Tenders for European cereal export refunds : a structural approach

Jean-Marc Bourgeon, Yves Le Roux

► To cite this version:

Jean-Marc Bourgeon, Yves Le Roux. Tenders for European cereal export refunds : a structural approach. [University works] Inconnu. 1994, 26 p. hal-02332553

HAL Id: hal-02332553

<https://hal.science/hal-02332553>

Submitted on 24 Oct 2019

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Distributed under a Creative Commons Attribution - NonCommercial - NoDerivatives| 4.0 International License

TENDERS FOR EUROPEAN CEREAL EXPORT REFUNDS: A STRUCTURAL APPROACH

Jean-Marc BOURGEON*, Yves LE ROUX**

* THEMA, UFR SEGMI, Université de Paris X Nanterre

** I.N.R.A.-E.S.R. - Institut National de la Recherche Agronomique
Station d'Economie et Sociologie Rurales de Rennes - Unité PAM

Octobre 1994
Version provisoire

Tenders for European Cereal Export Refunds : *a structural approach*^{*}

Summary

A large part of EU's export refunds are awarded through tender procedures. We apply auction theory to model the traders' behavior for weekly tenders of soft wheat intervention stocks. Specification and estimation of the optimal bidding strategy are developed under two opposing assumptions about the traders' valuation of grain, each corresponding to a particular functioning of international soft wheat and related markets. This structural approach allows us to conclude that this market is relatively competitive.

Key-words : EXPORT REFUND, CEREAL, AUCTION MODELLING, ECONOMETRICS, EUROPEAN UNION.

---

^{*} The authors are grateful to P.C. Abbott, H. Guyomard, E. Phimister, and I.M. Sheldon for helpful comments on earlier versions of this paper.

Introduction

Within the Common Agricultural Policy (CAP), export refunds and import levies are the major tools of trade regulation with third countries. Two-thirds of European grain expenditures¹ were concerned with these export refunds, which account for ten percent of the total agricultural budget. The 1992 CAP reform aims to reduce these costs by bringing down internal prices in order to reach a level close to the world price. But export refund awarding procedures remain the only instrument that allows a direct control of European exports, of both quantities and public costs.

The European Union (EU) has used different procedures in variable proportion over time, searching for the most efficient - and the least costly - export policy. To bridge the gap between the domestic price and the world price, the European Commission (EC) can resort to several kinds of subsidies, according to the origin of cereals (intervention stocks which are the property of the Union or private stocks), and their destination. The EC can use standing refunds, which are generally available without limitation on quantity, and export refunds which are tendered for. In the latter case, competition between traders simultaneously settles the unitary refund level and the quantity to be exported.

Whatever procedure is used by the Commission, three criteria are taken into account: the quantity to be exported (for a week, and for the whole marketing year), the budgetary cost of export financing, and the European Union export objectives, that is its willingness to save or gain market shares. That leads the Commission to anticipate various key variables: world supply and demand evolution, subsidies of other exporting countries, world prices, and European public and private stocks. At the same time, traders have to form expectations about the same variables. Depending upon these expectations, they determine their optimal bidding behavior, in terms of refunds for the open market or in terms of purchase price for intervention stocks.

This paper deals with the analysis of European export refund which are tendered for. Our objective is to determine the traders' valuation of the tendered cereals. In this respect, two opposite assumptions can be considered. First, grain has a different and a particular value for each trader. Consequently, each trader considers his own value when bidding. This assumption is referred to as the private value paradigm. Conversely, the second assumption is that the object has a common value for all bidders *ex post*, but this value is unknown *ex ante*. Before bidding, traders simply form an estimate of this common value. Among traders, estimates are different according to the information they get. Under this second paradigm, a bidder adjusts his strategy to his own estimate and prior belief about the others' estimates.

---

¹ Export refunds account for 50 percent of European grain expenditures in the new CAP.

Drawing conclusions about each of the two competing assumptions gives information about the organization of the world grain market. If the private value assumption turns out to be correct, that reveals possible segmentation of the world market, in which each trader has a specific market power (according to the specific geographical area he currently serves, for example). Existence of private values can also be the result of speculative behaviors: on the one hand, traders compete to get export contracts, and on the other hand they contest export refunds to hold these contracts. An imbalance between these two markets can produce different valuations for the same object, according to traders. Moreover, interactions with other related markets, such as grain futures markets, lead to a complex organisation which may create heterogeneous valuations.²

In the case of the common value paradigm, trade appears to be the result of an unique and homogenous world market. But, the common value assumption does not necessarily provide the proof of the "law of the one-price" on the world market. It would just mean that traders determine their optimal bidding as if the object has - *ex-post* - the same value. So, the existence of related markets does not exclude the common value assumption. In this case, an equilibrium is established between these different markets, on average.

Our purpose is not to give an accurate representation of the complexity of the world grain and related markets as a whole, but simply to characterize the main features of traders' behaviors, and then of the world grain market. This can be done within the two contrasting (and therefore illustrative) assumptions on grain valuation. For this purpose, we develop an empirical method simply based on an ordinary least squares estimator (further calculations are necessary to obtain a complete estimation of latent distributions). However, it is not possible to decide between the two paradigms with a statistical test, because both structural models simplify to the same reduced form and therefore conclusions have to be drawn via economic considerations only. Estimation results, and then characterization of behaviors under the both paradigms, will provide us for these economic considerations.

The paper is organized as follows. Section 1 provides a presentation of the EU awarding policy. Section 2 summarizes auction theory which can be used to model tenders and section 3 is devoted to econometrics. In this latter section we present a method which permits the estimation of the two competing models. Lastly, section 4 presents an empirical application of this method to tenders involving soft wheat intervention stocks.

---

² Note that there are bilateral agreements too, where political considerations prevail over market clearing.

1. Awarding of cereal export refunds

In the internal market, the European Union sets a market floor price (or intervention price) which is, in fact, a target price for intra-EU trade. Farmers can sell their products to the intervention authorities at this annually adjusted intervention price. Then, grain held in intervention stores is disposed of on the domestic market or through export.

Generally, the world price is considerably less than the European price. To ensure its export competitiveness, traders are given a refund, which makes up for the difference between the world price and the European internal price. This refund is not a simple and direct compensation, because the world price is itself the result of subsidies awarded by the EU and the other countries (Bonus Incentive Commodity Export Program, then Export Enhancement Program - EEP - in the United States, for example).

The result of these policies is that export prices on the world market are, on average, very close. This can be seen through the comparison between the European (fob Rouen) export price of awarded lots of soft wheat intervention stocks, and the US export price of hard red winter (HRW) wheat, which is one of the most representative world prices (see figure 1).³

Figure 1
Soft wheat export prices

pfob is the fob-EU export price of soft wheat intervention stocks, which can be obtained by traders for each lot, according to the purchase price they paid to the Commission (source: *European Commission data*).

hrw is the US fob gulf export price of HRW soft wheat, minus an average bonus, but including an average freight rate from the US to Western Europe (note that the HRW soft wheat is of slightly higher quality than European wheat (source: *International Wheat Council data*)).

³ HRW accounts for about 50 percent of US wheat exports.

Two major instruments are used by the European Commission to award refunds. Firstly, fixed or standing refunds, for which the unitary subsidy is constant and can be awarded for any quantity. Secondly, tenders, that allow the EC to set refunds and quantities, according to the traders' bids (Ferret, 1991; Agra Europe, 1994).

