SONDERFORSCHUNGSBEREICH 504

Rationalitätskonzepte,
Entscheidungsverhalten und
ökonomische Modellierung

No. 04-05

Auctions, Information, and New Technologies

Karl-Martin Ehrhart*
and Marion Ott**

October 2003

Financial support from the Deutsche Forschungsgemeinschaft, SFB 504, at the University of Mannheim, is gratefully acknowledged.

*Universitaet Karlsruhe, email: kme@vwl3.wiwi.uni-karlsruhe.de

**Universitaet Karlsruhe, email: ott@wiwi.uni-karlsruhe.de

Universität Mannheim
L 13,15
68131 Mannheim

Auctions, Information, and New Technologies[‡]

Karl-Martin Ehrhart* and Marion Ott**

** University of Karlsruhe, 76128 Karlsruhe, Germany, email: ehrhart@wiwi.uni-karlsruhe.de*

*** University of Karlsruhe, 76128 Karlsruhe, Germany, email: ott@wiwi.uni-karlsruhe.de*

ABSTRACT

Auctions have been developed for economic transactions with asymmetric information and they are the simplest means of price determination for multilateral trading without 'market makers.' During the last years, new technologies gave a boost to the development and usage of innovative auction formats in several fields. We explore some of the new possibilities of applications and explain the differences to traditional auction formats. Furthermore, we demonstrate the potentialities of auctions concerning information gaining for the auctioneer as well as for the participating bidders.

[‡] Forthcoming in *Knowledge of New Technologies*, edited by M. Kouzelis, Kluwer.

1. Introduction

Situations of economic interaction are usually characterised by asymmetric information. This means that one party knows something relevant that the other parties do not know. Asymmetries in information are pervasive in economic situations and usually have a strong impact on the outcomes and often lead to inefficient results. Therefore, economists have to ask how to deal with this problem. In searching for an answer, we have a look at one of the oldest economic institutions: the auction. Auctions have been developed for economic transactions with asymmetric information, and they are the simplest means of price determination for multilateral trading without 'market makers,' such as brokers. A well-known type of auction is the so-called English auction. This is an ascending bid, open-cry auction that is used, for example, for selling wine and arts and cattle. However, a wide variety of different formats exist (see Section 2). Auctions can lead to efficient outcomes, even in situations with asymmetric information. Moreover, auctions can help the auctioneer as well as the bidders to gain valuable information. If an auction is well designed, it induces bidders to reveal 'private' information, i.e. information about their true preferences, willingness to pay, production costs, and so on.

The first reported auction dates back to 500 B.C., when women were auctioned off as wives. Within the Roman Empire auctions were used to liquidate property and real estate goods. In England auctions became a popular means for selling artwork in the 17th century. This popularity continued through the centuries, and even today it is still quite popular to sell art objects and antiques at the fall of an auctioneer's hammer. In the 19th century, Dutch farmers began selling fruits and vegetables and German fishermen started selling their catch upon arrival at the port via auctions (Cassidy, 1967). In the 20th century, the number of fields involved in auctions continuously increased. These included the sale of oil and mineral rights as well as awarding public contracts. During the last two decades, auctions have also been used throughout the world to facilitate the transfer of assets from public to private hands. For example, auctions were used for the sale of industrial enterprises in Eastern Europe and telecommunication spectrum all over the world (Krishna, 2002).

The Internet gave the popularity of auctions a new boost. Auction websites like eBay are frequently used. Internet-based auctions are also used for central bank refinancing operations and in an increasing extent for business-to-business (B2B) transactions. Furthermore, electronically implemented auction formats are also applied in awarding public licenses and concessions. For example, auctions have been used worldwide for allocating telecommunication licenses (e.g. FCC in USA, GSM-1800 MHz in Germany, UMTS in the UK, Netherlands, Germany, Italy, Austria, and other European countries).

The use of new technologies has rapidly changed the image of auctions. The old market institution moved from traditional fields of application in the centre of innovative processes. Low transaction and search costs, decentralised bargaining, and global trade are slogans of the auction proponents. Besides these effects that emerge when auctions are applied, the auction as an instrument with clear specified rules has a lot of very nice inherent features.

