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The price effect of expanding fish auction markets¹

Patrice Guillotreau (1) and Ramón Jiménez-Toribio (2)

(1) University of Nantes (LEMNA), France ; patrice.guillotreau@univ-nantes.fr

(2) University of Huelva (MEMPES-AEA), Spain

Abstract

Fish markets can be expanded by two means, first by attracting newcomers in a local trading room and secondly by allowing remote bidders to participate. In both cases, electronic systems have played a key role in French primary fish markets. The computerisation of trading rooms started in the mid-1980s while connection through intranet or internet systems first started in the mid-1990s and then has spread more actively in France since 2007. However, the socioeconomic impact (on prices for example) of expanding markets by electronic means is far from being clearly predictable. Firstly based on an econometric analysis, this article presents evidence of increases in price level and variability after the implementation of local electronic auction systems. Secondly, a comprehensive survey of the 40 fish auction markets in France brings additional information about the effects of electronic remote bidding on fish prices. The analysis of these two empirical outcomes uses the cross-fertilization of the positivist auction theory in economics with the constructionist approach of Actor-Network Theory (ANT) in sociology to enrich the potential hypotheses lying behind the study of the structural impact of electronic systems on market prices.

Key-words: Auction markets, Electronic systems, Fish prices.

JEL Classification: C22, D44, Q11, Q22

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1. Introduction

This paper looks empirically at the impact of expanding fish markets by electronic means on price levels. Two different ways of enlarging markets have been made possible by the use of new technology: either by attracting new buyers in local or network trading rooms, or more recently by allowing remote bidders to buy in a local fish market. What can be expected in terms of prices and market organisation from such changes?

The theoretical conditions under which different auction systems result in different outcomes are well known in economics since Vickrey's seminal findings (Vickrey 1961, Wolfstetter 1996, Klemperer 1999, Maskin and Riley 2000). Previous empirical studies also showed a price difference when comparing a mere direct sales system to an auction system in the specific case of fish markets (Armstrong 2001, Helstad *et al.* 2005). When it comes to the impact that electronic auction systems may have on price levels and variability, empirical analyses are very rare and the expected outcome is unclear (Graham 1999).

The computerisation of trading rooms usually precedes a larger interconnection of market places by remote bidding through Internet. Interconnection must not be seen as a "natural" extension of computerisation but rather as a plan of the auction market managers to support prices by enlarging markets, like a "visible hand" shaping the future limits of the markets (Bestor 2004, Callon 1998). Therefore, the expected outcome must be acceptable for both fishermen and processors. Overall, the present high degree of competition and integration for most fish markets (Asche, *et al.*, 2004, Nielsen, *et al.*, 2009, Jiménez-Toribio, *et al.*, 2010) would lead one to expect a low impact of interconnection on local prices. It is nonetheless hard to believe that distant intruders in the auction system, by disrupting the social game in force in most fish markets, will not create asymmetry, new risk perception and therefore new behaviours by local traders.

The present study hypothesises that the implementation of electronic devices is not neutral on prices, even though the market organisation itself remains unchanged (same auction ascending regime for instance). Price changes should not be perceived as the mere products of a market expansion (e.g. same number of producers and more buyers), but rather as a more profound change of the market format that is obtained by electronic equipment or by remote bidding.

In the present study (section 2), evidence is given through a multiple break searching procedure (Bai and Perron, 1998, 2003a, 2003b) that the adoption of electronic auction systems – substituting the previous shout auction or pairwise trading in two French ports - has increased both price levels and volatility of live prawns (*Nephrops norvegicus*) (Guillotreau and Jiménez-Toribio 2006). Secondly, more changes are expected from the recent introduction of remote bidding access. In the Industrial Organisation literature, such a technological change implies an enlargement of markets which is known to produce higher price volatility after the deregulation of an oligopsonistic market (Slade, 1991)¹. Although the evidence of a long-term increase in metals price volatility was not found to be so clear by other authors revisiting Slade's conclusions, it leaves little doubt for them that Slade was right when stating that producer list prices (like in the case of pairwise trading) were found less volatile than exchange (auction) prices (Figuerola-Ferretti and Gilbert, 2001).

Although the remote auctioning technology has been developed very recently in France on a large scale, a substantial impact on prices has already been observed by the users. From a sociological perspective based on a comprehensive survey of the 40 auction markets along with a few in-depth interviews with managers, we show in section 3 that the price effects of remote bidding access seem to reflect a profound revision of auction market conditions (affiliation and asymmetry in particular) rather than the simple impact of market enlargement shifting the demand curve. The dual approach of both sections leads to a discussion about the compatible use of both positivist econometric results and the more constructionist Actor-Network Theory (ANT) approach to markets, in order to understand the changes that are under way.

2. Impact of a local electronic trading system on fish prices

This section begins with an historical look at the auction system as the dominant form of market organisation for fish products in Europe, where electronic equipment has recently begun to be used. Several outcomes of the standard auction theory as well as empirical results are synthesised in this section to stress the impact of electronic bidding systems on local market prices.

2.1 Fish auction markets and the introduction of electronic equipment

Auction markets are the prevalent trading institution in wild-caught seafood markets (Anderson and Martínez-Garmendia, 2003; Kirman 2001). In France, their introduction in big harbours such as Boulogne sur Mer or Concarneau dates back to the late 19th century but they could be even older (Matras-Guin 1987). The initial adoption of auction systems was nonetheless controversial: “in the mid-19th century, there was resistance to auctioning in British livestock markets because sellers feared collusion between buyers” (Graham, 1999:176). Nowadays, fishermen still complain about the supposed market power of primary buyers in the auction room and refuse to give information about their catches ahead of sales (Debril, 2000).

The trading organisation "varies from location to location, for little obvious reason" (Kirman, 2001:157). It is the same for the introduction of electronic bidding systems. Countries such as France

¹ This IO result challenges to some extent the theoretical expectations of conventional microeconomic literature, where higher competition (hence a more elastic supply curve) should reduce price volatility in the case of demand shocks.

or Spain are considered to be open to the implementation of electronic systems, whereas this is not the case in the United Kingdom² or Japan (Luc Schelfhout, cited by Graham 1999, p.183; Bestor 2004).

The type of sale also differs substantially from one fish market to another (Armstrong 2001): ascending "English" auctions, descending "Dutch" auctions, "Japanese" auctions through a closed-seal bid, second-price (or Vickrey) auctions, etc. In Europe, two systems are commonly implemented for fish markets: English and Dutch auction systems.

[Figure 1 here]

Nearly all of the primary fish markets in France are now equipped with modern electronic trading systems. They were first introduced in Lorient as early as 1979 but they were then abandoned after a month because the operators mistrusted the use of technology. New electronic bidding systems were installed in the mid-1980s (Port-en-Bessin 1986, Sète 1986, Saint-Guénolé 1987, Le Croisic 1988, La Rochelle 1988). In most cases, the use of electronic technology was limited to a local computerised trading room. In 1993, only one third of the fish auction markets in France had substituted the shout system for an electronic device. A decade later the proportion of equipped harbours is over 75% of the 40 fish auction markets (figure 1b). Very few markets have retained the old shout auction system despite its flexibility. For instance, some traditional auctioneers can choose between a descending or ascending system if they estimate that the price is too high or too low respectively.