At the beginning of the CAP, the European Commission only provided for the use of standing refunds. However, their fixity permitted important gains for the traders when the world price fluctuated too much. In such cases, it was not possible to adjust the refund immediately. Moreover, it was difficult to control exported quantities within this standing refund procedure. So this procedure was gradually given up in favor of tenders. Tenders have been established in the mid seventies. Tenders facilitate competition among traders and consequently reduce the unitary refund. In addition, tenders simultaneously allow control of the export price, which reflects the commercial policy of the European Union, and of quantity (price and quantity finally determine the budgetary cost). Nowadays, fixed refunds are still used, but they concern specific destinations for which there are not refunds tendered for, especially close-to-home countries. For these countries, a high level of subsidy is not needed. For other destinations which are covered by refunds awarded through tenders, fixed refunds exist but are lower than refunds which are tendered for. They allow traders who have « short hedge » positions and who can not get higher refunds through tenders, to hold their contracts with a minimum loss.

1.1. Tender procedures

There are two tender procedures which, in the case of soft wheat, are used at least for 50 percent of European exports (55 % from 1989 to 1993). The sharing of tenders between intervention stocks and the open market depends on both the world and European markets. Thus, high levels of intervention stocks and a weak absorption capacity of the internal market lead the EU to dispose of its stocks on the world market. Then, quantities concerned by open market tenders are residually fixed.

Intervention stock awards are generally concentrated at the beginning and at the end of the marketing year (see figure 2). Intervention stock awards are between 40 to 70 percent of wheat export licences from May to September, but often zero in the middle of the marketing year. Such a regularity is not observed for open market tenders. For the three last marketing years, intervention stock awarding represents 20 percent of wheat exports, and open market tenders less than 40 percent.

For both tender procedures, bids are anonymously submitted to the Cereals Management Committee which executes the cereals Commission policy.

Figure 2
EU soft wheat exports

Tenders for intervention stocks

Intervention stocks are tendered for by lots. Tenders take place each week, and they concern several lots at the same time. For one lot, each trader makes a per (metric) tonne sealed-bid. The bidding price is determined by keeping in mind the necessity of selling the lot on the world market at a competitive price.

In practice, the European Commission retains the highest bid for each lot and then, because several lots are involved, the highest bids are grouped together and ranked from highest to lowest. The Commission fixes a floor level, and all the bids higher than this level are accepted. This level corresponds to the minimum price the Commission judges acceptable, based on the offers made. At the same time, it corresponds to the maximum quantity it wants to export.

Open market tenders

In the case of open market tenders, the Commission buys an export service from traders who have to stock up on grain from within the internal market. The tenderer must specify the quantity he intends to export and the desired export refund. This refund reflects the subsidy level which is necessary to export to the world market, according to each tenderer (that is, in function of his supplying cost within the internal market).

Each week, the Committee lists the traders' proposals in increasing order of desired refunds, and adds up the quantities associated with them. The Committee fixes a maximum export refund, according to the export price that refund involves and according to the corresponding total quantity to be exported. A contract is awarded to any tenderer who has tendered for a rate of refund equal to or less than the maximum refund. Traders get the proposed refund (not the maximum one) if the obligation of export is fulfilled.

1.2. World grain and related markets

The world grain market is organised around a few excess-supply countries (the five « majors », US, EU, Canada, Australia and Argentina) which make up the deficits of the rest of the world. Supplies and demands are connected by a few international companies who simultaneously act all over the world. Those who intend to export from the EU have to take into account some specific variables related to the CAP, especially the way the European Commission awards the necessary refunds and the corresponding export certificates. In this respect, two main features have to be noticed. First, a refund, which is an export authorization, can be sold to another trader. Such a cession is very current (Court of Auditors of the European Communities, 1990; Debatisse, 1981). Second, traders have to hedge in futures markets, and such a need generally leads to speculative operations.

On the one hand, a market for refunds has appeared since the middle of the seventies (Debatisse, 1984) because the European regulations permit to transfer rights (but not obligations) deriving from export certificates. If, after the date a refund has been awarded, the export price in the world market decreases considerably, it may be in an exporter's interest to sell his refund to another trader rather than to obtain a contract at the current conditions, causing him a large loss. Otherwise traders can also bid to get refunds for speculation only, without intending to export effectively (Debatisse, 1981). Because of the possibility of re-selling refunds, and because of the possibility of hedging in futures markets, speculation against the Commission is one-way.

On the other hand, due to time-lags between the date of getting refunds and the date export is effective, traders have to protect themselves from (and generally speculate with) fluctuations in the effective export price, in the US dollar/ECU exchange rate (all grain transactions in the world market are paid in US dollars), and in the freight rates.

Generally, they cover their risks by hedging in futures markets. To cover the risk of price fluctuations, traders hedge in grain futures markets, especially in Chicago.⁴ Similar operations are used to cover the risks of exchange rate and freight costs variations. Then refunds awarded the same day may lead to different contracts in terms of dates of effective exports, prices and associated costs.

Motivations to hedge in futures markets are the followings. Suppose that a trader gets a refund after bidding for EC weekly tenders, but has not yet an export contract corresponding to this refund. Then he has to fear a decrease of the export price, because in this case the refund will not be sufficient.

---

⁴ *The Chicago Board of Trade is the major futures market for grain transactions. Some others exist in North-America (Kansas-City, Minneapolis, Winnipeg), but only one in Europe, which is of lower importance (the London Grain Futures Market, within the Baltic Mercantile and Shipping Exchange).*

Consequently, at the same moment he gets his refund, the trader sells futures for the same amount of grain, say a four-month contract. In the case he finds only a low price contract to hold his refund engagement, he can buy back his futures contract and make a profit, due to the simultaneous price decrease in the futures market. At least, this gain covers the loss in terms of refunds. Of course, if the export price increases, the refund he got few weeks or few months ago may allow for a larger profit.

Conversely, a trader may be in a « short hedge » position. That is he has a contract with a purchaser which obliges him to export at a due date, but he has no refund to fulfill this contract. Then, to cover the risk of a price decrease, he hedges by buying futures. The day he gets the refund, he sells back his futures contract if the refund is at a lower level than necessary.

All these markets to export grain (European market of refunds and certificates, competition among traders to get refunds from the Commission through tenders, and grain futures markets) may lead to valuations that differ among traders because of the different situations each of them can face, for a similar export operation. Moreover, some kind of specialisation exists among traders, in terms of grain quality or export destinations (Pivot, 1983, p. 149), that can lead to a real segmentation of the world market.

Some imperfect competition may occur in addition to the specialisation phenomenon, due to secondary markets. Besides the principal market, where the majority of transactions is made, secondary markets exist where the price is partially independent and where trader can act significantly upon the formation of this price (Debatisse, 1984). Existence of these secondary markets generally derives from shortcomings in the diffusion of information, and from shortcomings in transport organisation (Debatisse, 1984, p. 271).

This brief presentation of the world grain market shows that European refunds awarding relies on a complex market organisation. Does the world grain market react as if it were composed of supplies and demands which interact in a competitive way, so that only one price should prevail? This would seem to be the case, as only a few local markets, especially the Chicago Board of Trade, appear to influence the behavior and expectations of all agents. Then, the common value assumption may prevail. On the other hand, various interactions between markets (physical, futures, and so on) and time lags between realisations of operations (e.g. getting refunds and effective export) would indicate that traders may have different expectations on the valuation of grain they intend to export.⁵ At best, a perfect equilibrium between these markets (market of refunds, market of re-selling refunds, futures markets, physical markets) may lead to an unique and homogenous world valuation (and then the common value assumption may turn out to be correct). However a certain degree of imbalance would lead to different valuations.

---

⁵ *Segmentation of the world market on the basis of different qualities or destinations does not lead to different private values among traders who bid to get a refund, as far as the refunds apply to homogenous items.*

Thus, it seems particularly interesting to develop an approach in order to deal with this valuation problem. This approach is not meant to reflect all the previously described complex interactions, but just to give a characterization of their effects on the general organisation of the world grain market. That will be done through modelling the behavior of traders who bid to get refunds, within the two contrasting and illustrative assumptions about the grain valuation.

