half (46%) of the reduction in fleet size over the study period is due to the transfer of fishing vessels to other fleets and/or fisheries, mainly via the sale of vessels on the French second-hand market for fishing vessels. The other half (54%) is due to the decommissioning of vessels under the several multi-annual guidance programmes (MAGP) that were implemented during the study period.

Decommissioning schemes, organized by the Ministry of agriculture and fisheries, operated on the basis of a premium paid to vessel owners to permanently remove their fishing unit from commercial fishing activity in European waters[2]. The decision to scrap a vessel was not mandatory but depended on the fishermen's willingness to part with their fishing unit. The premium was defined by the administration for each scheme, within constraints set out in E.C. regulations concerning minimum age of decommissioned vessels[3] (10 years old), maximum level of premium per vessel size category, minimum level of vessel activity over the previous two years (75 days per year), and minimum vessel length. Vessel owners also needed to show that all debts, credit guarantees and/or mortgages were cleared at the time of the buyback. Inclusion of criteria based on fleet segments and/or vessel landings were also progressively included in the schemes. The general formula for the calculation of premiums by the national administration[4] was as follows:

$$P_i = f_j + v_j T_i$$

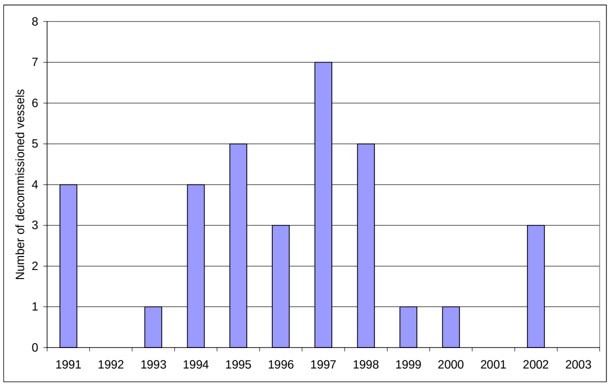
With P_i the total premium for vessel i, f_j the fixed premium and v_j the variable premium for vessels belonging to size class j (defined in gross tonnage), and T_i the gross tonnage of vessel i. In general, f_j tends to increase while v_j decreases with the gross tonnage of vessels. As vessel tonnage is more variable in the larger vessel classes, the formula allows to reduce the variability of P_i for vessels belonging to these classes. The formula was adapted according to the characteristics of individual vessels. For example, a higher value of the ratio of horsepower to gross tonnage was defined above which a 50% increase in the total premium

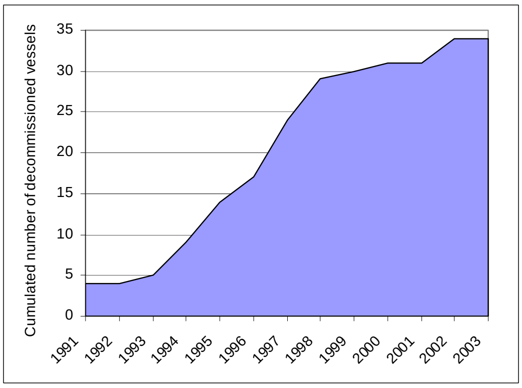
[2] Vessels are to be demolished, used for non-commercial fishing activities or transferred to non E.U countries.
[3] The age of a vessel is calculated on the first entry in the fishing industry.
[4] In practice, regional and local administrations have also supported the buyback of vessels, within the maximum amount allowed by the European regulation. Data on these additional subsidies to vessel owners for the scrapping of vessels was only available for part of the period studied, hence this information was not included in the analysis.

was offered, and a lower value of this ratio was defined below which a fixed minimum premium was offered. From 1998, modulations of the total premium calculated along the lines above were also made based on the age of the vessel. Modifications to the formula were also introduced for specific years, e.g. in 1991, a 50% increase of the total premium was also offered.