The auditorium trading system fits in with the Walrasian view of "perfect markets" but mobile systems were implemented in many important harbours as a compromise between the modern computer equipment and the former shout auction system. The so-called "Moby-clock" system was implemented by Aucxis Trading Systems (ATS) as "an electronic auction clock mounted on a battery powered vehicle which can move through the auction hall" (Graham, p.182). Fish are not conveyed on a rolling bed, but the electronic clock itself is driven by the auctioneer around the fish boxes. Consequently, bidders can see the fish. They are face-to-face around the boxes and can also observe each others' behaviour. In most cases sellers are also willing to use this "close-to-the-fish" system because quality can be more easily compared among fish boxes.

2.2 What can we expect from the introduction of electronic auction systems on primary fish markets?

The empirical impact of implementing an electronic auction system on fish prices remains unclear. "The argument that would convince most fishermen of the benefits of (electronic) auctions would be the fact that their introduction leads to the payment of higher prices for their fish. Whilst there is anecdotal evidence that this can be the case, the underlying arguments for the achievement of higher prices at electronic auctions are weak" (Carleton, 2000:56-57). Higher prices are nonetheless observed in fish auction markets as compared to direct sales according to Helstad *et al.* (2005:307). Supply-side explanations are proposed, (higher costs of handling fish, homogeneous lots, smaller quantities sold through auctions, etc.) but, surprisingly, no reference is made to the market organisation itself and the way buyers meet sellers.

Whatever the impact on prices and particularly in the case of Dutch bidding, the time period of sales in electronic auctions is considerably shorter, resulting in significant improvements (higher quality of

² The experience of Lochinver and Kinlochbervie in Scotland are very interestingly examined by Graham (1999, p. 184-198). Two arguments were used by opponents to electronic markets: the sales of important lots reduce the time advantage of implementing Dutch electronic auctions, the cost of grading fish for remote bidding could have been important. Mostly, local buyers feared to "lose" the fish that may have been sold in other continental ports. A conflict of interests between the harbour owner (Highland Harbours) and the managing company (Lochinver fishselling company) also appeared to have played a significant role in this failure.

fish, no congestion of suppliers, faster access to consumer markets). Some estimates suggest that organising sales between 25 suppliers and 25 buyers would take around 3 hours in a live (shout) system, against only half an hour with a Dutch electronic system (Graham, 1999:183). However, other evidence in Lorient shows that sales in simultaneous pairwise trading takes shorter time than electronic bidding organised lot by lot.

Four decades ago, Vickrey demonstrated the equivalence of revenue between Dutch and English auctions (Vickrey, 1961). The equivalence means that the expected revenue is the same and that rational bidders follow the same strategy whatever auction system is in force. The theorem of revenue equivalence is based on several central assumptions:

- Bidders cannot be split into groups with the members of one group systematically valuing the item higher than the members of other groups (symmetry of bidders).
- Their private values are independent and identically distributed (iid) (non affiliation).
- The absence of collusion among bidders.
- Bidders and sellers are risk-neutral.
- Payments are a function of bids only (and not of travelling distance for example).

Without these assumptions, the revenue equivalence theorem does not hold and prices can differ according to the system in use (Armstrong 2001; Klemperer, 1999; Milgrom and Weber, 1982; Wolfstetter, 1996). For instance, in asymmetric auctions where private values are not drawn from an identical probability distribution, a Dutch auction system may not select the bidder who has the highest private value. Bidders with higher valuations tend to submit a bid below their private value because their probability of winning the bid is higher due to the presence of other bidders having a lower private valuation. They can therefore bid less aggressively to outbid the competitors, depending on the distribution of the two groups.

Secondly, independence means that private values are not positively correlated. When they are, it affects the outcome of a Dutch auction system negatively, unlike an English auction system where the 'affiliated' bidders tend to bid more aggressively. In the latter case, they do so because the bidders who remain in the auction can observe that other bidders have also remained in the bidding process, and therefore can infer that these other bidders' valuations of the commodity are at least as high as the current price.

Finally, Dutch systems are also affected by the perception of risk. The bidders with higher valuations are less likely to hide their preferences if they are unwilling to lose the auction by waiting too long. Dutch systems can therefore lead to higher prices than those achieved with English systems as a result of buyers' responses to the risk of losing the lot.

2.3 A structural break model applied to a shellfish price series

In order to test for the impact of implementing electronic auction systems on fish prices (but not considering remote bidding at this stage), a time series analysis is undertaken by comparing the dynamics of prices for the same product (live prawns, *Nephrops norvegicus*) in two French ports (Lorient and Le Guilvinec) which are 150 km apart and introduced an electronic auction system on nearly the same date. The data are introduced first, then the econometric models and finally the results.

2.3.1 Data

Two different fish markets are selected to illustrate the variety of auction systems: Lorient and Le Guilvinec. Both concurrently implemented electronic trading systems respectively in March and April 2002.

Lorient offers a dual system for coastal and offshore fleets. This port has been selling fish in a trading room with descending-ascending (equivalent to English) auctions since March 1999. On March 19th

2002, the market for coastal species was totally re-organised with the implementation of a Dutch bidding system in the fish hall. Prior to that system the fishermen used to sell shellfish in a pairwise trading organisation. This system was described in the case of the Marseille wholesale fish market (Härdle and Kirman, 1995; Weisbuch *et al.*, 2000; Kirman, 2001) which operates in a similar fashion to the system previously in force in Lorient. All transactions were bilateral and no prices were posted. "There is little negotiation, and prices can reasonably be regarded as take-it-or-leave-it prices given by the seller" (Kirman, 2001:159). It is worth noting that entry barriers for fishmongers were lifted in Lorient with the new trading system, as before they had no access to the market.

The second example is given by seven ports in south Brittany, all managed by a single entity, the Chamber of Commerce and Industry in Quimper. One of these ports -Saint Guérolé- implemented a Dutch system in a trading auditorium in July 1987. Fifteen years later in April 2002, six neighbouring shout auction systems -including that of Le Guilvinec- were equipped with a mobile electronic trading system, with an ascending bidding process, similar to that of the offshore fish market in Lorient. Previously, the market of Le Guilvinec and its five neighbours were organized as shout English auction markets.

It is difficult to isolate the pure effect of electronic markets on prices from other effects. Prices for the same species can fluctuate greatly between different ports because of quality, different grading systems, low volumes, distance to markets, etc. The two Breton ports -Lorient and Le Guilvinec- were chosen to compare the price levels (P_l and P_g) of the same commodity -live prawns (*Nephrops norvegicus*)- with two different auction systems implemented at around the same date³. These two fish auction markets are separated by a distance of about 150 km and one of them -Le Guilvinec- is the market of reference for live prawns. The two markets are more or less equal in terms of landings, with an average of 770 and 600 tonnes respectively per year. The sample of average nominal weekly prices covers the period between January-1 1999 and December-52 2003 (figure 2), and shows a differential in favour of Le Guilvinec, particularly at the beginning of the period.

[Figure 2 here]

Market integration is understood here in a weak definition of the law of one price, i.e., by the extent to which supply and demand shocks are transmitted from one market to another. The elasticity of price transmission should then be estimated as close as possible to unity. Such a hypothesis relies on low transaction and transportation costs for homogeneous goods, which is the case for live prawns of the same quality type sold in two fairly close markets where some of the primary processors are present in the two ports. The two marketplaces do not have to trade intensively to be found integrated: it can be sufficient that buyers and/or sellers regard the two locations as alternatives (Fackler and Goodwin, 2001). Such a definition of market integration (convergence of prices in the long-run through the cointegration or the correlation of two or more time series) has already been applied to other types of fish markets which have proved to be highly integrated overall (Asche, et al., 2002, Asche, et al., 2004, Nielsen, 2005, Nielsen, et al., 2009, Jiménez-Toribio, et al., 2010).