2. Auctions modelling

This section is devoted to a brief presentation of auction theory within the two competing paradigms of private and common valuation of the bidden object. For a more detailed description, the interested reader can refer to the McAfee and McMillan, 1987; or Wilson, 1992, surveys. In the following, we refer to "principal" as the designer of the auction who wants to sell a single object and "bidders" as the possible opponent buyers (we assume that there is no coalition among them. For an analysis of this point, see Graham *et al.*, 1990). An auction is compared to a game, defined by an allocation rule (in most cases, the principal sells the object to the bidder who has made the highest proposal) and a payment rule (for example, he can decide that the price will be the highest announced bid: in this case, he organizes a first price auction; or the price can be the second highest bid). The problem is to determine the expected behavior of a risk neutral bidder i confronted with these rules. We shall consider a first price sealed bid auction, which corresponds to tender procedures. As indicated, the literature on auctions has exposed two opposite approaches concerning bidder's individual valuation of the object.⁶ We shall derive optimal strategies within the private value paradigm, with the extra assumption that the bidders are identical (symmetry assumption).

Within the private value assumption, an individual i who wins the auction (i.e. his bid is the highest one) will gain from the difference between his announced bid b_i and his valuation of the object v_i . Consequently, his expected gain Π_i depends on his private valuation v_i , his bid b_i , and the total set of the announced bids $b_{-i} \equiv (b_j)_{j \neq i}$. The expression of his profit is, for particular values of v_i, b_i, b_{-i} :

$$\Pi_i(v_i, b_i, b_{-i}) = [v_i - b_i] \mathbf{1}_{\{\forall j \neq i, b_i > b_j\}} \quad (1)$$

where $\mathbf{1}_{\{\omega\}}$ is the indicator function that equals 1 if ω occurs, 0 otherwise.

Each individual determines his bid b_i to maximize his expected gain. But, while each bidder knows his own valuation of the item, this valuation is unknown by other bidders, who, given the assumption of independently distributed private values, cannot rely on their own valuations to estimate it. For the other bidders, the private value of the individual j is a random variable V_j (we assume that the cumulative distribution function F_j of this random variable is common

⁶ Milgrom and Weber, 1982, provide a generalization of these two opposite assumptions.

knowledge). For a particular realization $(v_j)_{j=1,\dots,n}$ of the random variables $(V_j)_{j=1,\dots,n}$, a Nash equilibrium of the auction game is defined by n bids $(b_j^*)_{j=1,\dots,n}$, so that it is not in the interest of any bidder to individually modify his offer. Considering all possible values of the stochastic variable $(V_j)_{j=1,\dots,n}$, an auction game (Bayesian-Nash) equilibrium is consequently defined by n bid functions $(b_j^*(\cdot))_{j=1,\dots,n}$.

To determine such an equilibrium, we shall characterize the bid functions $b_j(\cdot)$. We assume that they are increasing functions of the individual valuations v_j :

$$b_j \equiv b_j(v_j) \text{ with } b_j'(\cdot) > 0 \quad (\forall j = 1, \dots, n).$$

Given that private values are stochastic, individual bids are random variables denoted by $B_j \equiv b_j(V_j)$. If the bidder i is risk neutral, he will be interested in his expected gain:

$$\begin{aligned} E\Pi_i(v_i, b_i) &= E[(v_i - b_i) \mathbf{1}_{\{\forall j \neq i, b_j < b_i\}} | V_i = v_i] \\ &= (v_i - b_i) E[\mathbf{1}_{\{\forall j \neq i, b_j < b_i\}} | V_i = v_i] \\ &= (v_i - b_i) P[\bigcap_{j \neq i} (B_j < b_i) | V_i = v_i] \end{aligned}$$

where $E[X | V_i = v_i]$ and $P[\omega | V_i = v_i]$ denote respectively the expectation of the random variable X and the probability of the event ω , given that V_i takes the value v_i . If the other bidders follow their equilibrium strategies B_j^* , the expected surplus of bidder i becomes:

$$E\Pi_i(v_i, b_i) = (v_i - b_i) P[\bigcap_{j \neq i} (B_j^* < b_i) | V_i = v_i]$$

Increasing $b_j^*(\cdot)$ has an inverse function $b_j^{*-1}(\cdot)$. When applied to stochastic equilibrium bids B_j^* , it generates the private value stochastic variable V_j . Consequently :

$$E\Pi_i(v_i, b_i) = (v_i - b_i) P[\bigcap_{j \neq i} (V_j < b_j^{*-1}(b_i)) | V_i = v_i] \quad (2)$$

with, under the independence assumption:

$$P[\bigcap_{j \neq i} (V_j < b_j^{*-1}(b_i)) | V_i = v_i] = P[\bigcap_{j \neq i} (V_j < b_j^{*-1}(b_i))] = \prod_{j \neq i} P(V_j < b_j^{*-1}(b_i))$$

and with the symmetry assumption:

$$\prod_{j \neq i} P(V_j < b_j^{*-1}(b_i)) = \prod_{j \neq i} P(V_j < b^{*-1}(b_i)) = [F(b^{*-1}(b_i))]^{n-1}$$

When the other bidders follow their equilibrium strategies, expected profit of individual i is then:

$$E\Pi_i(v_i, b_i) = (v_i - b_i) [F(b^{*-1}(b_i))]^{n-1}$$

Assuming that $b^*(.)$ is differentiable, a necessary condition for a bid $b_i = b^*(v_i)$ to be optimal is provided by:

$$\left. \frac{\partial \Pi_i(v_i, b_i)}{\partial b_i} \right|_{b_i = b^*(v_i)} = 0$$

i.e.:

$$\frac{d}{dv} [b^*(v_i) [F(v_i)]^{n-1}] = v_i \frac{d}{dv} [F(v_i)]^{n-1}$$

which is a first order differential equation, the solution of which is:

$$b^*(v_i) = v_i - \frac{\int_{v_0}^{v_i} [F(v)]^{n-1} dv}{[F(v_i)]^{n-1}} \quad (3)$$

where v_0 is the principal reservation value (that is, the minimum value of acceptable bids). The expression of the optimal bid (3) can also be written:

$$b^*(v_i) = E[\max(v_0, V_{(n-1)}) | V_{(n)} = v_i] \quad (4)$$

where $V_{(n)}$ is the (random variable of the) highest private value and $V_{(n-1)}$ the second one. Consequently, the optimal strategy of the bidder i is to bid the expected value of the second highest bid, assuming that the first one is his own valuation.

Now, consider the case where the principal proposes an item which is worth the same value c for all bidders (for example, its resale market value). This value is unknown at the time of the auction. Each bidder is supposed to be able to calculate a personal estimation of the common value c . We denote a_i the realization of the random variable A_i of such an estimate by the individual i , and assume that all these expectations are conditional upon the *ex post* common value c . In competing in a sealed bid auction, a bidder i cannot observe the behavior of others and therefore cannot improve his own valuation during the process of the game. However, if he presumes that his offer b_i is the highest one, he is obliged to attach probabilities to other bidders' estimated values. That induces refinements of his own valuation of the object.

The same type of reasoning previously developed in the private value paradigm gives the first order condition for an equilibrium strategy (see, e.g., Levin and Smith, 1991):

$$b^{*'}(a) = \frac{\int [c - b^*(a_i)] (n-1) f(a_i | C=c) [F(a_i | C=c)]^{n-2} dP[C | A_i = a_i]}{\int [F(a_i | C=c)]^{n-1} dP[C | A_i = a_i]} \quad (5)$$

3. An Ordinary Least Squares Estimator

The literature provides many estimation methods to determine latent distributions of private values or signals (see, e.g., Paarsch, 1992, 1994, or Laffont and Vuong, 1993). Here, we develop a simple method that relies on ordinary least squares to estimate both models, under the assumption of normality and log-normality of the private values (resp. signals of the common value) paradigm. The point to be noted is that it is not possible to discriminate between the opposite paradigms statistically: both structural models lead to the same reduced form to be estimated.