Schemes usually operated for a few months each year, on a first come first served basis, under budgetary limitations as to the total expenditure available for vessel buyback. The first important scheme, named the “Mellick plan” after the name of the Fisheries minister of the time, was implemented in 1991 in order to catch up with MAGP#2 targets. Subsequent schemes were set up nearly every year thereafter, under MAGP#3 (1993-96), MAGP#4 (1997-2002), and the more recent objectives adopted as part of the reform of the CFP (end of subsidies to the building and modernization of vessels).

Figure 3 – Evolution of the total number of vessels decommissioned from the fleet

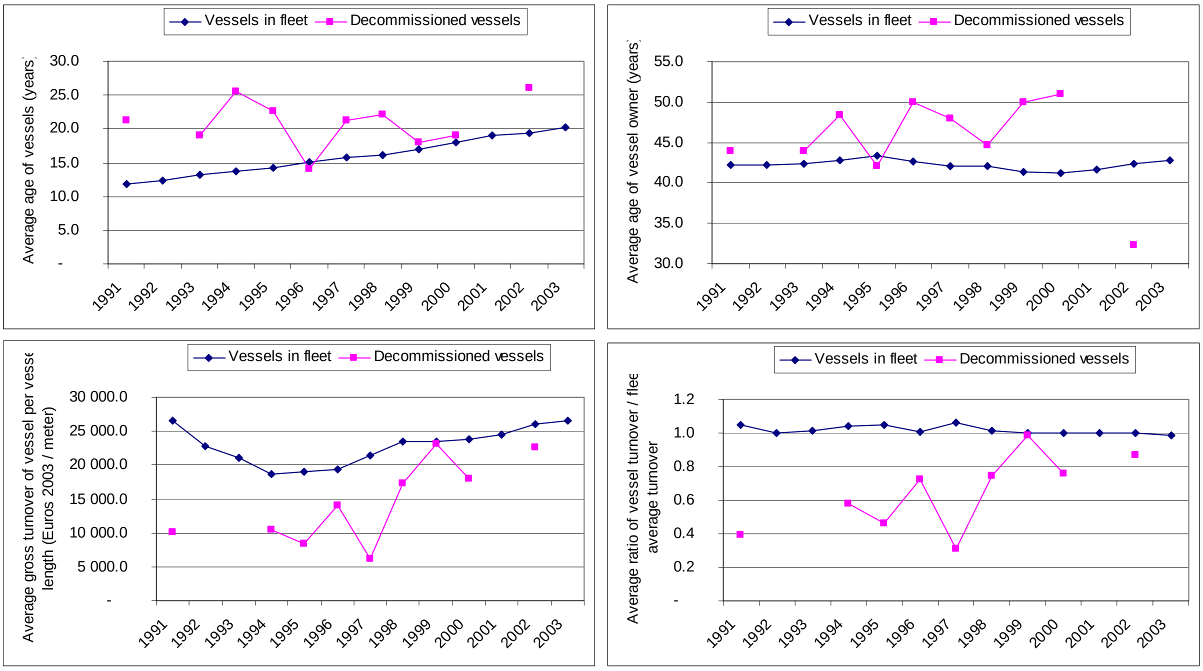




Left: number of decommissioned vessels per year; Right: cumulated number of decommissioned vessels.
Source : Ifremer – SIH, DPMA

The figure above presents the timing of vessel decommissioning in the fleet under study during the period, based on data available in the fleet register: after an initial effort in 1991, most vessel decommissioning in this fleet took place in the 1994-1998 period, with a peak in 1994-98. Evolution of the characteristics of decommissioned vessels as compared to the vessels that remained active in the fleet, during the period studied, are presented in figure 4. Variables considered are the average age of the vessels, the average age of the vessel owner, the average gross turnover (as a function of vessel length), and an indicator of individual vessel performance as compared to the average individual performance of vessels in the fleet. The two former variables are measured based on data from the fleet register. The two latter are derived from the French first sales monitoring system, and are measured in constant terms, using 2003 as the reference year.