Market integration is usually investigated by using prices in logarithmic form. This functional form is convenient to linearise a market integration or a mark-up model (of the type $p_1 = \alpha.p_2^\beta$) as it then offers the opportunity of testing the value of β (i.e. the elasticity of transmission between the two prices) which should be close to unity in the case of perfect market integration. Before estimating the univariate and VAR models, several types of unit root and stationarity tests, one of them considering different assumptions about the presence of a structural break, were performed on the two series (ADF, PP, DF-GLS, KPSS, ZA)⁴. Substantial evidence of stationarity is found for the two series. In most papers using economic time series, economic variables are found to be non-stationary (Nelson and Plosser, 1982), although no theoretical justification supports this evidence in commodity prices

³ More comprehensive results can be found in Guillotreau and Jiménez-Toribio (2006).

⁴ The results can be found in Guillotreau and Jiménez-Toribio (2006).

ADF: Augmented Dickey-Fuller; PP: Phillips-Perron; DF-GLS: Dickey-Fuller-Generalized Least Squares; KPSS: Kwiatkowski-Phillips-Schmidt-Shin; ZA: Zivot-Andrews.

(Wang and Tomek, 2004). In our case study the series were found to be $I(0)$ which led us to use standard econometric techniques instead of cointegration.

2.3.2 A multiple break searching procedure

Bai and Perron (1998, 2003a, 2003b) consider several structural changes in an economic relationship estimated by least squares. First the time series properties need to be identified because this technique is only applicable to stationary data. The main contribution of Bai and Perron lies in the partial structural change modelling that the procedure offers. They propose several tests to determine the number of structural breaks in a relationship. One of these tests considers the null hypothesis of k change(s) against the alternative hypothesis of $k+1$ changes.

The Bai and Perron (1998, 2003a, 2003b) model can be expressed as follows:

$$\begin{aligned} p_t &= x_t' \beta + z_t' \delta_1 + u_t & t = 1, \dots, T_1 \\ p_t &= x_t' \beta + z_t' \delta_2 + u_t & t = T_1 + 1, \dots, T_2 \\ &\vdots \\ p_t &= x_t' \beta + z_t' \delta_{m+1} + u_t & t = T_m + 1, \dots, T \end{aligned} \quad (1)$$

where p_t represents the dependent variable, x_t and z_t are vectors of covariates with $(f \times 1)$ and $(g \times 1)$ elements respectively and β and δ_j ($j=1, \dots, m+1$) are the corresponding vectors of coefficients. The convention $T_0=0$ and $T_{m+1}=T$ is used. The indices (T_1, T_2, \dots, T_m) denote the unknown breakpoints. In a pure structural change model, all coefficients are subject to changes at the same date and the corresponding variables should then be placed in z_t ($f=0$). In a partial structural change model, some of the variables whose coefficients are not subject to changes are placed in x_t ($f \neq 0$).

2.3.3 Results

2.3.3.1 Univariate models

As an argument often advocated by the promoters of electronic auction systems, a supposed advantage of such systems is that it would increase prices on the market. If this argument is correct, the technological changes should increase the price in each market, irrespective of what happens in the other market. For this reason, univariate models have been considered in order to determine the impact of the new trading system on the price of each market.

Using the multiple break searching procedure described in subsection 2.3.2, the price of live prawns in Lorient and Le Guilvinec are first analysed through the following model:

$$p_t = \mu_j + \sum_{i=1}^{51} \alpha_i SD_i + \rho p_{t-1} + u_t \quad t = T_{j-1} + 1, \dots, T_j \quad (2)$$

for $j=1, \dots, m+1$, where m is the potential number of breaks. p_t represents the variables Pl (Logarithm of the price in Lorient) and Pg (Logarithm of the price in Le Guilvinec), μ_j is the intercept (subject to structural change), SD_i represent 51 seasonal dummies (not subject to structural change), p_{t-1} is the one period lagged price (ρ not being subject to structural change) and u_t is the error term. Hence, the breaks are assumed to be in the constant of the regression.

The autoregressive term has been introduced to eliminate the serial correlation of the residuals. The Ljung-Box (LB) test for serial correlation has been performed for both models. Results of the Bai-Perron procedure for Pl and Pg are given in tables A1 and A2 (annex), respectively. No problems of serial correlation were encountered in the residuals of the two models at the 5% significance level. For Lorient, one single break date was selected by most of the criteria on week 2002:14 (April 1st 2002), i.e. just following the introduction of the electronic system. Once we have estimated model (2) for the prices in Lorient, the model can be expressed as follows:

$$\begin{aligned}
 PI_t &= 2.34 + \sum_{i=1}^{51} \alpha_i SD_i + 0.19PI_{t-1} + u_t, \quad t = 1999:2, \dots, 2002:14 \\
 &(0.16) \quad (0.06) \\
 PI_t &= 2.49 + \sum_{i=1}^{51} \alpha_i SD_i + 0.19PI_{t-1} + u_t, \quad t = 2002:15, \dots, 2003:52 \\
 &(0.17) \quad (0.06)
 \end{aligned} \tag{3}$$

$$R^2 = 0.76; \quad \bar{R}^2 = 0.69$$

Standard errors are in parentheses. After the break, the intercept increases, implying a relative increase of live prawn prices in Lorient since the electronic auction system came into force. For Le Guilvinec, one single break is found at week 2002:16 (April 15th 2002), i.e. the week just preceding the implementation of the electronic auction system. The intercept also increases, although to a lesser extent:

$$\begin{aligned}
 Pg_t &= 2.07 + \sum_{i=1}^{51} \alpha_i SD_i + 0.42Pg_{t-1} + u_t, \quad t = 1999:2, \dots, 2002:16 \\
 &(0.17) \quad (0.06) \\
 Pg_t &= 2.15 + \sum_{i=1}^{51} \alpha_i SD_i + 0.42Pg_{t-1} + u_t, \quad t = 2002:17, \dots, 2003:52 \\
 &(0.18) \quad (0.06)
 \end{aligned} \tag{4}$$

$$R^2 = 0.82; \quad \bar{R}^2 = 0.77$$

2.3.3.2 Multivariate Vector Autoregressive (VAR) model

The relationship between the two prices is now tested to see whether the introduction of electronic auction systems has affected the price linkage itself. If both prices have increased concurrently, the price relationship may not have been modified accordingly.

The analysis is performed through the estimation of a Vector Autoregressive (VAR) model (results in tables A3, A4 and A5 in the annex). There is one structural break according to the sequential procedure for the first equation of the VAR model (where the price in Lorient is the dependent variable). The location of the detected structural break is 2001:52 (25 December 2001; 95% confidence interval between 2001:44 and 2002:15).

There is a structural break in the second equation of the VAR model (where the price in Le Guilvinec is the dependent variable) according to the sequential procedure. The location of the break is 2002:16 (15 April 2002; 95% confidence interval between 2001:36 and 2002:36). The former can be explained by the implementation of the Euro and the latter by the implementation of the electronic auction system in both markets, which was at almost the same time. Impulse response models indicate that Le Guilvinec can be considered as the leader market⁵.

2.3.3.3 A significantly positive impact of electronic auctions on both market prices

The first results based on the univariate models quite clearly indicate that a single structural change matching the specific date of implementation of the electronic systems has modified the price setting conditions in the two ports considered separately. The two prices have had a positive impact after the system change, with a bigger price increase in Lorient (+16%) than in Le Guilvinec (+8%), despite a larger increase in quantity in Lorient (Table 1).

