

Why Fish Auctions Differ – Theory and Practise

Claire W. Armstrong

Norwegian College of Fishery Science, University of Tromsø, Norway

Abstract. In this paper we will study two auctions for fish found in Norway, and compare them applying auction theoretical assumptions. We will use the revenue equivalence theorem as a basis to explain why these two different auction mechanisms are chosen for the sale of fish. It is shown that the issues of risk aversion, common values and inclusion of travel costs may explain the choice of auction institution.

Key words: fish auctions, Norway, revenue equivalence

1. INTRODUCTION

Auctions are emerging as an increasingly preferred procurement process for government held assets to the public, in as diverse areas as spectrum bandwidth and fish farming quotas. This has increased the governmental agencies' interest in the workings of auctions. Fish auctions are the meeting place of two often adversarial sectors in the fishing industry – fisher and processor. The ownership of the auctions varies from different degrees of governmental involvement, fisher and/or processor interests, to completely independent owners. Hence we see the governmental sector as well as interests usually outside fisheries also being involved in fish auctions. The structure of fish auctions vary greatly and the underlying foundations of the auctions may be seen to be important for their longevity. Kaplan (2000) underlines the equity advantages connected with governmental involvement in auctions, seeing it as a positive lesson in co-management. In this sense it is of interest from a managerial point of view to clarify why different auctions work under different circumstances, which is the aim of this paper.

In auction theory and in actual life, we observe a number of different types of auctions. Economic auction theory explains under which conditions the seller or the buyer may prefer one type of auction rather than another. In this paper we will study two actual auctions for fish found in Norway, and compare them applying auction theoretical assumptions.

While applied economic literature relating to auctions is broad¹, studies of fish auctions are few and far between².

¹ Hendricks and Paarsch (1995) give a survey of empirical studies related to auctions, stating that so far, the two main goals of empirical work have been; 1) testing of behavioral theory, and 2) identification of the probability law governing the valuations of potential buyers. They discuss econometric studies, which have applied data from

Kaplan (2000) focuses on some organisational issues that differentiate auctions, such as the ownership of auctions, whether or not the goods are displayed, and also issues concerning ascending and descending auctions. Furthermore, little work is done as regards comparative studies of actual auctions³. In this paper we will study two aspects of variance between actual fish auctions; 1) the auctioning institution, namely the 1. price sealed bid auction vs. the English (ascending) auction, and 2) the possibility of taking transport costs into account. The two auctions we study are found in the pelagic and the northern groundfish fisheries in Norway.

When different auction systems are discussed, the central auction theory Revenue Equivalence Theorem (RET) is often pointed to in order to underline that the choice of auction type is irrelevant. According to the RET, the English and 1. price sealed bid auctions, as well as other auctions, all yield the same results. However, the RET is bound by a set of strict assumptions, which upon relaxation eliminates the revenue equivalence of the mentioned auctions. We wish to discuss, when relaxing these assumptions, under which conditions the seller would be expected to prefer one of the two auctions. This may give an explanation as to why we observe two quite

auctions for timber, as well as oil and gas leases. Applied studies of a descriptive and analytical nature have encompassed auctioning of a multitude of goods varying from soybeans to treasury bonds.

² See Arnarson and Trondsen (1998) for a presentation of Icelandic fish auctions.

³ Experimental studies comparing different auction mechanisms exist (early and recent examples are Frahm and Schrader, 1970, Lucking-Reiley, 1999), as well the comparisons of different technological issues in auctions (Bailey et.al., 1991, Buccola and Chieruzzi, 1981). See also Riley (1989) for enlightening theoretical study of comparison of auction mechanisms when two assumptions of the RET are relaxed.

different auction mechanisms being applied in the sale of fish in Norway.

The outline of the paper is as follows; first the two auctions are presented, followed by an introduction to the Revenue Equivalence Theorem. The different assumptions in the theory are relaxed, allowing one auction to be preferred in each instance. Finally, possible explanations for the application of two different auctions are discussed.