Figure 4 – Characteristics of decommissioned vessels



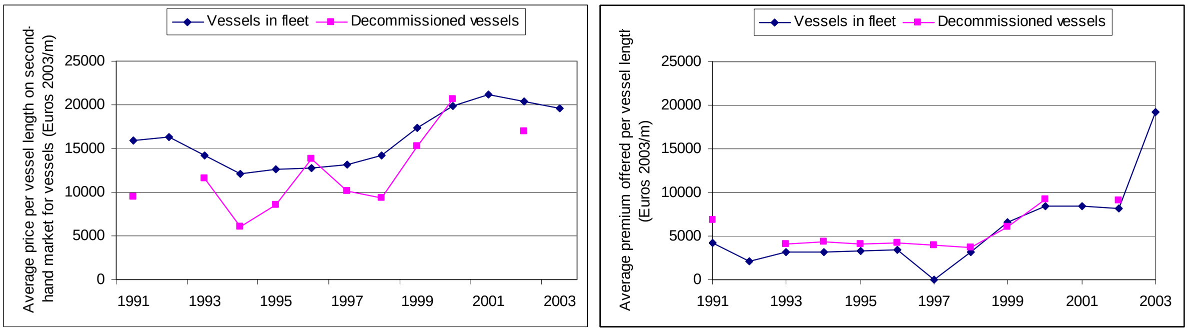
Top left: age of vessel; Top right: age of vessel owner; Bottom left: average turnover per vessel length (Euros 2003); Bottom right: average ratio of vessel turnover to average fleet turnover (Euros 2003).
Source : Ifremer – SIH, DPMA

Except for one year, decommissioned vessels have been consistently older than vessels remaining in the fleet, even with the increasing average age of vessels composing this fleet. For most years, the average age of owners of decommissioned vessels was greater than that of owners of vessels remaining in the fleet. Information available on the gross turnover of vessels shows that decommissioned vessels have been consistently below or at the level of gross turnover per vessel length observed for vessels remaining in the fleet. The indicator of individual vessel performance was calculated as the average ratio of gross turnover per vessel to the average gross turnover of the fleet. This ratio is almost always lower for decommissioned vessels than for vessels remaining in the fleet over the period.

In order to assess the incentives for vessel owners to decommission their vessels, the premiums offered to vessels in the fleet over the period were calculated, based on the above formula and taking into account the various modulations observed in the successive schemes. In order to assess the incentives for vessel owners to keep their vessels in activity, prices on the French second-hand market for individual vessels in the fleet were also estimated, based on an empirical model of the market for vessels over the 1985-2000 period (Guyader et al. 2003). Evolutions of the average calculated premium offered to vessel owners, and of the average price of vessels on the second-hand market are presented in figure 5. From this figure, it is apparent that decommissioned vessels have consistently fetched average prices lower than or equivalent to the average prices paid for vessels remaining in the fleet over the study period. Also, average premiums offered to vessels that were decommissioned were generally slightly higher than premiums offered to vessels that remained in the fleet[5].

[5] The fact that vessel prices always appear to be higher than the buyback premium is probably mainly due to the fact that additional subsidies for vessel buyback were paid by regional and local administrations, which have not been included here. Hence the total premium presented in the figure is a “theoretical” premium, which is mainly

Figure 5 – Evolution of average value of vessels and decommissioning premiums



Left quadrant: average estimated prices per vessel length paid on the second-hand market for fishing vessels;
Right quadrant: estimated premium per vessel length paid to decommissioned vessels.
Source : Ifremer – SIH, DPMA

In summary, it would seem from this preliminary description that vessels decommissioned from the 16-20m trawler fleet in South Brittany have tended to be older and less efficient than the vessels that remained in the fleet. This conforms with results obtained from the analysis of vessel decommissioning at the national level (Guyader et al., 2005). In addition, the analysis above shows that decommissioned vessels usually fetched lower prices on the second-hand market, an indication of the lower anticipated rents associated to holding on to such vessels. They were also offered slightly higher premiums under decommissioning schemes than the vessels that remained in activity.