In the following we give a short introduction to the basics of auction theory. We point out the impact of new technologies on the growth of the number of feasible auction formats. Furthermore, the auction institution’s potentialities with regard to gaining information in wide variations are highlighted. The conclusion summarises our main findings.

2. Auctions

2.1 Basics

In every auction there is an auctioneer who carries out the auction, and there are several bidders submitting bids in order to buy or sell one or more items. As a characterization of an auction we use the following definition (McAfee and McMillan, 1987):

An auction is a

- Market institution with an
- Explicit set of rules determining
- Resource allocation and
- Prices on the basis of
- Bids from the market participants.

Two more characteristics should be mentioned. The rules of an auction have to be given in advance and may not be changed once the auction has begun, and there is no need for other input besides the bids.

As you can easily see from the definition, there are different tasks for participants in an auction: the seller's task is to design or choose an appropriate auction mechanism, and the bidders' task is to determine their optimal bidding strategy. The calculation of such a strategy is based on the values the bidder assigns to the object, in some cases also on the expected other bidders' valuations, and the rules of the auction. If both market sides perform these tasks well, the auction is ensured of an efficient result, i.e. the object goes to the bidder who values it the most.

2.2 Information and Valuation

Uncertainty and asymmetry of information are characteristics of the application of auctions. First, it is realistic to assume that the auctioneer does not know each bidder's precise valuation of the item at the time when the auction is carried out. Note, if the auctioneer is aware of bidders' valuations, he needs not run an auction. He can

maximise his revenue by offering the item at a high price to the bidder who values it the most. Second, a bidder may know his individual valuation; however, he usually does not know other bidders' valuations. If each bidder precisely knows his value of the item, this is called the *private values* case. This situation applies, for example, to auctions of art objects and antiques in which bidders assign different values to the objects that they intend to buy for their own use and not for resale. Implicit in this situation is that there may be differences among bidders' valuations which reflect their differences in taste. On the other side, consider bidders as dealers who intend to resell the objects, or think of the sale of oil and mineral rights. In these cases, the item has an objective value. However, particularly in the case of oil and mineral rights, the true value is not known to the participants at the time of the auction. The actual value of an oil right, for example, depends on the amount of oil actually lying beneath the ground and its quality. In these cases one speaks of *common values* (McAfee and McMillan, 1987, Krishna, 2002).

An auction's information structure strongly influences the bidders' bidding behaviour and, therefore, also whether the bidders are successful and the auctioneer receives the expected revenue. Moreover, different auction formats, which are presented in the following sections, may have an impact on optimal bidding behaviour and the outcome of an auction, too.

2.3 Single Object Auctions

The four standard auction types for selling one single item are the *English auction*, the *Dutch auction*, the *first price sealed bid auction*, and the *second price sealed bid* auction or *Vickrey auction* (Vickrey, 1961). Let us characterise these four auctions through the rules of the mechanisms and the optimal bidding strategies in the case of private values (for example, Klemperer, 1999).

The most popular type of auction is the English auction. It is an ascending price, open-cry auction in which the price rises successively. The bidders either call out the bids themselves or the seller increases the price. The winner is the last active bidder, and the object is sold to the price equal to the highest bid (i.e. the last announced price). In this auction, a bidder's dominant strategy is to bid as long as the price is below his

valuation for the object. This bidding strategy is always the best for him no matter what the other bidders do. Once his valuation is reached, he leaves the auction. If every bidder chooses this strategy, the object will be sold to the bidder with the highest valuation for a price equal to the valuation of the bidder with the second highest valuation (or slightly above or below, depending on prescribed bid increments). Amongst standard auction types, the English auction is the only auction with the chance of reconsidering bidding strategies once the auction mechanism has started. Nevertheless, a bidder should establish his strategy in advance.

The second type of open-cry auctions is the Dutch auction. In contrast to the English auction, this is a descending price auction. The seller decreases the price starting at a relatively high level. When one of the participants accepts the price, he wins the auction and has to pay exactly this price. Hence, only one bid is seen in this type of auction. Optimal bidding in a Dutch auction is more complicated than in the English auction. The calculation of the optimal bid in a Dutch auction is associated with bidder's uncertainty about other bidders' valuations and therefore is more challenging than in the English auction. It is obvious that only a bid below the individual valuation can be optimal for a bidder. Moreover, a decrease in the bid increases the gains from winning, while at the same time it decreases the probability of winning.