[Table 1 here]

⁵ The results and discussion are not detailed in this article but can be found in Guillotreau and Jiménez Toribio (2006).

The Moby-Clock (equivalent to an ascending regime) introduced in Le Guilvinec does not represent such an important change for the bidders as the one in Lorient where a modern electronic system (with a descending auction) substituted the traditional pairwise trading organisation. In the latter, the market has been significantly transformed by newcomers and new trading behaviour. Many other fishing boats have joined Lorient because of attractive prices, and many fishmongers now come daily from towns located 100 miles away because of the easier access to the bidding process (unlike in the previous trading organisation where local primary processors held a dominant position) and the fact that Lorient is closer to the big city markets (Nantes, Rennes, Angers). The sales of live prawns in Lorient have increased from an average of 12 tonnes per week before the break to nearly 18 tonnes afterwards (+50%), whereas the growth was only 18% in Le Guilvinec (from 11 to 13 tonnes).

With regard to auction theory, several reasons may explain the bigger impact on prices in Lorient. This port has implemented a Dutch (descending) bidding system whereas Le Guilvinec preferred an English ascending auction system. The revenue equivalence theorem, which asserts that equilibrium prices are independent of the auction system, only holds under certain critical assumptions (Armstrong, 2001). The actual price behaviour in these two ports suggests that at least two of these assumptions do not hold in this case.

In particular, the symmetry assumption no longer holds in Lorient because some bidders (fishmongers) present higher private valuations than others (local primary processors). During the first hour of the sales, distant fishmongers with higher private valuations tend to dominate the auction by paying higher prices before leaving the port early. In the final hour, only local primary processors with lower private values are present, and the price falls significantly. Prices can fluctuate a lot between the beginning and the end of auction sales. The two groups of bidders are clearly asymmetric. The impact on prices depends on the precise nature of the two distributions of private values and on their combination. The effect is presumably neutral in Le Guilvinec where the community of buyers has not changed since the introduction of the new trading system, and is positive in Lorient after the collapse of the entry barrier to agents (fishmongers) with higher valuations. In the same respect, one may consider that the perception of risk has changed more significantly with the shift from the pairwise trading to an electronic Dutch auction system (due to the well-known winner's curse effect), than with the simple transformation of the English shout auction into an electronic English auction system.

The bigger impact on average prices observed in Lorient is presumably more due to the substitution of auctioning for the pairwise trading organisation previously in force, than to electronics *per se*. Asymmetry and the perception of risk have simultaneously increased since the implementation of the new system. In such circumstances a Dutch system produces higher prices than an English auction system (Maskin and Riley, 2000). The probability of winning the auction is significantly affected by the implementation of a Dutch system: an English system would provide more information about other bidders' private valuations.

Interestingly, the introduction of the Euro represented a good opportunity for the implementation of electronic auction systems with support from harbour managers and with the assistance of European and regional subsidies. The introduction of the Euro seems to have been perceived differently in each place without affecting the average price in the two markets separately (otherwise, two break dates would have been found as the Bai-Perron procedure allows). The volatility of prices may have increased after the implementation of the Euro: managers interviewed reported irrational behaviour of bidders in the weeks following the introduction of the single currency, as if the Euro currency did not have the same value as French currency after conversion. This volatility was perhaps amplified by electronic auction systems since the latter tend to exhibit higher prices with larger variation than direct sales on fish markets (Helstad *et al.*, 2005:310). It would also fit with IO literature results whenever an oligopolistic (or oligopsonistic) market is expanded (Slade, 1991). We used the same measure of volatility as in Figuerola-Ferretti and Gilbert (2001), the standard deviation of price returns for each period, to show that the increase in the variance of price returns was even greater for Le Guilvinec (+5.6 pts) than for Lorient (+2 pts), despite a more fundamental systemic change in the latter case.

3. The introduction of remote bidding in French fish markets

In a more sociological perspective, the introduction of remote bidding systems in French fish markets is analysed through an Actor-Network Theory approach (Callon, 1999). First the theoretical view on market technology is introduced, then an analysis of the historical development of electronic fish markets in France, and then the enrolment of technology to prepare a large-scale interconnection of marketplaces.

3.1 The ANT view on market technology

The adoption of new technology in the trading system can be viewed as deterministic. This means that a technological change modifies the way agents interact, as if it was elaborated outside any social influence, having its own intrinsic dynamics. Conversely, a pure constructionist approach sees technology as fully embedded in the social world. A third approach is proposed by the Actor-Network Theory (ANT), which “seeks to understand the process by which a network is constructed by enrolling social and material elements” (Callon, 1986), that is, how the social groups involved in the innovation process interact through their power relationships. Technology and social networks are not separate elements, but technical change cannot be entirely explained by the bargaining position of actors.

When applied to markets, the ANT approach pays attention to the social and technical mechanisms by creating an acceptable compromise between agents with different interests. It considers that the diversity of market forms, even in culturally close economies, provides evidence that markets are not shaped only by economic efficiency and transaction cost reduction motives. The way supply meets demand is analysed as a complex algorithm, that is a logical programme defining rules and operations that are simple enough to be calculated by a machine (Muniesa, 2000). Obviously, these algorithms are not defined independently from their users: “in negotiating the form of the technology of the electronic market, the negotiation is acting as a surrogate for negotiating the social structure of the market network” (Graham, 1999:14).

Two concepts are suggested to make the process explicit by which the rules are designed: framing and overflowing (Callon, 1998:16). The first one is inspired by the sociologist Erving Goffman to describe the frame in which interactions take place and whose meaning and nature impose themselves on the participants. In the context of markets, the traded elements must be properly and objectively defined, disentangled from their initial environment to permit the transfer of property, and calculable. The theoretical underlying idea is to create a space of calculability by making trading relationships as impersonal as possible. Some authors talk about “lock-in” to define “all the mechanisms through which the evolution of a market or an institution becomes more and more irreversible” (David 1984, cited by Callon 1998:48).

The second concept of overflowing depicts the impossibility of keeping transactions in the frame. Any attempt to internalise externalities will produce new externalities. Callon uses a metaphor to refute the division of research between sociologists and economists: his intention is not “to warm-up the cold *homo æconomicus* by the additional soul of *homo sociologicus* (including his values, emotions, moods...)” (Callon, 1999). In a mainstream view, economists would consider that framing is a desirable objective, and overflowing (i.e. the so-called externalities) should be avoided. In contrast sociologists would claim that framing is expensive and imperfect, and therefore that overflowing is more commonly observed. It appears to be far more productive to distinguish between a “cold” environment, when market institutions are locked in and accepted as such by economic agents, and a “warm” context when the institutional format of market is not yet stabilized. Economic calculus is obviously made easier in the cold framework. “The intrinsic ability to negotiate (...) lies less in laws and institutions (...), than in the existence of a technical infrastructure of instruments and devices provided by them” (Callon, 1999, p. 420).

Typically, the introduction of electronic equipment in primary fish sales offers an opportunity for agents to negotiate their market positions. Electronic auction systems have been introduced as a solution to the imbalance between buyers (primary processors) and sellers (fishermen) in favour of the latter. The objective of a major supplier of electronic trading systems in Europe is “to make (your) market more competitive, more transparent, and try to keep the added value on the production level as much as possible” (Graham, 1999:178).