3 A model of vessel exit

In this section, a simple model of the probability for a vessel to remain in or exit from the 16-20 meter trawler fleet of South-Brittany is developed. First, the general model proposed to predict exit is described (figure 6). Second, an empirical test of this model over the main years of vessel decommissioning plans is presented.

Given the definition of a fishing fleet used here, a vessel exit from a fleet implies either that the vessel is decommissioned, with the vessel owner receiving a premium paid by the Administration, or that the vessel is transferred to another fishing fleet in European waters. In practice, the latter option implies that the vessel owner sells his vessel to another agent who will either use the vessel to a similar purpose in another region along the French coast, or convert it to another commercial fishing purpose. The owner of the vessel that is being transferred is paid a price struck in a private bargain on the second-hand market for fishing vessels. In either case (decommissioning or sale), he will trade his vessel against an (immediately available) amount of money fixed according to the characteristics of the vessel.

Alternatively, if the vessel owner keeps his vessel, he can expect to gain the sum of discounted net returns from fishing with this vessel over the duration of his activity, to which he will add the discounted price at which he expects to sell his vessel when he decides to either retire from the fleet, change fishing vessel, or both.

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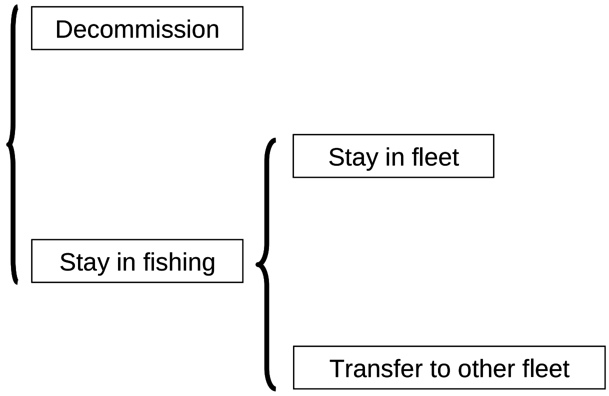
used in this analysis in terms of the relative value of this premium for decommissioned / non-decommissioned vessels and of trends in the premium.

Figure 6 – A model of vessel exit



We develop a model of the probability that a vessel will be decommissioned in a given year, i.e. exit the fleet permanently against payment of a premium by the administration. In principle, the net return from each alternative to which vessel owners are confronted can be defined as

$$NR_{i,0} = \begin{cases} R_0 \\ \left[\sum_{t=1}^{n} \frac{V_t}{(1+i)^t} \right] + \frac{R_n}{(1+i)^n} \end{cases}$$

$$NR_{i,1} = P_i$$

with $NR_{i,0}$ the anticipated net return from holding to a fishing vessel, R_0 the current value of the vessel on the second hand market, V_t the anticipated net returns derived from operating the vessel each year, i the prevailing interest rates in the economy, R_n the anticipated resale value when the vessel is sold, and n the number of years of activity before the vessel is sold. n could be for example the number of years of activity remaining to the vessel owner before retirement[6]. $NR_{i,1}$ is the anticipated net return of decommissioning the vessel, equal to the premium paid by the Administration (at national, regional and local levels).

3.1 A binary choice model of vessel decommissioning

In what follows, we develop a model of the probability for a vessel from the fleet to be decommissioned during the period under study.

[6] We assume in this case that vessel owners operate fishing vessels, which is generally the case in the fleet considered, and that they must sell their vessels when they retire, due to the regulatory framework operating in France.