2. THE AUCTIONS

In Norway all first-hand sale of fish is legally protected and organised through sales organisations that are connected to the fishermen's associations. Along the Norwegian coast there are several of these sales organisations, with a large variety of ways of organising the first hand sale of fish. We study two actual fish auctions; first, the auction for pelagic fish for consumption run by the Norwegian Fishermen's Sales Organisation for Pelagic Fish (hereafter called the Pelagic auction). This is a sealed bid auction, where within a time limit of one hour buyers can offer single sealed bids for fish put out for sale. The fish is however not available for viewing, as it may still be out at sea in the fishing vessel. The second auction we will study is the so-called Triple auction, mainly concentrated on demersal species, which three different fish sales organisations organise co-operatively. This is an intranet open English (ascending) auction, where within a limited time period of a few hours, bidders can compete for the fish put out for sale. Again, this is not a viewing auction. In both cases the buyers have all relevant knowledge regarding the seller.

One other issue clearly differentiates the two auctions, namely how transport costs are handled. Transport costs are considerable in many fisheries; for Norway especially as the country has a long coastline, and in some areas there are vast distances between single buyers. In the Pelagic auction the fisher determines the geographic area which she wants the auction to encompass as regards buyers. She must accept the highest bid amongst these buyers unless there is a higher bid from outside the prior determined geographic area. Then, depending on the relative travel costs connected to the highest "inside" and "outside" bid, she can pick the buyer that gives her the highest *net revenue*. Either the minimum price centrally negotiated with the producer organisation or the fisher's individually chosen minimum price is the reserve price of the auction. In the Triple auction the fisher determines the geographic area which she wants the auction to encompass as regards buyers. She must accept the highest bid amongst these buyers, as long as it is above either her chosen minimum price, or some average historic price that the sales organisation sets as the reserve price.

The history of the two auctions differs markedly, which may explain the choices as regards auction institution. The Pelagic auction was established in the 70s, and was amongst other things based on the idea of a legal monopoly (the sales organization) taking social responsibility. Hence the Pelagic sales organization was critical of the dangers of a possible buyers' frenzy in the English auction. Furthermore the Pelagic sales organization owns half of the fish oil and meal factories in Norway and therefore has interests on both sides of the table⁴. The Triple auction was established towards the end of the 80s, which was a time with much greater degree of "fend for ourselves" attitude. Fisher's organizations were more pressed as regards their monopoly rights. Social responsibility was not as important as getting the highest price for the fishers. This latter auction was also established as a result of seeing the pelagic auctions' functioning. One justification given for why a long established auction such as the Pelagic auction was not copied, was that the English auction was seen as preferable from the fisher's viewpoint, especially owners of smaller vessels (Nergård, pers. comm.). Are these issues compatible with auction theory? Let us study the theory to see whether it can help elicit answers.

3. AUCTION THEORY

In order to ascertain why the two fish auctions are different, it may be useful to turn to the theory of auctions. Let us now study the Revenue Equivalence Theorem (RET) (first presented by Vickrey, 1961), and its assumptions, and see how our two auctions fit in with this central auction theorem.

3.1 Revenue Equivalence Theorem⁵

Assumptions:

- A1 Bidders are risk neutral.
- A2 Bidders have independent private values for the item being auctioned, as opposed to common values in the instance of possible resale.
- A3 Bidders are symmetric. That is, all bidders appear the same to the seller and to each other.
- A4 Payments are a function of bids only

⁴ This may not be really relevant today as oil/meal is now only a small part of the total catch. It may, however, have played a role in the 70s when the auction was introduced, despite the fact that the Pelagic sales organization was a smaller factory owner at that point in time.

⁵ The RET can be further generalised (see Klemperer, 1999), but for our use, the following exposition is sufficient.

Given these assumptions, the theory shows (see for instance McAfee and McMillan, 1987) that English (ascending) auctions, Dutch (descending) auctions, first- and second-price sealed auctions all yield the same average price. So according to the RET it is irrelevant which auction institution is chosen, given the above assumptions. Are however all the assumptions satisfied in our fisheries auctions⁶? What happens when we ease the RET assumptions? More specifically, in what way may A1-A4 be violated in fisheries? Our mode of study will be to ease one assumption at a time⁷.

4. THE FISH AUCTIONS IN LIGHT OF THE THEORY

In the following we will analyse the auctions by determining the relevance of the assumptions of the RET in the case of fish auctions. Where the RET assumptions are not appropriate the effect upon optimal auctions of a relaxing the assumptions will be discussed.