Other motivating factors can influence the decision to implement electronic markets, such as preparing local buyers to become remote buyers for their own trading system, and consequently accepting distant newcomers in the local sale system. Fish markets have been expanded either by introducing local newcomers having different private values (mongers vs processors), as seen in section 2, or by attracting remote bidders through Internet. In the latter case, the socioeconomic implications are different because remote bidding requires a bigger “framing” effort (Callon 1998, Debril and de Saint Laurent 2003) and results in new habits for bidders such as non-viewing procurement. This new context is likely to alter the computing ability of agents, thus affecting the level and variability of prices.

3.2 The introduction of remote bidding systems in fish markets

An in-depth study of the 40 fish markets in France (LEN-Corrail 2007) complemented by both a phone survey of 6 auction managers in June 2007 and qualitative data collected from other references (Debril 2000, Debril and de Saint-Laurent 2003) has provided new information about the implementation and effects of electronic systems in French fish markets, in particular with respect to the introduction of remote bidding.

3.2.1 Mobile auction systems as a committing compromise

As demonstrated by Debril and de Saint-Laurent (2003), the “Moby-clock” system (see section 2.1 for a description) takes into account the interests of all the stake-holders: sellers, buyers and auction managers. Fishermen prefer to sell fish on-view to make the quality more visible for which they have been working hard onboard over several days. Buyers like the discretion of electronic devices that can be hidden inside pockets. Finally, auctioneers appreciate the apparent neutrality and transparency provided by the electronic signals: “*From the moment a buyer has pressed his button, he cannot argue any longer, nobody else can press the button for him*” (as said by an auction manager, cited in Debril and de Saint-Laurent 2003). This descending-ascending system is not the first choice of the auctioneers because it takes longer to sell fish than with a Dutch system. However, it quite closely reproduces the former shout auction system and gives bidders more opportunity to exchange information during the sale (with a risk of affiliation). An opening price is proposed by the auctioneer before going down around the clock. When a buyer makes a bid the clock stops with three lights being switched on for about one second each. During this signalled delay, other bidders may intervene with a higher bid, until a single buyer remains in the auction. This system looks more like an English auction system and takes more time than a simple Dutch system (which ends with the first bid), this explains why the latter is preferred in markets for coastal species where the number of lots is higher (there is a wider variety of species in smaller quantities).

Despite its acceptance by both sellers and buyers which has led to the success of “Moby-clocks”, from an ANT perspective, one may consider that this electronic equipment has been *enrolled*⁶ in a strategic way by auction managers who have already planned to extend the system to remote bidders. Moby-clock presents the advantage of malleability (Debril and de Saint-Laurent 2003, Holm 2007): it can be adopted without disrupting the social game of agents: “*I cannot tell you that this system is going to last: I have selected five different auction software packages, meaning that if the users complain about the current system and demand a descending one, then I can change it at once*” (as said by an auction manager, cited in Debril and de Saint Laurent 2003).

⁶ Enrolment is defined as the mechanism by which a role is defined and attributed to a participant (or an equipment) who accepts it (Callon 1986, p. 189).

[Figure 3 here]

This will appear to be of major importance, the “Moby-clock” trading system has also been designed implicitly to allow more distant practices, although it was not presented as such by managers to users before its implementation. Figure 3 shows the same information displayed on the main screen and on the walls (arrow and ellipse) of the trading room in order to give local buyers a chance to participate more discretely (and remotely) in the auction. Simultaneously, the information is available on the computer screen in the private office of each local buyer who can participate without being seen by other bidders. This enrolment of technology by auction managers resulted in a large dissemination of remote access systems in France, partly inspired by foreign experiences and by a few pioneers.

3.2.2 Remote auctioning

International experiences

In remote bidding systems, distant buyers can participate simultaneously with local ones in the bidding process (figure 4). A distinction is made between local and remote systems, local and remote networks, internet and inter-connected systems such as the Icelandic system where sales are organised simultaneously for lots of single species for all the domestic ports (Carleton, 2000).

[Figure 4 here]

The introduction of remote auction systems presents the same heterogeneity in Europe as local computerised trading rooms. Some countries are more willing to adopt them than others. The first experience undertaken in a fish market was in Zeebrugge (Belgium) in 1987. This port had a strong advantage with its geographical position close to the biggest European markets (United Kingdom, France, Germany), but was limited by the low level of local landings, and therefore looking for new suppliers and buyers. Around 2000, the company intended to create a large interconnected European market for fish but abandoned this idea and has remained a simple system supplier.

A remote bidding system was also introduced in Bergen (Norway) mainly because of the distance between the landing sites, the difficulties of using the road between the ports and low domestic demand. Two important remote auction systems have been implemented: a sealed bid auction system for pelagic fish and an open English auction system (Armstrong 2001). Both are Intranet technologies and non-viewing auction systems - the fish being sold at sea for pelagic catches. Both are auctions within a limited time.

Iceland presents an interesting case with respect to market interconnection. This country had no tradition of auction systems before the 1990s (landing sites are scattered all along the coastline with bad transport infrastructures). In 1987, the first attempt to link three fishing ports was undertaken and the network was computerised five years later (Arnarson and Trondsen 1998). The increase of prices was such that the network attracted newcomers in this English style auction through a public address system (TENGILL). Local buyers raise a paddle showing their bid which is registered by a local operator who transfers the information remotely to a central shouting auctioneer who is visible to the buyers. In 1994, a second system (BODI), this time based on Dutch (and button) bidding through internet protocols, was implemented by two major market organisers in a joint venture (Islandmarkadur or ISM hf). The two systems attempted to merge in 1997 but without success (Graham 1999, p. 203). The Individual Transferable Quota (ITQ) system implemented in Iceland in 1984 has returned Icelandic vessels to the national auction system which used to land in Europe (because otherwise 25% of their fish quota would have been withdrawn). However, it did not out-compete the contractual system completely (direct sales between fishermen and processors) despite

higher prices because of the ITQ system and vertical integration between fishing and processing (Arnarson and Trondsen 1998).

Remote bidding in France

In France, the proportion of fish auction markets authorising a remote access to their electronic bidding system reached 28% in 2007, of which two thirds had less than 15 distant buyers and one third less than 38. A few pioneers attempted to set up the first remote system as early as May 1994 (table 2). The manager of the Cherbourg fish market had arrived only two years before, just after being employed at the national seafood bureau where he was in charge of the development of the national fish data information system. At that time, prices were extremely low in this market and his first idea was to “*inter-connect the market with the healthier neighbour market of Port-en-Bessin*” (auction manager, pers. com.). Finally the two managers decided not to inter-connect their markets through an auction network, after considering that it would only disseminate information about the excess of supply. Instead they both preferred to attract remote buyers individually. Another reason was that the two electronic equipment suppliers were different at that time, making the inter-connection more complex technically.

The Cherbourg manager started in May 1994 with two distant buyers located in two close harbours, and accepted four new remote buyers in 1997, including two local processors buying fish from their own office. The technology had changed between the two dates: first an analogic telephone system, then a numerical telephone network (*Numéris* end-to-end technology using modems in 1997). Although better, the latter system was far from perfect: after the bidding impulse, the system had to wait for the reply of all connected modems, creating breaks in the sales. Consequently after receiving proposals, a new numerical system was adopted without any reaction delays. In June 2007, the number of remote buyers was 34 out of a potential number of 100. The increase in sales to remote buyers has been gradual, in 2006 reaching more than half (53%) of landings in tonnes and 61% of the sales value. The average price of all landed species has increased by 18% between 2002 and 2005 but the implementation of the remote bidding system is certainly not the only reason for this growth.