Figure 7 – Modelling vessel decommissioning

The probability for vessel *i* to be decommissioned d_i is modeled as a binary choice (d_i=0 if vessel stays in fishing, d_i=1 if vessel is decommissioned). We assume that observed changes in vessel status in the fleet register reflect choices made by their owners: i.e. vessel owner *i* is assumed to maximize utility by selecting between the two possible alternatives *d*. An individual owner's indirect utility function for alternative *d* is given by

$$U_d(NR_d, \varepsilon_d) = V_d(NR_d) + \varepsilon_d$$

with NR_d the anticipated net return from alternative *d*, and ε_d the individual specific random components of the owner's utility. The owner will choose d_1 if

$$V_1(NR_1) + \varepsilon_1 \geq V_0(NR_0) + \varepsilon_0 \text{ or } \left[V_1(NR_1) - V_0(NR_0)\right] + \left[\varepsilon_1 - \varepsilon_0\right] \geq 0$$

A latent regression model is specified as

$$d^* = V(NR) + \varepsilon$$

with

$$V(NR) = \left[V_1(NR_1) - V_0(NR_0)\right] \text{ and } \varepsilon = \left[e_1 - e_0\right]$$

The observed counterpart to d^* is $d = 1$ if and only if $d^* > 0$

The probability that a vessel owner will decommission his vessel is (assuming a logistic distribution):

$$P_i = P\left[d_i = 1\right] = P\left[d^* > 0\right] = \frac{1}{1 + e^{-V(NR)}}$$

3.1.1 Data

The model was tested using the data available concerning key economic variables (cf. previous section) for years 1991 to 1998 included, as these were the years during which the main decommissioning schemes were implemented. Because of missing data as regards the characteristics of vessels and vessel owners and other key variables, only part of the observations on the population could be included in the analysis: the sample on which the model was estimated comprised between 60% and 82% of the vessels in the fleet depending on the year considered, with observed rates of exit comparable to those observed in the population throughout the period (18 vessels decommissioned in the sample between 1991 and 1998, whereas 29 vessels were decommissioned in the population).

Dependent variable

Two versions of the model were implemented, taking two alternative definitions of the choice set available to vessel owners.

Model A1

In the first version, full account was taken of the time needed for the fleet to be reduced: all the vessel-years for which information was available were included in the analysis. This led to count vessels present in one year as a decision to stay ($d = 0$), as opposed to vessels being decommissioned as a decision to exit ($d = 1$), with as a consequence a fairly small vessel exit ratio over the study period: 3.2% of total decisions (18 decommissioning choices, against 546 choices to keep the vessel in the fleet).

Model A2

The second version of the model worked on the assumption that the decision to decommission over the study period could be considered as a unique choice, that could be made at any point in the time period considered, independent of the exact timing of this decision. This led to select the last year for which vessels were present in the sample and the information available for the vessel in that year, in order to estimate the model. The effect of this approach was to increase significantly the proportion of the total number of decommissioning choices in the fleet. The vessel exit ratio in this case was 15,1% (18 exit choices against 101 choices to keep the vessel in the fleet).

Independent variables

The independent variables included in the equation for $V(NR)$ are presented in the table below. These include four variables pertaining to individual vessels: (i) the estimated price of individual vessels on the second-hand market, (ii) the estimated decommissioning premium paid for each vessel in a given year of the time period, (iii) the individual economic performance of vessels (in terms of gross return per vessel) as compared to the average performance of vessels in the fleet, and (iv) an administrative measure of the crew size of the vessel. Variables (i), (ii) and (iii) were calculated as a ratio of the variable to vessel length, in order to avoid scaling effects due to vessel size. In addition, the observed average rate of interest in the French economy during the study period was included as a fifth variable. This could be considered as a proxy for the discount rate applied by vessel owners to the anticipated future benefits derived from fishing with their vessel; it can also be considered as a measure of the cost of (re)investing in a fishing vessel. The proposed economic interpretation of each of these variables is summarized in the table below. Following the model specified in the previous section, variables (i) and (iii) are expected to influence negatively the probability for a vessel to be decommissioned during the study period, while variables (ii) and (v) are expected to influence this probability positively[7]. Variable (iv) can influence the decommissioning probability both ways: since it is used here as a measure of vessel size, its influence will be a function of the differences in the costs/earnings ratio for vessels of different sizes.

[7] If the interest rate is considered as a proxy for the discount rate used by vessel owners in their evaluation of the net present value of future returns from fishing with a vessel, then an increase in this variable will entail a decrease in this net present value, and an increase in the probability that a vessel is decommissioned, all else equal.