A very common auction is the first price sealed bid auction. The sealed bids of the participants are collected until a closing date. Then all bids are opened, and the bidder with the highest bid wins and has to pay his bid. Again, a bidder has to calculate a bid that depends on his valuation and his assumptions about other bidders' valuations.

An auction with very nice features that is not frequently used is the second price sealed bid auction or Vickrey auction. As in the first price auction, every bidder submits a sealed bid and the winner is the bidder with the highest bid. However, he only has to pay the second highest bid. A bidder's strategic considerations are very simple because his dominant strategy is to submit a bid equal to his own valuation. Note that in this auction type the bid only determines whether the bidder wins the auction or not. The price he has to pay if he wins is beyond his control. Suppose, a bidder bids below his valuation. If he wins, the level of his bid has no influence on the price. In comparison to his dominant strategy bid, however, he will lose whenever at least one other bidder submits a bid between his bid and his valuation. Imagine now that a bidder bids above

his true valuation. If he does not win the auction or the second highest bid is below his true valuation, this does not change the situation at all. However, if he wins and the second highest bid is higher than his valuation, he experiences a loss because he has to pay a price higher than his valuation. Therefore, it is always best to bid the true valuation in the Vickrey auction.

The English auction and the Vickrey auction both have a solution in the form of a so-called dominant strategy equilibrium. The dominant strategy equilibrium concept is very strong, as it never pays to deviate from the dominant strategy, no matter what the other bidders do. Furthermore, the dominant strategy is independent of risk attitudes. If a bidder plays this strategy, he will never regret his bid ex post. In both auction types, the bidder with the highest valuation wins the auction and pays a price equal to the second highest valuation (on average, in the case of the English auction). In contrast, in the first price sealed bid auction and the Dutch auction no dominant strategies exist. There is a trade-off between increasing the probability of winning the auction (high bid, close to valuation) and increasing a bidder's rent in case of winning (low bid). Assuming that every bidder has a private valuation for the object, that they know the number of bidders, their risk attitudes, the distributions of valuations, and that they are aware that every other bidder knows all that, then it is possible to calculate the optimal bids. The situation a bidder faces in the first price sealed bid auction and the Dutch auction is exactly the same. In both auctions they have the same information, and the bidder with the highest bid wins and has to pay his bid. Thus, these two auction types are said to be strategically equivalent, and the optimal equilibrium bids are therefore the same. Calculating the optimal bid in these two auctions is a difficult task for which a lot of information is required. Since the calculation is based on the probability distribution of other bidders' valuations, it is possible that a bidder regrets his bid ex post (i.e. an expected profit maximising bidder always submits a bid below his valuation). Thus, it may happen that the item is sold to someone else at a lower price than a bidder's valuation (McAfee and McMillan, 1987).

These four standard auction formats have a common characteristic which is summarised in the famous *revenue equivalence theorem* (Riley and Samuelson, 1981; Myerson, 1981): if the bidders are risk-neutral, have independent private valuations for the object, are (ex-ante) symmetric, and the payment only depends on the bids, then the

expected price in all four auctions is the same. More precisely, the bidder who values the item the most wins the auction and has to pay (on average) the second highest valuation. This means that no matter which auction type is chosen by the seller he can expect the same revenue if the aforementioned conditions are satisfied. Note that these conditions are very restrictive and fairly unrealistic. However, this simplified case serves as a valuable reference point in the analysis of auctions.

The four standard auctions are traditional mechanisms for selling one single object to one of several bidders. Many variations and enhancements of these auction types are in use. For example, the seller may set a reserve price in form of a required minimum bid. He is not willing to sell the object below this price. It can be shown that it is advantageous for the seller to set a reservation price higher than his own valuation of the item (Myerson, 1981). Results also change if we drop the assumptions of risk-neutral bidders and/or of bidder symmetry (Vickrey, 1961; Holt, 1980; Maskin and Riley, 2000). If we relax the assumption of private values and consider cases with interdependent values and common value components, things also change. Here, for example, the problem of the so-called *winner's curse* arises. This refers to the possibility that the bidder who wins the auction pays more than the true value of the object, which was not known to the bidders while they were bidding (Milgrom and Weber, 1982).