A1; *Risk Neutrality*

Do we for instance observe risk aversion amongst the buyers? We may assume that buyers (fish processors) in some instances are risk averse since if they do not win an important bid, they may have to close down, or lay off workers for shorter or longer time periods. In the case of a risk averse buyer, and a risk neutral seller, the theory tells us that a 1. price sealed bid auction gives higher prices than an English auction, and hence the former is preferred by the seller⁸. The reason for this result is that bidders' risk aversion makes for higher bidding in the 1. price

⁶ The reader should note that it is not certain that the two auction mechanisms presented will have the same number of bidders, due to the insider/outsider part of the Pelagic auction. In this case if all RET assumptions hold, the seller will prefer the auction which gives the highest number of bidders. As we will show, not all the RET assumptions hold, and hence this issue is not clear.

⁷ Some research has been done on the relaxing of several of the assumptions simultaneously; Milgrom and Weber (1982) study auctions with risk averse bidders having affiliated values, but no qualitative comparisons between the English and 1. price sealed bid auctions can be made. Asymmetry combined with common values have also been studied with the same inconclusive results as regards comparisons between the two auction mechanisms (see Maskin and Riley, 2000). Studies of forms of payments other than just the bids, in this case entry fees, have been combined with risk aversion and affiliated values (Milgrom and Weber, 1982), but this is not relevant to the auctions studied here.

⁸ The same is the case for a risk averse seller combined with a risk neutral buyer; again the seller prefers the 1. price auction.

sealed bid auction. The 1. price sealed bid auction "exploits risk averse buyer's greater fear of loss" (Riley, 1989, p. 48), and the hidden nature of the bids creates higher bidding than the English auction, where bidders can observe each bid made. Thus, if this is the case, the Pelagic auction is preferred by the fishers.

Risk aversion is usually deemed as important when the item being sold is very valuable, making bids large relative to the bidder's asset. In a situation where processors bid for catches on a daily basis, the issue of risk aversion is not so relevant for fisheries. In some specialised fisheries risk aversion may be present due to limited catches, or long term auctioning of harvests⁹. In the major groundfish and pelagic fisheries which are the mainstay of our two auctions, however, the assumption of risk neutrality in the RET may be seen to hold, making the choice between the two auctions irrelevant. The second assumption of independent private values may however not be so easily accepted.

A2; *Independent private values*

The first part of the assumption is that the buyers in the auction have *individual* values reflecting differences in tastes. In the case of a fish auction the tastes have for instance determined or are determined by the buyer's production mode and sales orientation. The second part of the assumption is that these individual values are *private*. That is, no one knows anyone else's values. This could be justified by the secrecy surrounding industrial activity, from production to sales. Do we however actually see buyers rather having *common values* in fisheries? That is, the values may be common to the buyers, in the sense that they have similar plans for the fish bought, and these values are also not private but rather commonly known or guessed at. That is, are the agents bidding in fact guessing the unique true value of the fish for sale? In a number of auctions this is the case to some degree, for several reasons. For one, the processors who bid are not sure what price they will finally obtain for the processed fish. Hence they are not certain as to the actual value of the fish for them. Secondly, it is not always the producer who buys the fish. In Norway we now see instances of fishers buying their own harvest, freezer storing it for later sale at an expected higher price. Furthermore, there exist agents who buy from the fishers and sell to the producers. In these

⁹ An example of an informal auction where risk aversion holds is that of the Kamchatka crab off the coast of Northern Norway. Here one has observed firms putting in bids to the fleet prior to harvesting, where a fixed price per kg is offered to all vessels for the whole season, given that a certain percentage of the fleet delivers to the bidding firm. In this case the total bid is large relative to the assets of the firm. So far the buyers have decided this mode of offering a price, hence auction theory would lead us not to expect a 1. price sealed auction.

situations there may clearly be common values. How does this affect prices in the auctions? In a 1. price sealed bid auction this results in the so-called “winner’s curse”, as every bidder wants to determine the true (common) value of the item, and the winner therefore knows that everyone else believes the value to be below the winning bid. The English auction eliminates to some degree the winner’s curse, as information about the bidders’ “guesstimated” values are revealed during the bidding process. However, one would expect more sophisticated bidders to take the winner’s curse into account and bid cautiously in a 1 price sealed bid auction (McAfee and McMillan, 1989). A rational or experienced bidder (usually the case as regards fish producers) will presume that his estimate is the highest, and will bid the second-highest perceived valuation, given the assumption that all others do the same. In this sense the common value does not result in one of the auctions being preferred instead of the other.