For example, assume a normal distribution of either the private values, or the signals of the common value. Then:

$$E(b_l^w) = \sum_{k=0}^K \beta_k z_{lk} + \kappa_p \sigma_p$$

within the private values paradigm (σ_p is the standard deviation of the private values, $\sum_{k=0}^K \beta_k z_{lk}$ their mathematical expectation)

$$E(b_l^w) = \sum_{k=0}^K \alpha_k z_{lk} + \kappa_c \sigma_c$$

within the common value paradigm (σ_c is the standard deviation of the signals, $\sum_{k=0}^K \alpha_k z_{lk}$ their mathematical expectation)

For a given number of bidders, κ_p and κ_c are constant terms and β and α are two vectors of parameters that differ only by the term relative to the constant. That is, $\beta = (\beta_0 \delta)$ and $\alpha = (\alpha_0 \delta)$ where δ is a vector of K parameters that affect non constant exogenous variables, and β_0 (resp. α_0) is the constant term of the mathematical expectation of the private values (resp. signals). Then, it is the same regression of b^w against the vector of exogenous variables that gives an estimate of the vector δ and the constant term of both models. Additional calculations are necessary to compute σ_p and σ_c , and then to derive β_0 and α_0 .

We will briefly present some explanation in this section. More details can be found in Bourgeon, 1994.

3.1. Private values paradigm

Assume that private values of the n bidders follow the same distribution function F_l , for each auction l . The private value paradigm permits us to simplify expression $E(b_l^w)$. In this case, as proposed by Laffont, Ossard and Vuong, 1991, one can apply the Revenue-Equivalence Theorem (Myerson, 1981), which states that the seller's expected revenue $E(b_l^w)$ is the same whether a first or second price auction is designed. Thus, one can write (see also (4)):

$$E(b_l^w) = E(\max(v_0, v_{(n-1)}))$$

where $v_{(n)}$ is the highest private value, and $v_{(n-1)}$ the second one. Assuming that the seller does not set a reservation price, we obtain:

$$\begin{aligned} E(b_l^w) &= E(v_{(n-1)}) \\ &= \int \dots \int v_{(n-1)} f(v_{(1)}) \dots f(v_{(n)}) dv_{(1)} \dots dv_{(n)} \\ &= \int n(n-1) u F_l(u)^{n-2} f_l(u) (1 - F_l(u)) du \\ &= \int u dF_l(u) \end{aligned}$$

where F_l is the cdf of the second highest private value of the l^{th} auction.

Assuming that, for each auction l , private values follow a normal distribution with mean $\bar{V}_l = z_l' \beta$ and variance σ_p^2 , one can show that the mathematical expectation of the winning bids is the linear expression:

$$\begin{aligned} E(b_l^w) &= \int_{-\infty}^{+\infty} (\sigma_p t + \bar{V}_l) d[\Phi_2(t)] \\ &= \bar{V}_l + \sigma_p \tilde{k}_1 \end{aligned} \quad (6)$$

where:

$$\tilde{k}_1 = \int_{-\infty}^{+\infty} t d[\Phi_2(t)]$$

and Φ_2 is the cdf of the second highest random variable among n standard normal random variables, i.e. (where Φ stands for the cdf of the standard normal):

$$\Phi_2(t) = n \Phi(t)^{n-1} [1 - \Phi(t)] + \Phi(t)^n$$

Consequently, $\tilde{k}_1$ is the expected value of the second highest random variable among n standard normals and, for a given number n of bidders, $\tilde{k}_1$ is a constant⁷. We can estimate the latent distribution of the private values with a linear regression. But, if $\bar{V}_l = \beta_0 + z_l' \delta$ (with $\beta = (\beta_0 \delta)$ and $z_l = (1 \ z_l')$), such an estimation does not allow us to directly identify the standard deviation σ_p , but only the constant $\beta_0 + \sigma_p \tilde{k}_1$, and the vector δ . To determine all the parameters of the latent distribution, it is also necessary to express σ_p . This can be done from the standard deviation of the winning bids. If $\hat{\sigma}_{b^w}$ is an estimation of the standard deviation of the winning bids, then an estimation of σ_p is given by:

$$\hat{\sigma}_p = \hat{\sigma}_{b^w} \frac{1}{\sqrt{k_2 - \tilde{k}_1^2}}$$

⁷ For n greater than 3 bidders, this expression is positive. Then the mathematical expectation of the winning bids is greater than the mathematical expectation of the private values. Furthermore, this expression increases with the number of bidders.

where $\tilde{k}_2$ is a constant that is defined by:

$$\tilde{k}_2 = \frac{2(n-1)}{n-2} \left(\int_{-\infty}^{+\infty} t^2 d[\Phi(t)]^n - 1 \right) - \frac{n}{n-2} \left(\int_{-\infty}^{+\infty} t d[\Phi(t)]^{n-1} \right)^2$$

3.2. Common value paradigm

We will see here how the same linear estimation can give parameters of the common value model and of the private values model (except the constant terms and the standard deviations of the signals or of the private values).

Assume that signals a_i are normally distributed with mean $c_i = z_i \alpha$ (z_i is a vector of explanatory variables of the signals, α is a vector of parameters) and variance σ_c^2 . The theoretical winning bid is given by (see Levin and Smith, 1991; Wilson, 1992):

$$b_i^w = a_i^w - \alpha_n \sigma_c + \beta \exp(-k_1 a_i^w / \sigma_c)$$

where:

a_i^w is the winner's signal,

$k_1 = \int_{-\infty}^{+\infty} t d[\Phi(t)]^n$ is the expectation of the winner's standardized signal $\left(\frac{a_i^w - c_i}{\sigma_c} \right)$,

$$\text{and } \alpha_n = \frac{\int_{-\infty}^{+\infty} t^2 d[\Phi(t)]^n}{\int_{-\infty}^{+\infty} t d[\Phi(t)]^n} = \frac{k_2}{k_1}$$

It is possible to show that the mathematical expectation of the winning bids is:

$$E(b_i^w) = c_i - \sigma_c \frac{\text{Var}(U_{(1)})}{E(U_{(1)})} + \beta \exp(-k_1 c_i / \sigma_c) \int_{-\infty}^{+\infty} \exp(-k_1 t) d[\Phi(t)]^n$$

where $U_{(1)}$ is the order statistic « highest value among n realizations of a standard normal ». β is always less than or equal to zero. Then the mathematical expectation of the winning bids is always less than the mathematical expectation of the signals. That is, on average, a winner never losses money within this paradigm.

In the case of a linear optimal bid function (that is when $\beta = 0$), the mathematical expectation of the winning bids is a linear function of the mathematical expectation of the signals:

$$E(b_i^w) = c_i - \sigma_c(\alpha_n - k_1) \quad (7)$$

For a given number of bidders, $(\alpha_n - k_1)$ is a constant. So, it is possible to get an estimation of b^w with ordinary least squares. If $c_i = \alpha_0 + z_i' \delta$ (with $\alpha = (\alpha_0 \delta)$ and $z_i = (1 \ z_i')$, such an estimation does not allow us to directly identify the standard deviation σ_c , but only the constant $\alpha_0 - \sigma_c(\alpha_n - k_1)$, and the vector δ .

If the set of explanatory variables is the same whether we assume the private values paradigm or the common value paradigm, the same least squares estimation gives the same parameters for these variables (that is with the regression of b^w against z , which has to be considered either as the set of explanatory variables of the private values, either as the set of explanatory variables of the signals). Only the constant terms and the standard deviation of private values in the first case, and of the signals in the second case, have to be derived in a different way.