2.4 Multiple Object Auctions

Multiple object auctions can be used if multiple related items are to be sold. Objects may be physically identical or distinct. If a seller intends to auction multiple objects, many options are open to him because a variety of designs for multiple object auctions exist, which differ in several dimensions. The most popular types are the following: a sequence of single object auctions, sealed bid auctions for identical objects (e.g. the *uniform price auction*, the *discriminatory price auction*, the *multi-unit Vickrey auction*), the *fixed price tender*, the *simultaneous multiple-round ascending auction*, and *package auctions*. Each of these auction formats was designed for special purposes and has its characteristic strengths and weaknesses, e.g. strategic demand reduction and bid shading, regret and exposure problems, and the winner's curse. In this context, it has to

be mentioned that these types of auctions are characterised by different levels of complexity and require different bidding strategies (Ausubel and Cramton, 1998; Krishna, 2002; Ehrhart, 2001).

3. Information and Learning in Auctions

3.1 Generating Information

Auctions may serve as information generators in multiple ways. Incentives to collect information prior to an auction may lead participants to make careful preparations. In private value auctions, for example, the bidders may try to learn about resale possibilities, about costs of production in the B2B sector, or about the competitors' valuations in first price and Dutch auctions (Persico, 2000). In common value auctions, bidders should be interested in information about the true value of the object. This information may be costly, so precise evaluation of the object might be too expensive. In the course of the auction, the auctioneer is able to gather private information about participants' preferences, provided he chooses an appropriate auction format. This may also become accessible to the bidders. Particularly in common value auctions with incremental bidding, the exit bids deliver valuable information. If the auction format supports an efficient allocation, the result of the auction informs participants about the one with the highest valuation. Thus, gaining information in advance, during the course of auction, and after the auction is possible.

3.2 Information and Learning in Single Object Auctions

We first consider the English auction. If the bidders follow their dominant strategy, i.e. they bid until the price exceeds their valuation, the auctioneer ascertains the bidders' valuations via their drop-out prices. At the end of the auction, he has learned a lot about bidders' valuations; however, he does not know the valuation of the winner who values the object the most. The price formation is driven by the competition between the bidders. Thus, the evolution of the price gives the seller a hint of the value of the object on the market, particularly if a large number of bidders competes in the auction.

In the course of a Dutch auction, the auctioneer only learns the aggregate information of the winning bid, provided that the winning bidder has calculated his bid using all available information. As a result, the auctioneer learns less in a Dutch auction than in an English auction. In fact the Dutch auction is the type of auction with the least information gain for the auctioneer.

In the first price sealed bid auction the seller opens all submitted sealed bids. Again, these bids depend on the bidders' individual valuations and their information and assumptions about the other bidders' valuations. In contrast to the strategic equivalent Dutch auction, the auctioneer receives information from all bids and not just from the highest bid.

The optimal information gain for the auctioneer is provided in the Vickrey auction. If all bidders play their dominant strategy, then the seller will know all valuations. In contrast to the first price auction, it is very easy for him to generate this information from the bids: he can simply read it off.

So far we only considered the private values case in which we assume that every bidder has a private valuation for the object. Now, we consider the case of a pure common-value object in which the value of the item is the same for all bidders, but it is not known in advance. At the time of the auction, bidders may access different information about the value of the item (Klemperer, 1999). Hence, in open-oral auctions, a bidder's estimation of the item's true value is influenced by observing his competitors' bids, which give a hint about the other bidders' information. Therefore, in the case of common value objects, the English auction for example, serves as an information generator about the true value of the object. Note that contrary to the private value case, the English and second price auctions are no longer equivalent in the case of common values. In the English auction the seller can expect a higher revenue than in the second price auction. In the English auction, the information gained in the course of the auction reduces bidders' uncertainty and thus the danger of the winner's curse and therefore leads to more aggressive bidding (Milgrom and Weber 1982).

Moreover, in the common value case it is on average more advantageous for the seller, who can access private information about the object to publish all available information than to keep information secret, to publish only selected positive

information, to publish an aggregated version, or to bias the information before publishing (Milgrom and Weber 1982).