The case of La Rochelle is also interesting because the adoption of a remote system (through the telephone network) was nearly concurrent to Cherbourg. One important factor has fostered the development of remote bidding: the common financial deposit (serving as guarantee for the procurements) that buyers could pay instead of the individual deposit for each marketplace in the former regime. This single deposit system at regional level took place in 2004. Technically, information on the weight of landed coastal fish is put online automatically through a weighing-machine with tactile screen. For the distant fishing fleet, a fax is sent from the boat at sea and the catch data is registered online. In 2007, 22 distant buyers competed with 18 local buyers (of which 2 bought an internet access to buy remotely). The same year, the remote buyers accounted for 35% of the landed fish in quantity and 38% of sales value.

[Table 2 here]

Curiously, the example of Cherbourg and La Rochelle has been imitated 10 years later, when technology has become more mature and reliable. In January 2002, the port of La Turballe implemented a remote bidding system to sell anchovies in its brand new trading room. According to the manager, the impact on prices has been anecdotal but the remote system had a tremendous effect on the social structure of buyers. Prior to this system, local processors used to buy fish for Spanish wholesalers. Since its introduction, the latter have purchased fish directly without ordering through locals: “*when opening the remote bidding system, we naively thought of attracting new buyers, in particular from Spain, but the effect has just been to skip over the local buyers*”, as said by the auction manager in La Turballe. Unfortunately, the anchovy stock collapsed rapidly and the fishery was closed in June 2005 (it will be closed until the end of 2010). The significant internet system investment has become useless. In June 2007, five remote buyers were nonetheless registered (3 Spanish and 2 French) for the small pelagic fish.

Interestingly, most of the auction managers have imposed restrictive conditions to authorise remote access. For instance, the Cherbourg manager considers his auction market as “*very open. Access rights are delivered every fortnight, but the exit is easy too. Buyers must fulfil one of the following conditions: to purchase at least 1% of the yearly tonnage, or 1% of the sales value, or to justify an assiduity of 72 active days within the year*”. If a buyer fails to achieve one of these conditions, he is removed from the system for at least 6 months. In Quiberon, the assiduity to the market must be of at least 21 days per quarter and justify a minimum of 0.03% of the sales value within the quarter, which is an easy objective to comply with.

To make the remote system more acceptable for the local processors, auction managers adopt different strategies. In La Rochelle, a local trademark (*Port de Pêche La Rochelle*) was created to certify local products and to generate product differentiation for locals. In Roscoff, the manager had to accept new vessels and landings. Increasing the quantity of landings is usually the most common compensation that managers concede to their buyers.

3.3. What impact is to be expected on prices?

When the first remote bidding systems were first introduced in France (1993-94), no spectacular effect on prices was expected, unless this move was strategically meant to convince the reluctant suppliers and buyers to accept this technology (enrolment). Indeed, an auctioneer stated in 1993: “*theoretically (sic), interconnection should increase the potential number of buyers, harmonise prices and reduce gaps between ports, but this assumption does not resist to the reality of facts*” (Le Marin, December 1993).

However, when it comes to remote electronic access (e.g. through Internet), the effect might be different: the influence of other bidders could be even greater than in a local trading room. Even when agents can perfectly calculate the market equilibrium given their knowledge of the marketed quantity, the level of demand, the number of participating traders, etc., they will not base their decisions on this expected equilibrium, but on their expectations of the other players' strategies (Kirman, 1995). Expectations of others' strategies might be different with an electronic system compared to a shout auction.

In particular, internet technology has introduced asynchronies. In some cases, the introduction of a time limit for bidding has resulted in “sniping” behaviour, people wait until the final seconds to make a bid below their private value (Deveaux, 2003). For instance, a limited amount of time is fixed in the two Norwegian auction fish markets as mentioned above (Armstrong 2001). No sniping strategy is possible in the sealed bid envelope system because of the limited time of one hour to offer a single sealed bid, and therefore there is no available information on competitors' bids. However demersal fish is sold by ascending English auction within a limited time frame of a few hours, and this makes sniping possible. Comparable effects could be anticipated whenever remote bidders in 'blind' conditions do face local buyers, creating asymmetry in the bidding process.

The perishable nature of fresh fish creates physical barriers to the extension of remote bidding systems. The logistics of fresh products, with higher asset specificity than for ordinary products, is therefore more difficult to organise. Delivered products after remote purchase are frequently refused by buyers because the quality of fish does not meet their expectations. This physical limit has been observed in other countries such as Iceland where logistic problems have arisen with the remote system with transportation costs of empty boxes sent back to their owners (Arnarson and Trondsen 1998). The freshness of the product matters a lot when selling the fish. The huge number of fish lots to be sold in a few hours makes the full market integration - that is, the sequential organization of the sales of all products on a nationwide scale - almost impossible. The organisation and coordination costs to match supply and demand would be tremendous. The experience of Lorient shows these problems of trading organisation since the sales period tends to be extended for one or two hours because more agents now participate in this market. Consequently, prices are usually lower at the end of the sales period because the best bidders (fishmongers) have to leave the auction early to open their fish shops. Usually, each auctioneer knows “his” buyers perfectly and organises the sales in connection with this knowledge, setting up the initial price for each lot as close as possible as to the

clearing price to save time for operators. A good and qualified auctioneer can organise a great number of transactions in a very short period of time. It becomes more difficult for him to organise sales with an increasing number of remote bidders in the system.

Nevertheless, most of the auction market managers are enthusiastic about the remote system and agree upon the positive effects it has had on prices. As an example, one of the auctioneers in La Rochelle reports at least two species (sea bass and squid; figures 5a and 5b) for which prices have been significantly affected: *“Before the implementation of the remote bidding system, we were facing regular marketing problems. Now the withdrawals have been reduced and prices are more consistent with other markets because two remote bidders from Brittany are interested in these products”*. Supermarket buyers are now involved in the auction system and push all prices upwards. The auction manager in Roscoff, another squid marketplace authorising remote bidders since October 2005, also reported that squid prices, since the introduction of remote bidding, have become *“more coherent with the other marketplaces in France”*, that is higher and closer.

[Figure 5 here]

The underlying objective of remote access is to foster non-viewing purchase of fish in order to prevent collusion among bidders. Once again, following the powerful embeddedness of economy in economics (Callon 1998:23), more framing efforts are brought into the market mechanisms to remove overflowing (that auction theorists would call affiliation) issued by the social interactions remaining in the local auction market systems (Debril and de Saint-Laurent 2003). In that aspect, it has been successful, especially with a Dutch auction system. One auctioneer reports: *“When remote auctions were first introduced, local buyers were very few. 95% of the sales were coming from trawlers of 20 to 25m. They had a good pre-announcement system of catches. With the increasing market share of coastal fleets, this system is not so good and landings may fluctuate between 300 kilos and 10 tonnes without any announcement before the sales. It was then very easy for the dozen bidders to set up collusive prices and to share the lots among them in a sort of playground atmosphere. With the introduction of only two remote buyers, this atmosphere has totally disappeared and more pressure has been put on the local buyers”*.