Here, within the common value assumption, and with $\beta = 0$ (linear strategy), the variance of the signals is proportional to the variance of the winning bids:

$$\sigma_c^2 = \frac{Var(b_i^w)}{Var(U_{(1)})}$$

Then an estimation of the standard deviation of the signals is given by:

$$\hat{\sigma}_p = \hat{\sigma}_{b^w} \frac{1}{\sqrt{k_2 - k_1^2}}$$

$Var(U_{(1)})$ is always less than one. Then the variance of the signals is always larger than the variance of the winning bids. And the larger is the number of bidders, the larger is the multiplier $1/Var(U_{(1)})$, i.e., the larger is the variance of the signals relatively to the variance of the winning bids.

Expressions of mathematical expectations of the winning bids, and approximations of their standard deviations, are presented in the following diagram, under the both paradigms, and under two assumptions about the distributions of private values or signals of the common value:

	$E(b_l^w)$	σ
Normal distribution		
Private values	$z_l \beta + \sigma_p \tilde{k}_1$	$\hat{\sigma}_p = \hat{\sigma}_{b^w} \frac{1}{\sqrt{\tilde{k}_2 - \tilde{k}_1^2}}$
Common value	$z_l \alpha - \sigma_c (\alpha_n - \tilde{k}_1)$	$\hat{\sigma}_p = \hat{\sigma}_{b^w} \frac{1}{\sqrt{\tilde{k}_2 - \tilde{k}_1^2}}$
Log-normal distribution		
Private values	$\tau_n(\sigma_p) \prod_{k=1}^K z_{lk}^{\beta_k}$	$\sigma_p \# \frac{\sigma_{b^w} / E(b^w)}{\sqrt{\tilde{k}_2 - \tilde{k}_1^2 - \tilde{k}_1 \sigma_{b^w} / E(b^w)}}$
Common value	$\gamma_n'(\sigma_c) \prod_{k=1}^K z_{lk}^{\alpha_k}$	$\sigma_c \# \frac{\sigma_{b^w} / E(b^w)}{\sqrt{\tilde{k}_2 - \tilde{k}_1^2 - \tilde{k}_1 \sigma_{b^w} / E(b^w)}}$

The case of the log-normal distribution is presented in the appendix. All proofs and more detailed explanations can be found in Bourgeon, 1994.

4. Application : tenders of soft wheat intervention stocks

The framework described above is applied to tenders of soft wheat intervention stocks⁸. Such an estimation heavily relies on several assumptions (in addition to the ones which are necessary for a symmetric Bayesian-Nash equilibrium). Hence, for simplicity, we consider that a separate tender applies to each lot. For a given lot, the highest bid is accepted if it is higher than a minimum sale price, or reservation price, which we assume to be known *ex ante*. (See Elyakime *et al.*, 1994, for an estimation method with secret reservation price).

Weekly tenders are presented in reports issued by the EU Cereals Management Committee. These reports contain information about purchase prices of awarded lots, quantities of each lot, and places where lots are located. Tenders apply to homogeneous lots by prefixing correctives, according to differences in quality on the one hand and to the destination of exports on the other hand (that is, to take into account freight costs but also to favor specific destinations). The data set covers tenders held between March 1991 and June 1992, that is to say 424 awarded lots. The main statistical features of used data are summarized in table 1.

Variables which can explain private or common values can be divided into three sets :

- time variables, which reflect seasonal shifters ;

⁸ Open market tenders are a more complex means of awarding because both quantities and refunds are endogenous.

- price variables : posted and actual US export price (i.e. bonuses awarded within EEP are taken into account) ; internal price, the level of which can act upon the timeliness to export in the world market ; exchange rate of European Currency Unit (Ecu) versus US dollar ;
- quantity variables : EU and US exports, and total EU export awarded the same day, which is related to the *ex post* reservation price.

For each auction i , the variable b_i^w is the winning bid, expressed in green Ecu. The internal price is expressed in French francs (the parity between the French franc and the green Ecu is constant over the period of estimation), and world prices are expressed in US dollars. Quantities are expressed in million tons.

Table 1

	Average	Minimum	Maximum
Quantity per lot (monthly average)	5 500 tonnes	4 600 tonnes (February 1992)	7 600 tonnes (June 1992)
Number of awarded lots per tender (monthly average)	7	1	36 (July 1992)
Purchase price, including the " technical refund " (Ecus/tonne)	84.4	74.1	110.2

We assume that there are 15 bidding traders for each auction (that is, the major international companies, some national or European shippers, and eventually cooperatives; for more details, see Debatisse, 1984), which seems to be very close to the reality.

First, we present and comment on the linear estimations of the model, under both the normal and the log-normal assumptions. These estimations allow us to characterize the effects of the exogenous variables on the private values as well as on the *ex ante* signals of the common value. After that, we will derive additional parameters which characterize the distributions of the private values or of the signals.

4.1. Effects of economic variables on private and common values

The parameter estimates are given in table 2. The two assumptions concerning the distributions of private values or signals produce a very satisfying fit. All variables are significant under both distributional assumptions. Recall that in the log-normal case, estimated parameters have to be interpreted as elasticities.

The exchange rate has a positive effect on bids: *ceteris paribus*, an increasing value for the US dollar involves higher bids, expressed in Ecus. The elasticity is equal to one (1.079): any change in the exchange rate only induces a mechanical adjustment of European traders' bids.

Table 2

Distribution	Normal	Log-normal
Constant	22.353 (4.1)	6.210 (21.1)
Variables z_i	Parameters δ	
ECU/US (exchange rate Ecu/USD)	14.351 (17.6)	1.079 (17.0)
QUS (US exports)	- 4.847 (-8.8)	- 0.023 (- 8.4)
USP (actual US export price)	0.587 (50.5)	0.591 (39.6)
ECP (EU price)	- 0.057 (- 23.2)	- 0.889 (- 21.0)
R^2	0.908	0.877
RMSE	3.00 %	3.23 %

Student statistics between parentheses

US exports have a negative effect. When they increase, European traders have to minimize their purchase price in order to stay price-competitive in the world market. However, one may notice that the elasticity is very low (- 0.02).

One important result is the effect of the actual US export price. The price used in our estimation is the fob US price (HRW), corrected by an average of bonuses. Traders' bids are obviously determined by this export price. This is a confirmation of the leadership role that US trade plays, and consequently that US export subsidy policy plays. Such a strong result stems, no matter what estimated specification. *Ceteris paribus*, especially for the exchange rate, an increase of 1 % of the US export price induces an increase of about 0.6 % of the European traders' purchase price.

The internal price has a negative effect on winning bids. When this price increases it may be less profitable to export to the world market rather than selling in the European market. So traders decrease their bids ⁹.

Note that the effects of the quantities which are tendered for are never significant.

⁹ Note that the CAP reform involves a decrease of internal prices. Consequently, such a measure would induce an increase of traders' bids. It becomes less costly for the EC to sell its intervention stocks onto the world market. For example, if internal prices decrease of 10 percent, the EC can sell its intervention stocks at about a 9 percent higher level, which has a positive effect on the European agricultural budget.

4.2. Distribution of private and common values

Table 3 gives estimations of the distribution characteristics of private values and of signals of the common value.