Tableau 1 - Independent variables

Variable name	Definition	Interpretation
LOGP_occas_m	Ratio of estimated value of the vessel on the second-hand market, to vessel length (logged value)	A measure of anticipations as regards the discounted value of owning a particular vessel in terms of future rents
LOGPr1EU_m	Ratio of estimated decommissioning premium for the vessel, to vessel length (logged value)	A measure of the public incentives provided for decommissioning a given vessel
Camit_SB	Ratio of vessel gross return to vessel length, divided by the average ratio observed for the fleet (index)	A measure of the recently observed productivity of the vessel, relative to the average productivity of vessels in the fleet
LOGTauxdinteret	Average interest rate (logged value)	A measure of the cost of (re)investment in a vessel and/or of preference for present revenues
LOGfEffectif_final	Vessel crew size (logged value)	A proxy for the size of the fishing unit, hence for vessel operating costs

3.1.2 Model results

Estimation results for model 1 are presented in the tables below. The model is globally significant, and all the coefficients are significant[8]. The performance of individual vessels as compared to the average performance of vessels in the fleet, the value of a vessel on the second-hand market, and the interest rate play negatively on the probability for a vessel to be decommissioned.

Tableau 2 – Model 1 estimation results

Variable	Coefficient	Standard Error	b/St.Er.|	P[|Z|>z]	Mean of X
Constant	13.2340560	12.7891373	1.035	.3008	
CAMITSB	-5.11661392	1.15326962	-4.437	.0000	1.02325699
LOGPR1EU	5.31673590	1.68264058	3.160	.0016	8.31026267
LOGTXD	-7.81032458	2.28467407	-3.419	.0006	2.08220978
LOGPOCCA	-5.07774357	1.11304016	-4.562	.0000	9.42609069
LOGFEFF	3.02609119	1.79230748	1.688	.0913	1.63613146

The fact that the interest rate has a negative influence on the decommissioning probability contradicts with the expected sign of this variable. This could be due to the fact that, while it is not a good measure of the discount rates used by vessel owners in their evaluation of future returns from fishing with their vessel, it provides a measure of the cost of investment in the fishery. Since a large proportion of the vessel owners who decommissioned their vessels did so to invest in another vessel, it could then be expected that the cost of (re)investment in the fishery plays negatively on the probability for vessels to be decommissioned.

[8] The different versions of the model were estimated using different statistical software packages (SPSS, SAS, LIMDEP); all the model runs yielded the same results.

The incentives provided by the Administration in terms of decommissioning premiums have a positive influence on this probability, as does the crew size of the vessel. In this case, larger vessels have thus a higher chance of exiting the fleet, which could be interpreted as the consequence of higher costs/earnings ratios for vessels of a given size class.

While the model is valid, its overall explanatory power is not very high, (the value of the MacFadden coefficient calculated in Limdep is 0.50627), and its predictive capacity remains limited, as is illustrated by the table below. This is probably due to the relatively small number of decommissioning choices, relative to the total number of choices included in the analysis, already discussed.

Tableau 3 - Frequencies of actual vs. predicted outcomes (model 1)

	Predicted		
Actual	0	1	Total
0	543	3	546
1	11	7	18
Total	554	10	564

Predicted outcome has maximum probability.
Threshold value for predicting Y=1 = .5000

Whereas the model provides 97,5% of correctly predicted choices, these are mainly choices to stay in the fleet (99,5% correct predictions), which are in much larger number in the total choice set. Model predictions as regards vessel exits is much less effective (39% of correct predictions).

Estimation results for model 2 are presented in the tables below. The model is globally significant, and its overall explanatory power is improved in comparison to model 1 (the value of the MacFadden coefficient calculated in Limdep is 0.59251). The coefficients have the same signs as in the previous model. Except for crew size, all are significant. The fact that the crew size variable is not significant in this case may be due to the correlation that exists between this variable and the other independent variables used in the estimation. Taking it out of the model however leads to a lower performance of the model, in terms of both overall explanatory power and predictive capacity.