New strategic behaviour can be observed because of remote bidding. Over time, local buyers end up getting to know which products are of interest for remote bidders. In one auction market with ascending bids, an auctioneer reported several cases of local buyers pushing up the bids voluntarily even though the latter were not interested in the products. Another auctioneer states this is a common practice between local buyers in the auction hall but it usually concerns buyers interested in the same lots. They may push up the bid intentionally to outcompete a rival on the downstream market in a sort of “raising rivals’ costs” strategy. However, they become exposed to retaliation by the local rival. When it comes to distant buyers, the probability of retaliation is not so high because remote buyers have little ability of knowing who has competed for the bid. An auctioneer says: *“I have a remote buyer who can alone increase the price of one species. However, the local buyers cannot push up the bidding process because auctions are descending and stop with the first bid”*. In other words, the “winner’s curse” in a Dutch system deters the strategic behaviour of locals against distant buyers. Again, the type of auction is not neutral on prices after the introduction of remote bidders. Information is clearly asymmetric between local and distant buyers, to the extent that a phone line has been implemented in one of the marketplaces in order to increase the level of information for remote buyers before and during the sales. The manager of this auction market is even intending to add an audio link through internet between the auctioneer and the remote bidders. Asymmetry is thus twofold: remote buyers may value the fish differently but have also less information than local buyers.

4. Conclusion

The results obtained in section 2 are consistent with most of the empirical findings of the auction literature: the substitution of an auction market for a former pairwise trading organisation increases price levels (Bulow and Klemperer 1996, Arnarson and Trondsen 1998, Helstad *et al.* 2005). However, our results show something more: in at least one of the two fish market places (Le Guilvinec), the market institution has not basically changed because the same ascending (English) auction system and the same community of traders have been preserved. Nonetheless, the introduction of an electronic auction system has significantly modified the prices of fish (live prawns) both in level (increased) and volatility (higher after the change).

Regarding the relationship between the two French ports (Lorient and Le Guilvinec) rigorously selling identical products, a better price integration has been achieved after the implementation, but the price volatility for both has also significantly increased. This result concurs with other findings showing that the substitution of a producer price system into an auction market creates unstable prices (Slade 1991), indicating that the fish market in Lorient was presumably oligopsonistic prior to the electronic auction system. The decrease in concentration allowed by the expansion of an oligopsonistic market including new buyers increases variability. However, the case of Le Guilvinec is more puzzling because the same English system remains, with buyers facing each other around the fish boxes: *“technically I tried with the electronic suppliers to create an electronic auction software imitating as far as possible the shout auction system previously in force”* (as said by the auction manager in Le Guilvinec, cited in Debril and de Saint-Laurent 2003).

Some conjectures can be interestingly raised through the cross-fertilisation of the positivist auction theory (Wolfstetter 1996, Klemperer 1999) and the constructionist Actor-Network Theory (Callon 1998, Graham 1999, Holm 2007). The technological choice provides a new organisational design by determining the spatial setting of sales. The objective of the auction manager is clearly to use technology to eradicate the social relationships hindering the “pure” Walrasian market clearing. This is if we assume that the mobile auction system was strategically planned by the managers to prepare for the adoption of a remote bidding system. Previously some innovations permitted by the electronic device were negotiated among the stake-holders and introduced (enrolment of the Moby-clock technology by the auction manager), such as the screen information projected on the market hall walls or on the personal computers in the buyers’ offices. By authorising a non-viewing system for some of the bidders, this new market frame limits affiliation among bidders, thus affecting the market outcome. Auction theory predicts that affiliation leads to higher prices in ascending auctions (Wolfstetter 1996). In the former system, this affiliation could sometimes result in collusive behaviour among buyers who could share the lots after the sales (Debril and de Saint-Laurent 2003). With the new electronic system, prices can be more unstable when buyers tend to bid more aggressively than they used to do.

At first, remote bidding was circumscribed to local buyers who could bid from their adjacent office through the computer network instead of inside the auction room. This small step towards a non-viewing auction has represented kind of a revolution for buyers who had always calculated their private valuation in front of the fish boxes where they can evaluate the gradation, quantity and quality of the fish, but also exchange information with other bidders (increasing the risk of affiliation and collusion). This has also imposed new constraints for managers having to improve and harmonise their gradation system in order to display the product characteristics on an electronic catalogue before the sales. In the formatting process of a Walrasian market, this can be viewed as an essential but difficult step of the framing process (Garcia 1986, Callon 1998). This codification process can also be interpreted as a reduction or even an impoverishment of the role of buyers who previously evaluated the quality of lots before and during the sales. This is also because electronic systems take into consideration less complex information than formerly collected by buyers (Debril and de Saint-Laurent 2003). Consequently, time is saved and re-invested in the sales of smaller lots, thus attracting more buyers (like fishmongers) who are willing to pay more for the fish (Debril and de Saint-Laurent 2003). Once again, this complies with the auction theory statement about the symmetry condition. Groups of bidders having different private valuations (large and small primary processors, retailers) will now compete more frequently in the auction and may bid more or less aggressively according to the presence or absence of others, explaining the higher level and the more unstable pattern of prices achieved by the remote-bidding system.

The influence of the port managers on the implementation of electronic auction systems is very important. The whole movement towards remote bidding can be seen as a project of disentanglement of the objects (fish products), the trading technology (computers and moby-clock) and the market agents from their social, cultural and technological context: standards are defined for products, as well as measurement, monitoring and control devices, to remove the social relationships out of the system and create this abstract space of calculability that economists constantly wish to implement (Garcia 1986, Callon 1998, Graham 1999, Debril and de Saint-Laurent 2003). Such instruments play the role of mediators between economics and economy, framing the market as it “should” be theoretically (Holm, 2007). The implications of the embeddedness of markets in economics (Callon, 1998:23) must be fully acknowledged to understand market outcomes. The diversity of trading and bidding systems in use, sometimes within a single country or region, demonstrates that the selection of market technology is not entirely motivated by economic efficiency, but reveals the negotiation of the social structure in the market (Carleton, 2000; Debril and de Saint-Laurent, 2003; Graham, 1999). The enrolment of market devices and social relationships has warmed up the market temporarily, surrounding bidders with more uncertainty. The institutional framework is not yet “refreshed” as opportunistic strategies allowed by electronic auction systems may address new questions to auction theory and managers (e.g. sniping or other strategic behaviour between local and remote bidders).

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Table 1 Descriptive statistics of the two periods

€ and %	<i>PGV</i>	<i>PLO</i>	<i>PGV– PLO</i>
<i>Mean before April 2002 (Standard deviation)</i>	9.7 (2.7)	8.3 (2.3)	1.4 (0.4)
<i>St.-dev. of price returns</i>	<i>16.0%</i>	<i>18.7%</i>	<i>+1%</i>
<i>Mean after April 2002 (Standard deviation)</i>	10.4 (3.4)	9.5 (2.7)	0.9 (0.7)
<i>St.-dev. of price returns</i>	<i>21.6%</i>	<i>20.7%</i>	<i>+4%</i>

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Table 2 Remote bidding access in France