Table 3

Estimations of the mathematical expectation and of the residual standard deviations of the winning bids				
$\hat{E}(b^w) = 84.44$ Ecus				
Normality assumption : $\hat{\sigma}_{b^w} = 2.522$				
Log-normality assumption : $\hat{\sigma}_{b^w} = 2.730$				
Estimated expectations and standard deviations of private values and of signals of the common value				
Private values	$\hat{\sigma}_p$	β_0	$\hat{V}$	$\hat{\sigma}_p / \hat{V}$
Normal	8.93	11.20	73.3	12.2 %
Log-normal	0.1335	424.43	72.0	13.4 %
Signals of the common value	$\hat{\sigma}_c$	$\hat{\alpha}_0$	$\hat{c}$	$\hat{\sigma}_c / \hat{c}$
Normal	4.60	23.15	85.2	5.2 %
Log-normal	0.0582	502.73	85.29	5.8 %

If the private values paradigm prevails with a normal distribution, the average of private values is about 15 percent less than the winning bid, or the second highest value. The standard deviation of these private values is about 9 Ecus (around an average of 73 Ecus), that is 12 percent. This dispersion of values is not small: 90 percent of the private values are, on average, in the interval [56, 91]. So, if the private values paradigm holds, the segmentation of the world market among European traders would be significant. Similar results are generated using the log-normal assumption.

Moreover it is noticeable that the average of the private values is always considerably less than the winning bid (which is the seller's revenue) corresponding to each lot (see figure 3). One can observe this gap on average over all the observations, with a mean of private values ($\hat{V}$) equal to 72 Ecus (under the normal assumption), and a mean of the winning bids ($\hat{E}(b^w)$) equal to 84.4 Ecus. Further, this average of the private values converted into US dollars is always considerably less than the actual US export price (see figure 3, where the actual US export price is evaluated from the HRW export price, minus an average of bonuses, plus an average freight rate from the USA to Western Europe). For the latter case, the difference in quality is not sufficient to explain the gap. For the former case, such a situation seems rather unrealistic.

Whereas the aim of the traders is to speculate against the Commission when bidding to get refunds (or to purchase intervention stocks), it would mean that they always loose money on average. Actually the average of the traders' valuation (approximated by $\bar{V}$) would be less than what they pay (that is the winning bids b^w). Thus, the assumption of private values does not seem to fit to the empirical knowledge of the market.

If the paradigm of private values holds, that is if there is a segmentation of the world market among traders which leads to different valuations for the same cereal¹⁰, that would mean that international prices are very high, relatively to European traders' valuations. Actually, the US export price (HRW) and the winning bids (in terms of resale price onto the world market) are very close, as it can be seen on the figure 3. Quantities exported at these prices account for a large part of world grain trade¹¹, and they are 20 to 25 percent higher than the average of European traders' valuations. Then, those who have the lowest private values would have to stock up at a very high price, relatively to the value they attach to the item. That does not seem to be credible.

Figure 3
US export price, Winning bids, and Averages of the Private values

The winning bids and the estimated averages of private values are converted from Ecu to US dollar and expressed in terms of resale price onto the world market. HRW is the US export price.

¹⁰ in terms of quality, and after having taken into account a corrective for differences of freight costs.

¹¹ HRW accounts for 50 percent of US soft wheat exports, and exports from intervention stocks represent 20 percent of European soft wheat exports.

Figure 4
US export price, Winning bids, and Common value

Conversely, if the common value paradigm prevails, which means that bidders know the uniqueness of the price after bidding, but do not know its value before bidding, then the dispersion of *ex-ante* personal approximations is rather low. The standard deviation of these signals is 5 to 6 percent of the average common value, whatever assumption is made about the distribution of the signals. Under the normal assumption, this standard deviation is 4.6 Ecus, while the average common value is about 85 Ecus. This average common value is the same for both distributional assumptions. The estimated common value, converted into a US dollar export price, is either nearly equal to, or slightly lower than the US export price (evaluated as previously) (see figure 4).

Moreover it is quite noticeable that this common value is nearly equal to the average of the winning bids (84.4 Ecus). That can be seen for each lot (see figure 4). With 15 bidders, the competition seems to be sufficient to lead to this closeness: here the seller's revenue (equal to the winning bid) and the bidders' valuation are the same, on average, and consequently there is no rent for the buyers.

Then, the assumption of common value seems more realistic than the private values' one. It is not possible to decide between these two assumptions with a statistical test, but we can prefer the common value paradigm on the basis of economic teachings which are drawn from estimation results. The choice of common value would indicate two main features. On the one hand, the common value paradigm entails the uniqueness of the price reference in the world grain market, in spite of the complexity of its organisation and the speculative behaviors of traders (hedging in futures markets, possibility of re-selling refunds, and so on). This conclusion is consistent with experts' opinions who readily speak of « the » world price, but also, for

example, with the European Commission which explicitly takes into account an US export price to determine the necessary and acceptable refund (Ferret, 1991). On the other hand, the closeness between the common valuation of traders and the Commission's revenue points out the efficiency of the awarding procedure, because traders buy intervention stocks at a level very close to their own valuation.

Conclusion

In this paper we have pointed out the importance of refund awarding procedures for EU cereal exports. An analysis of these procedures can be drawn from auction theory.

The derivation of structural approaches of uncompetitive markets like tender procedures has provided important theoretical results that have not yet been completely exploited by empirical work. This research has presented a simple econometric method which holds for both common and private values paradigms. The application concerns an important feature of the European agricultural policy, namely, the refund awarding policy. This econometric method leads to a linear least squares estimator which is the same for the common value model and for the private values model, if an identical assumption is made on private values or signals' distributions. The outcome is the simplicity of the estimation procedure, since only an ordinary least squares estimator is needed to measure the shifters' effects. Specific additional estimations are used to characterize private values or signals' distributions. Moreover, for a given set of explanatory variables, this method proves that the effects of these variables are the same under both the private values and the common value assumptions. Further, because of the use of the same regression for both paradigms, no specification test can be used to decide between these paradigms.

The estimation results show that European traders' behavior is highly dependent on US export prices. This behavior is also sensitive to US export quantities. Otherwise, the elasticity of traders' purchase offers to the US dollar exchange rate is equal to one. This means that exchange rate movements only induce mechanical adjustments. Lastly, the timeliness to export in the world market is significantly influenced by domestic price variations.

The characterization of private values or signals' distributions highlights some features of the market. If traders have different and independent private values for cereals when bidding, the dispersion of these values is 12 to 13 percent of the mean value, with this, on average, 15 percent less than the winning bid. These results might prove heterogeneity and significant segmentation of the grain world market. But several reasons indicate that the private values assumption can not turn out to be correct here. Actually, the estimation results show that, on average, the traders' private values should be lower than the purchase price they accept to pay for cereals to be exported. This does not seem to be plausible, given the strategic and speculative behavior of traders.

Conversely, if traders determine their optimal bidding as if grain to be exported has the same *ex post* value, but if they do not know it precisely *ex ante*, then, among bidders, *ex ante* personal approximations of the common value are very close. The *ex ante* knowledge of *ex post* valuation seems nearly perfect, and the mean winning bid, that is the seller's revenue, equals the *ex post* common value. On average, the tender procedure used to sell European soft wheat intervention stocks leads to efficient competition among traders, who would gain from no profit. The common value assumption seems to fit, better than the private values assumption, the reality of the market. If this paradigm holds, this means that an unique reference acts upon the agents' behaviors at the world level. Further, the estimation results confirm the leadership role that US trade plays: the US export price remains the unique reference point (even if it can sometimes be a response to European export subsidy policy).

Finally, one has to point out that competition among European (and world) traders and the information available to each of them, imply that the tender procedure used by the EC is an efficient one, because no gain is extracted by traders.

Appendix

Log-normal distribution of private values

Here, we assume that logarithms of private values are normally distributed with mean $\ln \bar{V}_i = \sum_{k=1}^K \beta_k \ln(z_{ik})$ and variance σ_p^2 , where $(z_{ik})_{k=1, \dots, K}$ are explanatory variables of private values (eventually including a constant), and $(\beta_k)_{k=1, \dots, K}$ are parameters.