Bidders may alternatively have *affiliated values*, that is, if one bidder perceives the value of the item to be high, there is a greater probability of other bidders also perceiving this. This is especially relevant with regard to unknown final prices of processed fish. That is, if one buyer perceives the final export price of the fish to be high, there is a greater probability that also other buyers have the same perception. This affects the relative attractiveness of the different auctions, in that the English auction conveys information about the bidders, which gives less information rent to the bidders. This extra information weakens the winner’s curse, leading to more aggressive bidding. This increases the prices, making the English auction more attractive to the seller (Milgrom and Weber, 1982).

Given that we observe affiliated values in fisheries, the English auction would seem to be preferable from the seller’s viewpoint.

A3; Symmetry

Asymmetry is defined as *observable differences* between the bidders. Examples of this may for instance be different types of producers; a fish species may be either frozen or salted, resulting in different production costs and finally obtaining different market prices. This again undoes the RET. However, which way the price will go (up or down) in the different auctions is indeterminate in this case. Furthermore, is asymmetry really an issue in fish auctions? To some degree the auctions are differentiated, herring for oil/meal is auctioned in one specific auction¹⁰, while herring for consumption is auctioned as described. Hence, what we do see are auctions being specified for the different productions. Thus in effect, different reserve

prices are determined for each type of fish production. This is due to fish quality often determining the usage, and thereby which production one sells toward. *Within* an auction the agents can be seen to be symmetric¹¹.

A4; Payments as a function of bids only

We observe that in the case of the Pelagic auction, when the outside bid is the highest bid, payments depend on travel distance as well as the bid. That is; bid minus travel cost gives the final payment to the fisher, as described below

$$p = b - c(\Delta),$$

where p is payment to seller, b is bid and $c(\Delta)$ is the cost as a function of the distance Δ to the buyer. In this case the Pelagic sealed bid auction is optimal from the seller’s point of view, as she can in this case choose the bid that gives her the maximum net revenue.

Above we have shown that relaxing Revenue Equivalence Theorem (RET) assumptions A1 (allowing risk aversion) or A4 (payments depend on travel distance as well as bids), makes the 1. price sealed bid auction, that is the Pelagic auction, preferable to the seller. The relaxing of A2 (allowing affiliated values), renders the English auction, and hence the Triple auction, usually being preferred by the seller. Relaxing A3 (symmetry) has indeterminate effects.

5. DISCUSSION

In the above analysis we have pinpointed the assumptions regarding risk neutrality and asymmetry as being more acceptable in fish auctions than the assumptions of independent private values and payments depending on bids only (though the latter clearly holds for the Triple auction). Nonetheless, degree of risk aversion may differ for the two auctions that we study. The choice of the sealed bid auction in the case of travel cost inclusion and risk aversion on the behalf of the buyer has clear theoretic reasoning from a seller’s point of view. In the real world we find that the processors of pelagic harvests are not as prevalent along the Norwegian coast as the demersal fish processors. Hence the securing of transport cost coverage makes sense in the pelagic auction more so than in the case of the Triple auction. The vessels delivering in the pelagic sector are furthermore very diverse as regards size. However, there is a relatively greater degree of large vessels in this sector than in the demersal fisheries for which the Triple auction caters to. Hence each catch that the processors bid upon are larger in the pelagic sector, making for greater risk aversion. This also throws light on

¹⁰ In Norway the auction for herring used for oil/meal is similar to the Pelagic auction presented here, only it does not allow bids outside the predetermined area.

¹¹ In the case of substantial efficiency differences between the processors, there is however clearly asymmetry.

the small vessel owner apprehension mentioned earlier for the Triple auction.