<i>Port</i>	<i>Date of equipment</i>	<i>No. of distant buyers in June 2007</i>	<i>Observations</i>
Cherbourg	May 1994	26	61% of sales value in 2006 against 10% in 1998 and 2% in 1994. Auction through Internet since 2002 (PEFA system). Fee=75€/month
La Turballe	January 2002	5	Remote bidding through Internet for pelagic fish (anchovy, horse mackerel). Implemented by PEFA (Zeebrugge).
Lesconil	April 2002	3	Remote access for 3 buyers in a neighbour auction market.
La Rochelle	1994 (RTC) November 2004	22	First system implemented in 1994 through a telephone network. Current fee = 75 €/month (the first year is free)
Oléron	April 2005	6	Implementation cost = 250€ + 78€/month.
Roscoff	October 2005	53	19 remote buyers initially; 53 in June 2007 accounting for 53% of the sales tonnage; more boats have joined the auction (waiting list) to even out supply and demand.
Grandcamp	2005		
Port-en-Bessin	1994 2005 (new system)	15	Firstly implemented in September 1994, three months after Cherbourg. An auction network was even envisaged at that time.
Granville	2005	10	
Saint-Quay Portrieux	October 2006	38	Of the 38 lines opened in 2006 only some 15 regular and major buyers remain; the fee is 40 € per month + condition of assiduity
Erquy	October 2006	38	Fee = 40 € per month
Quiberon	January 2006	11	Fee = 67€/month
Dieppe	June 18 th 2007	5	Auction network with Fécamp. 5 buyers from Dieppe are now connected through Intranet with Fécamp. 10 screens to bid potentially in Fécamp. Internet connection in July 2007
Fécamp	June 18 th 2007	5	Auction network with Dieppe (5 buyers from Dieppe). 5 screens to bid potentially in Dieppe.
Audierne	July 7 th 2007		Managed by CCI Quimper ; pilot-experience for the 6 other markets.
Le Guilvinec, Loctudy, Douarnenez, Saint Guénolé, Concarneau,	September 2007		Managed by CCI Quimper. Will follow the experience of Audierne.
Royan	October 2007		Contact was taken with Quiberon

Source: Own elaboration from a survey conducted in June 2007.

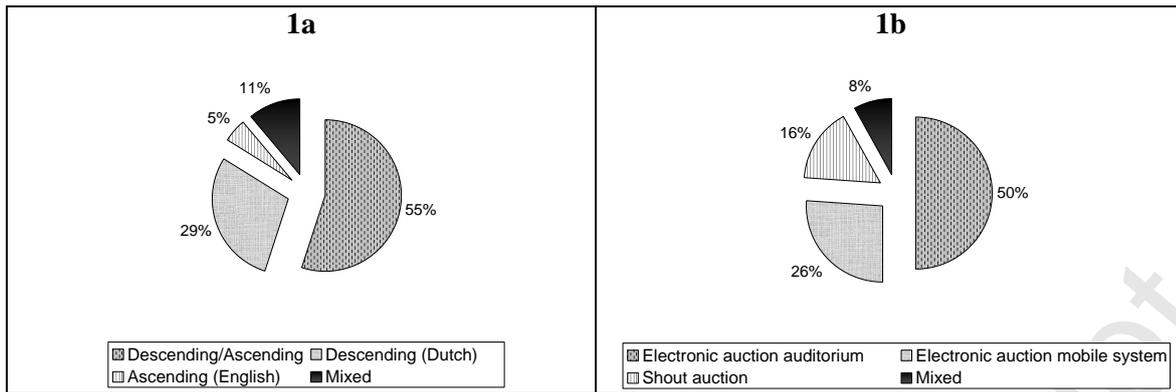


Figure 1: Types of auction systems for fish markets in France

Source: LEN-Corral 2007

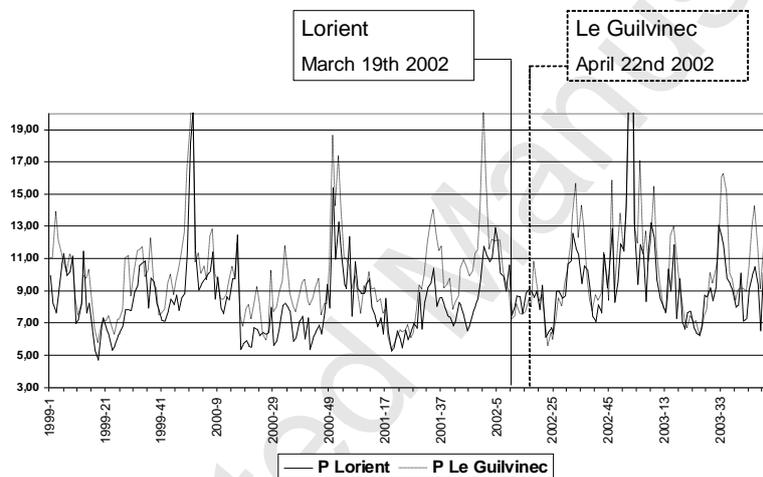


Figure 2. Weekly Prices (€/kg) of live prawns in Lorient and Le Guilvinec

NB: The two dates are the respective dates of implementation of electronic auction systems

Source : Réseau Inter Criées (RIC) – France Agrimer



Figure 3. "Moby-clock" system in Loctudy

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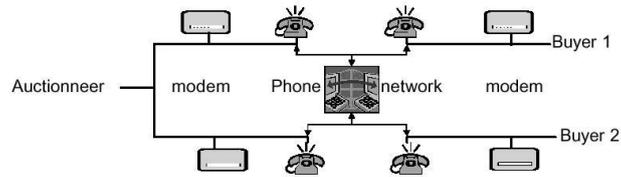
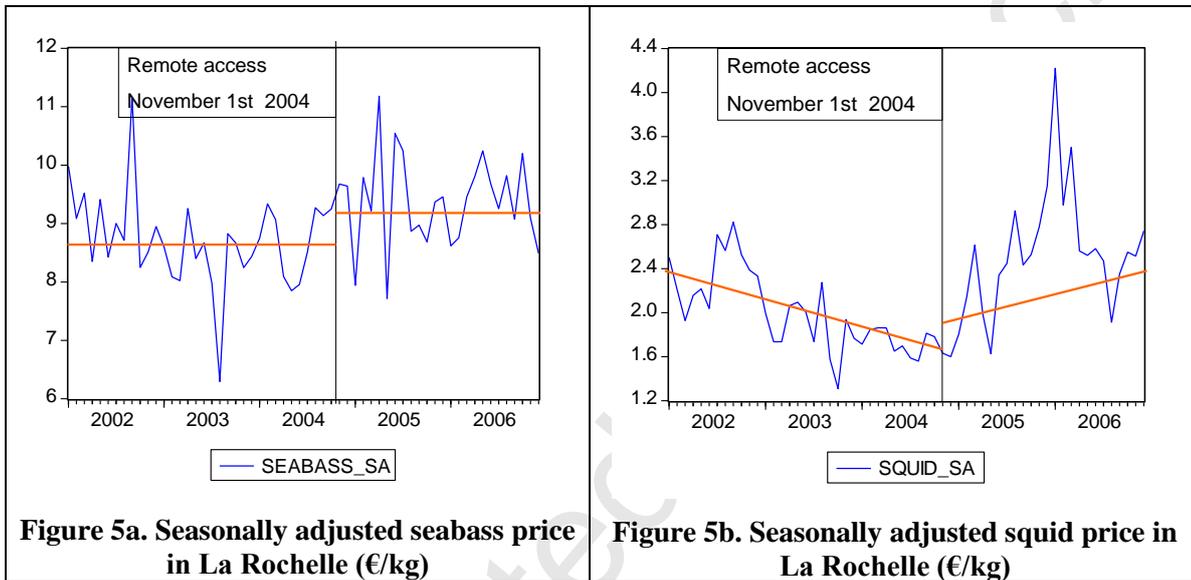


Figure 4. A remote bidding system
(Carleton, 2000)



Research Highlight

>Fish auction markets can be expanded by electronic means. >The impact
>of
electronic auctions is tested by a structural change model. >We find evidence of an increase
in price level and variability in two French ports. >Remote bidding access increases
asymmetry but reduces the affiliation of bidders. >A survey of auctioneers shows that remote
bidding may also increase price levels.

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