Then, one can show that the mathematical expectation of the winning bids is:

$$\begin{aligned} E(b_i^w) &= e^{-\sigma_p^2/2} \int_{-\infty}^{+\infty} e^{\sigma_p t} d[\Phi_2(t)] \bar{V} \\ &= \tau_n(\sigma_p) \prod_{k=1}^K z_{ik}^{\beta_k} \end{aligned} \quad (8)$$

Where: $\tau_n(\sigma_p) = e^{-\sigma_p^2/2} \int_{-\infty}^{+\infty} e^{\sigma_p t} d[\Phi_2(t)]$

And, taking logarithms:

$$\ln(E(b_i^w)) = \ln(\tau_n(\sigma_p)) + \sum_{k=1}^K \ln(z_{ik}) \beta_k$$

An estimation of $\ln(b^w)$ can be obtained with ordinary least squares. But if the vector $(z_{ik})_{k=1, \dots, K}$ includes a constant, it is not possible to get an estimation of β_0 on the one hand, and an

estimation of $\tau_n(\sigma_p)$ (and then of σ_p) on the other hand. The estimation only provides with a constant equal to $\tau_n(\sigma_p) + \beta_0$.

The same problem of identification of parameters than in the normal case appears here. We will see later how an additional estimation can give an approximation of σ_p , and then of the constant included in $(z_k)_{k=1, \dots, K}$.

The expression (8) shows that the mathematical expectation of the winning bids is equal to the mathematical expectation of the private values, multiplied by a coefficient $\tau_n(\sigma_p)$. This multiplier increases with the number n of bidders, which reflects the increasing competition among bidders. That is, for a given σ_p , the larger is the number of bidders, the larger is the ratio between the winning bid and the average of the private values. But $\tau_n(\sigma_p)$ is a decreasing function of σ_p : the larger is the standard deviation of private values, the higher can be the second highest private value. Otherwise, when the number of bidders is large enough (say at least $n = 5$ for a standard deviation less or equal to 1), $\tau_n(\sigma_p)$ is greater than one. In this case, we see that the mathematical expectation of the winning bids is always larger than the mathematical expectation of the private values.

Lastly, to solve the previous identification problem, the standard deviation of the private values can be expressed in terms of the standard deviation of the winning bids (σ_{b^w}), through an implicit relation. This one can be approximated to get:

$$\sigma_p \approx \frac{\sigma_{b^w} / E(b^w)}{\sqrt{\tilde{k}_2 - \tilde{k}_1^2 - \tilde{k}_1 \sigma_{b^w} / E(b^w)}}$$

Empirical approximations of σ_{b^w} and $E(b^w)$ give an estimation of σ_p , which allows to derive β_0 .

Log-normal distribution of signals

Assume that $\ln a_i$ is normally distributed with mean $\ln(c_i) = \sum_{k=1}^K \alpha_k \ln(z_{ik})$ and variance σ_c^2 , the mathematical expectation of the winning bids is given by the following expression:

$$\begin{aligned} E(b_i^w) &= E(a_i^w \gamma_n(\sigma_c)) \\ &= \gamma_n(\sigma_c) c_i \int_{-\infty}^{+\infty} e^{\sigma_c t} d[\Phi(t)]^n \\ &= \gamma'_n(\sigma_c) \prod_{k=1}^K z_{ik}^{\alpha_k} \end{aligned}$$

where:

$$\gamma'_n(\sigma_c) = \gamma_n(\sigma_c) \int_{-\infty}^{+\infty} e^{\sigma_c t} d[\Phi(t)]^n$$

and:

$$\gamma_n(\sigma_c) = e^{-\sigma_c^2/2} \frac{\int_{-\infty}^{+\infty} e^{\sigma_c t} (t + \sigma_c) d[\Phi(t)]^n}{\int_{-\infty}^{+\infty} (t + \sigma_c) d[\Phi(t)]^n}$$

Then, when taking logarithms of the mathematical expectation of the winning bids:

$$\ln(E(b_l^w)) = \ln(\gamma'_n(\sigma_c)) + \sum_{k=1}^K \ln(z_{lk}) \alpha_k \quad (9)$$

If $(z_{lk})_{k=1,\dots,K}$ includes a constant, then $\alpha = (\alpha_0 \delta)$. The same linear regression as in the case of private values, within the assumption of log-normal distribution, gives an estimation of δ . That is, with a regression of $\ln b^w$ against $(\ln z_k)_{k=1,\dots,K}$ by ordinary least squares. Here the constant term in this regression is $\ln(\gamma'_n(\sigma_c)) + \alpha_0$ and it is not possible to directly get σ_c and α_0 .

$\gamma'_n(\sigma_c)$ is always less than one but very close to one when σ_c is small. So, within the log-normal assumption again, the mathematical expectation of the winning bids is, on a average, always smaller than the common value c_l . The "winner's curse" does not hold here. Otherwise, one have to notice that $\gamma'_n(\sigma_c)$ increases with n but decreases with σ_c .

Lastly, it is possible to derive the standard deviation of the signals from the mean and the standard deviation of the winning bids. An implicit relation can be found between σ_c , $E(b^w)$ and σ_{b^w} . Then, an approximation of σ_c is given by:

$$\sigma_c \# \frac{\sigma_{b^w} / E(b^w)}{\sqrt{k_2 - k_1^2 - k_1 \sigma_{b^w} / E(b^w)}}$$

where k_1 and k_2 are the first and the second moments of $U_{(1)}$.

Empirical approximations of σ_{b^w} and $E(b^w)$ give an estimation of σ_c . Then the constant α_0 in the expression of c_l can be derived.

References

Agra-Europe (1994). CAP Monitor.

Bourgeon, J.M. (1994). Asymétries d'information et comportements stratégiques dans l'établissement de la Politique Agricole Commune. Thèse de doctorat. Université Paris X Nanterre.

Court of Auditors of the European Communities. (1990). Special report n° 2/90 on the management and control of export refunds accompanied by the replies of the Commission. Official Journal of the European Communities, 90/C 133/01.

Debatisse, M.L. (1981). EEC Organisation of the Cereals Market: Principles and Consequences. Center for European Agricultural Studies, occasional paper 10, Ashford, Kent: Wye College.

Debatisse, M.L. (1984). Cerealexport. Paris: Atya.

Elyakime, B., Laffont, J.J., Loisel, P., and Vuong, Q. (1994). First Price Sealed-Bid Auctions with Secret Reservation Prices. Annales d'Economie et de Statistique 34: 115-141.

Ferret, M. (1991). Guide du Commerce Extérieur. Paris: Office National Interprofessionnel des Céréales.

Graham, D.A., Marshall, R.C., and Richard, J.F. (1990). Differential Payments Within a Bidder Coalition and the Shapley Value. The American Economic Review 80(3): 493-510.

Laffont, J.J., Ossard, H., and Vuong, Q. (1991). Econometrics of First Price Auctions. Working Paper 9107, IDEI Toulouse.

Laffont, J.J. and Vuong, Q. (1993). Structural Econometric Analysis of Descending Auctions. European Economic Review. 37: 329-341.

Levin, D. and Smith, J.L. (1991). Some Evidence on the Winner's Curse: Comment. The American Economic Review. 81(1): 370-375.

McAfee, R.P. and McMillan, J. (1987). Auctions and Bidding. Journal of Economic Literature XXV(2): 699-738.

Milgrom, P.R. and Weber, R.J. (1982). A Theory of Auctions and Competitive Bidding. Econometrica 50(5): 1089-1122.

Myerson, R.B. (1981). Optimal Auction Design. Mathematical Operations Research 6(1): 58-73.

Paarsch, H.J. (1992). Deciding between the Common and Private Value Paradigms in Empirical Models of Auctions. Journal of Econometrics 51(1-2): 191-215.

Paarsch, H.J. (1994). A Comparison of Estimators for Empirical Models of Auctions. Annales d'Economie et de Statistique 34: 143-157.