3.3 Information and Learning in Multiple Object Auctions

What has been said about information and learning in single object auctions in the previous section basically applies for multiple object auction procedures, too. However, the collection and the correct analysis and interpretation of information can be much more complicated than in the single object case. Furthermore, the danger that the process of generating useful information is disturbed is much higher in multiple object auctions. The reasons for these problems usually lie in characteristic weaknesses of the chosen auction designs and in the bidders' restricted capability or insufficient preparation for participating in a complex auction procedure. Game theoretical analyses as well as the courses and the results of some telecommunication auctions, for example, support this hypothesis (Ausubel and Cramton, 1998; Ehrhart, 2001; Klemperer, 2002; Seifert and Ehrhart, 2003).

4. New Technologies and Appropriate Auction Designs

Recently the application field for auctions has changed. The reasons for this are enhanced possibilities caused by the use of information technology. More complex auctioning procedures have become feasible which may help sellers to gain valuable information about bidders' preferences. Extensive multiple object auctions and Internet-based auctions with participants in different locations are examples of this.

4.1 C2C-Auctions

Electronic auctions are popular in the Internet and are used for several purposes. Auctions in the consumer-to-consumer (C2C) sector are well known. They are conducted by companies such as eBay, Yahoo, Ricardo, and Amazon. Internet-based auctions have also recently been used for business-to-business (B2B) transactions, particularly in the automotive sector. Most of those electronic auctions are part of

eProcurement and eSourcing, and they are thus inverse auctions with suppliers acting as bidders. Electronic Procurement and electronic Sourcing are a supplement to and an enhancement of traditional markets.

Let us first concentrate on C2C-business. Here, eBay, for example, offers the platform and the tools for running auctions. The participants are private sellers and buyers, which is meant by the expression consumer-to-consumer. The auction platform organises the communication between market participants. Participation occurs independent of the location (however, most auctions are for participants in the same country only). This is the first important difference from traditional auctions which are organised at a fixed time and a predetermined place where all bidders have to come together. The timeframe is still fixed (for individual differences see next paragraph), but C2C-auctions, in general, run for several days, and the time for submitting a bid is arbitrary within this period. The bidders do not have to meet at a certain place, and thus many more potential buyers can be addressed.

Furthermore, bidders do not have to keep an eye on the auction for the whole auctioning period. In many C2C-Internet auctions, self-acting bidding agents (proxies) act on behalf of the bidders and increase their bids. The bidders just have to submit their maximum bids. This common auction type is usually carried out as a second-price auction and therefore induces bidders to reveal their true willingness to pay their maximum bid.

Amazon auctions have a scheduled end time; however, the auction continues if there are still active bidders. An auction does not end until ten minutes have passed without a bid being submitted. Auctions on eBay operate under similar rules as Amazon auctions but have a fixed deadline at which the auctions definitely end. Roth and Ockenfels (2002) consider the implications of these different ending rules. Although a bidder does not have a dominant strategy in this type of auction, the eBay ending rule implies incentives for ‘sniping’. Sniping denotes the bidding behaviour of submitting a bid as late as possible. Sniping is a reasonable behaviour in this kind of auction. However, there are also arguments against sniping. If all bids in an auction with this ending rule were submitted at the last possible moment, it would essentially be converted into a sealed bid auction with some uncertainty about whether bids go through.

4.2 B2B-Auctions

Auctions in B2B-markets also have the advantage of being independent of location and local distribution. Thus, it becomes possible for locally distributed bidders to participate in a live auction (in contrast to a sealed bid auction with a fixed finish time). The auction's organiser also has the advantage of being able to contact bidders all over the world and allow them to bid simultaneously. In the business-to-business sector it is thus possible to take advantage of competition between suppliers, instead of protracted bilateral bargaining in several rounds, to determine prices. The other bidders do in general not know a bidder's identity. Suppliers, on the other hand, can reach new customers without huge effort by participating in Internet auctions.

Electronic auctions are ascribed to have several advantages for both suppliers and buyers (Ott, 2002). For the supplier it is easier to find buyers, and for the customer it is easier to find sellers. For different industrial sectors, special Internet marketplaces exist where the two parties can meet. The procurer hopes to find greater market transparency and thus the best offer in the market. As he is able to contact a larger number of suppliers, he expects lower prices due to stronger competition. Getting in contact with a large number of suppliers without the help of information technology would be too expensive and time consuming. B2B-autions also have some advantages for the supplier with respect to information compared to bilateral bargaining. A well-designed auction should have clear rules and a well-defined information processing and supply structure. Participants can track the course of the auction and have access to information about their bargaining position at any time.[1] Acceleration of proceedings and lower transaction costs are further advantages of procurement via Internet auctions.