From the analysis one could claim that the Triple auction has justification from the seller point of view if one suspects affiliated values. It is somewhat unclear why the demersal sector should have a greater degree of affiliated values than the pelagic sector. However, based on the relatively higher number of small vessels in the demersal sector, there is in this sector lesser economic risk involved in a vessel freezer storing a small catch for future sales.

Some issues outside of the RET have been used as arguments for one auction type instead of the other. Conventional wisdom has it that there may exist bidder's frenzy in English auctions. However, as McAfee and McMillan (1987, p.707) observe: "Such an assertion of irrational behaviour should be treated with caution". In auctions that take place with much the same buyers day after day, it seems unreasonable to assume such irrationality. Another issue of possible relevance is that within the industry there has been an attitude that a sealed bid is more appropriate for sale of fish harvests that are to a large degree homogeneous as regards quality. That is, an English auction is desired for more heterogeneous fish harvests. Thus, pelagic fish, due to its relatively speaking more homogeneous harvesters, is seen as acceptably auctioned in sealed bid auctions, while demersal species are perceived to be preferably auctioned in English viewing auctions. However, in our case both auctions are over an intranet, hence this argument can only be based on tradition. Furthermore, if the sales organisations see the need to secure legitimacy of an auction not only among their own members, the sellers, but also among the buyers, the issue of buyer preferences come in as an additional issue here. We will however not pursue this, as the legal protection of the sales organisations and their tie to the fishermen's associations make this not seem particularly relevant.

The observations made illustrate that for governmental involvement in auctions the realisation of why the auctions are preferred by whom should be present. It is clear that as long as the RET does not hold, something which seems quite apparent in the case of fish auctions, different auctions will be preferred by buyers and sellers. It may be spurious to claim that the above mentioned issues explain why the two different auction institutions were chosen in the first place. However, these auction theoretical issues may in part explain why the auctions still remain in place.

6. ACKNOWLEDGEMENTS

The author would like to thank Derek J. Clark for valuable comments.

7. REFERENCES

- Arnarson, I. and T. Trondsen., Value adding in the first hand sales of fish. A comparison between contract-, and auction market prices. A descriptive analyses of the Icelandic case, Proceedings of the 9. conference for International Fisheries Economics and Trade (IIFET 98), Tromsø, 1998.
- Bailey, D. V., M. C. Peterson and B . Brorsen, A comparison of video cattle auction and regional market prices, *American Journal of Agricultural Economics*, 73(2), 465-75, 1991.
- Buccola, S. T. and A. M. Chieruzzi, Costs of marketing slaughter cattle: Computerized versus conventional auction systems, *Agricultural Economics Research*, 33(3), 31-35, 1981.
- Frahm, D. G. and L. F. Schrader, An experimental comparison of pricing in two auction systems, *American Journal of Agricultural Economics*, 52(4), 528-34, 1970.
- Hendricks, K. and H. Paarsch, A Survey of Recent Empirical Work Concerning Auctions, *Canadian Journal of Economics*, 28(2), 403-26, 1995.
- Kaplan, I. M., Seafood auctions, market equity and the buying and selling of fish: lessons on co-management from New England and the Spanish Mediterranean, *Marine Policy*, 24, 165-177, 2000.
- Klemperer, P., Auction theory: A guide to the literature, *Journal of Economic Surveys*, 13(3), 227-86, 1999.
- Lucking-Reiley, D., Using field experiments to test equivalence between auction formats: magic on internet, *American Economic Review*, 89(5), 1063-80, 1999.
- Maskin, E. S. and J. G. Riley, Asymmetric auctions, *Review of Economic Studies* 67(3), 413-438, 2000.
- McAfee, R. P. and J. McMillan, Auctions and bidding, *Journal of Economic Literature*, 25, 699-738, 1987.
- Milgrom, P. R. and R. J. Weber, A theory of auctions and competitive bidding, *Econometrica*, 50(5), 1089-1122, 1982.

Nergård, A., representative for the Norwegian Raw Fish Sales Organisation (one of the organisations behind the Triple auction), pers. comm., 2000.

Riley, J. G., Expected revenue from open and sealed bid auctions, *Journal of Economic Perspectives*, 3(3), 41-50, 1989.

Vickrey, W., Counterspeculation, auctions and sealed tenders, *Journal of Finance*, 16, 8-37, 1961.