Pivot, C. (1983). Le blé français face à l'environnement international. Paris: Economica.

Thiel, S.E. (1988). Some Evidence on the Winner's Curse. The American Economic Review 78(5): 884-895.

Wilson, R. (1992). Strategic Analysis of Auctions. In R.J. Aumann and S. Hart (eds.), Handbook of Game Theory 1. Amsterdam: Elsevier Science Publishers, 227-279.

DOCUMENTS DE TRAVAIL

Septembre 1994

- 90-01 L'IMPACT DE LA PROPOSITION AMERICAINE AU GATT SUR LES AGRICULTURES DE LA CEE ET DES USA. Hervé GUYOMARD, Louis-P. MAHE, Christophe TAVERA (1990).
- 90-02 AGRICULTURE IN THE GATT : A QUANTITATIVE ASSESSMENT OF THE US 1989 PROPOSAL. Hervé GUYOMARD, Louis-P. MAHE, Christophe TAVERA (1990).
- 90-03 EC-US AGRICULTURAL TRADE RELATIONS : DO POLITICAL COMPROMISES EXIST ? Louis-P. MAHE, Terry L. ROE (1990).
- 90-04 ANALYSE MICRO-ECONOMIQUE DE L'EXPLOITATION AGRICOLE. Catherine BENJAMIN (1990).
- 90-05 PSE, AMS AND THE CREDIT FOR SUPPLY MANAGEMENT POLICIES IN THE GATT NEGOTIATIONS (application to the EC case). Hervé GUYOMARD, Louis-P. MAHE (1990).
- 90-06 COMPLETING THE EUROPEAN INTERNAL MARKET AND INDIRECT TAX HARMONIZATION IN THE AGRICULTURAL SECTOR. Hervé GUYOMARD, Louis-P. MAHE (1990).
- 90-07 ALIMENTATION ANIMALE ET DYNAMIQUE DES PRIX DES MATIERES PREMIERES SUR LE MARCHE FRANCAIS. Yves DRONNE, Christophe TAVERA (1990).
- 91-01 ECONOMIC BEHAVIOUR OF AGRICULTURAL HOUSEHOLDS : IMPLICATIONS OF ASSUMING PERFECT SUBSTITUTABILITY BETWEEN LABOURS. Catherine BENJAMIN, Hervé GUYOMARD (1991).
- 91-02 LIMITATION DES IMPORTATIONS EUROPEENNES DE SUBSTITUTS DES CEREALES : IMPACT BUDGETAIRE ET DE BIEN-ETRE ECONOMIQUE. Chantal LE MOUEL (1991).
- 91-03 L'EVOLUTION DE LA POLITIQUE AGRICOLE COMMUNE ET SON IMPACT SUR LES PRODUCTIONS ET REGIONS AGRICOLES FRANCAISES. Hervé GUYOMARD, Yves LEON (1991).
- 91-04 PUBLIC INPUTS, ALLOCATABLE FIXED FACTORS AND THE THEORY OF THE MULTIPRODUCT FIRM : A CLARIFICATION. Hervé GUYOMARD (1991).
- 91-05 LA REFORME DE LA PAC : Une révolution ou un grand pas dans la bonne direction ? Hervé GUYOMARD, Louis-P. MAHE (1991).
- 92-01 LA POLITIQUE AGRICOLE COMMUNE DANS L'ETAU DE L'URUGUAY ROUND. Hervé GUYOMARD, Louis-P. MAHE (1991).
- 92-02 TRADE COMPROMISES BETWEEN THE EC AND THE US : An Interest Group - Game Theory Approach. Martin JOHNSON, Louis-P. MAHE, Terry L. ROE (1992).
- 92-03 LE PROJET Mac SHARRY : facteurs de sensibilité du débouché céréaliier communautaire. Hervé GUYOMARD, Louis-P. MAHE (1992).
- 92-04 JOINT DECISION IN LABOUR SUPPLY AND DEMAND BEHAVIOUR : AN ANALYSIS OF FRENCH AGRICULTURAL HOUSEHOLDS. Catherine BENJAMIN, Hervé GUYOMARD (1992).
- 92-05 MODELE DE TRANSMISSION DES PRIX GARANTIS DE CEREALES DANS LA COMMUNAUTE ECONOMIQUE EUROPEENNE : DEVELOPPEMENTS THEORIQUES ET APPLICATION A LA FRANCE. Yves SURRY (1992).

- 92-06 IMPORT TARIFFS, DOMESTIC DISTORTIONS AND "MARKET LINKAGES". Chantal LE MOUEL (1992).
- 93-01 CONSEQUENCES DE LA REFORME DE LA PAC SUR L'AGRICULTURE BRETONNE. Anne-Marie PELHERBE (1992).
- 93-02 LA REFORME DE LA PAC ET LES NEGOCIATIONS DU GATT - QUELLE COMPATIBILITE ? Hervé GUYOMARD, Louis-P. MAHE (juin 1992).
- 93-03 THE EC AND US AGRICULTURAL TRADE CONFLICT AND THE GATT ROUND : PETTY MULTILATERALISM ? Hervé GUYOMARD, Louis-P. MAHE, Terry L. ROE (1993).
- 93-04 DECISIONS DE TRAVAIL DES MENAGES AGRICOLES FRANCAIS. Catherine BENJAMIN, Alessandro CORSI, Hervé GUYOMARD (1993).
- 93-05 PSE AND DISTORTING AGGREGATE MEASURE OF SUPPORT IN THE CONTEXT OF PRODUCTION QUOTAS. Hervé GUYOMARD, Louis-P. MAHE (1993).
- 93-06 IS A PRODUCTION QUOTA PARETO SUPERIOR TO PRICE SUPPORT ONLY ? Hervé GUYOMARD, Louis-P. MAHE (1993).
- 93-07 PRODUCER BEHAVIOUR UNDER RATIONING WITH TRADABLE RIGHTS. Hervé GUYOMARD, Louis-P. MAHE (1993).
- 93-08 CALCUL DES ELASTICITES PRIX ET REVENU SOUS HYPOTHESE DE BUDGETISATION PAR ETAPES : une méthode approchée. Alain CARPENTIER, Hervé GUYOMARD (1993).
- 94-01 LA REFORME DE LA PAC ET LES NEGOCIATIONS DU GATT. Perspectives pour l'agriculture française et communautaire. Hervé GUYOMARD, Louis-P. MAHE (1993).
- 94-02 L'OFFRE DE TRAVAIL DES FEMMES. Application à l'agriculture française. Catherine BENJAMIN, Hervé GUYOMARD et Michel SOLLOGOUB (1994).
- 94-03 LA NOUVELLE INSTRUMENTATION DE LA POLITIQUE AGRICOLE COMMUNE. Hervé GUYOMARD et Louis-P. MAHE (1994).
- 94-04 A NOTE ON THE ESTIMATION OF PRICE FUNCTIONS. Ludo PEETERS et Yves SURRY (1994).
- 94-05 A MICRO-ECONOMETRIC ANALYSIS OF MILK QUOTA TRANSFER: APPLICATION TO FRANCE. Xavier DELACHE, Hervé GUYOMARD, Louis-P. MAHE, Xavier IRZ (1994).
- 94-06 ANALYSE MICRO-ECONOMIQUE D'UN MARCHE DES DROITS A PRODUIRE : APPLICATION AUX QUOTAS LAITIERS EN FRANCE. Xavier DELACHE, Catherine GOUDOUNECHE, Hervé GUYOMARD, Louis-P. MAHE, Xavier IRZ. (1994).
- 94-07 TENDERS FOR EUROPEAN CEREAL EXPORT REFUNDS: A STRUCTURAL APPROACH, Jean-Marc BOURGEON, Yves LE ROUX (1994).