Tableau 4 – Model 2 estimation results

Variable	Coefficient	Standard Error	b/St.Er.|	P[|Z|>z]	Mean of X
Constant	15.2482397	21.1229226	.722	.4704	
CAMITSB	-4.71301067	1.67574465	-2.812	.0049	.89748340
LOGPR1EU	6.46721385	2.63066477	2.458	.0140	8.21615999
LOGTXD	-4.93272483	2.76714437	-1.783	.0747	1.89157332
LOGPOCCA	-6.17796019	1.58457918	-3.899	.0001	9.36459946
LOGFEFF	-.70497089	2.29268328	-.307	.7585	1.63109956

The predictive capacity of the estimated model is also improved, as is illustrated by the table below. While 96% of the choices to keep the vessel in the fleet are still correctly predicted, 72% of exit decisions are now also correctly predicted.

Tableau 5 - Frequencies of actual vs. predicted outcomes (model 2)

	Predicted		
Actual	0	1	Total
0	97	4	101
1	5	13	18
Total	102	17	119

Predicted outcome has maximum probability.
Threshold value for predicting Y=1 = .5000

The marginal effects of the variables included in model 2 (as calculated in Limdep) are presented in the following table. All the variables appear to have a similar level of influence (in absolute value terms) on the probability that a vessel will be decommissioned. The two variables with the largest influence in this model are the decommissioning premium and the value of the vessel on the second-hand market, while the relative performance of individual vessels and the interest rate have an intermediate influence. The variable with the lowest influence is the crew size.

Tableau 6 – Model 2 marginal effects

	Marginal effect for
Variable	**All Obs.**
ONE	22618
CAMITSB	-.06991
LOGPR1EU	.09593
LOGTXD	-.07317
LOGPOCCA	-.09164
LOGFEFF	-.01046

In both versions of the estimated model, the constant term is not significant. This could be due to the fact that an important explanatory variable has been omitted from the analysis. Different variables summarizing the information available on fishing vessels, their economic performance, as well as the economic context in which they operate, and the biological status of stocks were tested as extra explanatory variables. None of the variables used allowed an improvement in the significance and/or the predictive capacity of the model. It is possible that some key variables, for which no information is available to the authors, also influenced the probability for vessels to be decommissioned. More probably, the data used to measure the economic performance of vessels (i.e. gross turnover), or the incentives provided by decommissioning premiums may be incomplete, hence only part of the influence of these variables is effectively captured in the estimation. In addition, the model might be improved by accounting explicitly for the fact that there are two options for a vessel to remain in fishing: i.e. stay active in the fleet under consideration, or transfer to another fleet via the second-hand market for vessels. This is developed in the following section, using a multinomial model of vessel exit.

4 Conclusion

In this section, we developed a model of the probability that a vessel would be decommissioned from the fleet of 16-20m trawlers operating from the ports of Southern Brittany in the 1991-1998 period, and tested this model against the data collected in the TECTAC project concerning this fleet. The nature of the choice considered leads to empirical difficulties in estimating this model: decisions to decommission a vessel represent only a limited fraction of the decisions to keep vessels in activity, in any given year, or throughout the study period. Hence, two versions of the model were tested, taking two different perspectives on the definition of the choice set. Both versions provide empirical results which lead some credit to the model of decommissioning choices that was developed; the second version has a better predictive capacity. Overall, results from the analysis suggest that, in this fleet, decommissioned vessels were the least efficient and least valued ones. It also appears that decommissioning choices were directly influenced by the cost of investment in the French economy, which is probably a consequence of the fact that a large proportion of owners decommissioned their vessels in order to buy another one. These results would thus suggest that the overall impact of decommissioning schemes in terms of reducing the fishing capacity of this fleet have been limited in practice. This, in addition to the various technical improvements observed aboard vessels (see report XX), has contributed to the marked increase in landings per vessel observed from the mid-90ies.

5 References cited.

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