[1] In many actual auctions, however, the bidders are provided with very little information. This may have an impact on the strategy and on the seriousness of bidding. The design and implementation of B2B-auctions should allow participants to rely on a truthful mechanism (Ott, 2002).

4.3 Central Bank Operations

The main refinancing operations stand at the centre of the Eurosystem monetary policy. These are offered by the European Central Bank (ECB) on a weekly basis with a two-week maturity. This procedure represents the primary way that the Eurosystem makes refinancing available to the financial sector. As a rule, main refinancing operations take the form of so-called repo auctions.

Since several thousand banks participate as bidders in these auctions, it is impossible for all these banks to send representatives to the central bank once a week. Therefore, it is common practise to submit bids via Internet just in time. Former alternatives such as submitting bids via telephone or sending sealed bids by mail are associated with excessive effort and expenses compared to the Internet procedure.

The main refinancing operations are also supposed to aid in gaining information about the money market, which is important for evaluating and planning monetary policy. For this, it is necessary that the participating banks indicate their true demand for refinancing in their bids. Consequently, the procedure should be designed in such a manner that the banks are induced to reveal their true demand. Until May 2000 the fixed price (rate) tender procedure was employed almost exclusively. However, this method does not meet this requirement. During the time in which this type of auction was applied, a continual rise in the bids could be observed, and there was not any doubt that the banks immoderately exaggerated their true demand with their bids (Ehrhart, 2001).

As a consequence, in June 2000 the ECB decided to switch to the method of the discriminatory price (rate) auction. In this auction banks may submit up to ten rate-quantity bids. Since a very large number of banks participate in the repo auctions, the discriminatory price auction procedure induces banks to approximately reveal their true willingness to pay for liquidity.[2] Thus, the goal of the Central Bank to gain valuable information about the money market is obtainable but only by intensely employing information technology.

[2] In a discriminatory price auction, optimal bidding requires bid shading, meaning that bidders underrepresent their true valuation (Ausubel and Cramton, 1998).

4.4 Other Applications

During the last decade, auctions have become more important for awarding public licenses and concessions. One reason is that they are supposed to be a more efficient allocation mechanism than so-called ‘beauty contests’ (Binmore and Klemperer, 2002).

For this purpose, telecommunication licenses, for example, have been auctioned all over the world. Licenses for telecommunication services are based on the right to send and receive radio signals on a certain frequency over a specified geographic area. For this purpose, in different countries several auction formats were used which differed with respect to the degree of complexity. As before, the auctions need to have been well designed in order to induce bidders to reveal in their bids their true willingness to pay. The auction format designed for the German UMTS auction in the year 2000, for example, met this requirement to a certain degree; however, it was characterised by a high degree of intricacy (Seifert and Ehrhart, 2003). In this auction, the number of licenses was not fixed in advance. Both the frequency endowments of a licensed operator as well as the number of licenses resulted endogenously from the auction. The frequency spectrum was divided into 12 blocks which were simultaneously auctioned in a multiple round, ascending auction. In order to become licensed, a bidder had to obtain at least two blocks. Consequently, it was possible that either four, five, or six bidders became licensed. It is intuitively clear that complex auctions, like the German UMTS auction, can only be conducted by means of strong electronic support.

Recently, auctions have also been considered for use in environmental policy, i.e. for allocating emissions allowances. Auctioning emissions allowances in advance will generate valuable price signals at an early stage and therefore help participating companies to cope with the tasks of the new instrument, provided that the auctions are designed in an appropriate way (Ehrhart et al., 2003). This project, however, requires a complex, multiple object auction setting in which several thousand companies participate at the same time. This task is only manageable with the support of powerful computer networks.

5. Conclusion

The auction market institution has proven to be a powerful instrument for managing specific economic transactions, particularly in situations that are characterised by a high degree of asymmetric information or not yet existing markets. Even in this situation, auctions may create efficient outcomes. New technologies empower the old market institution of auctions that have already been applied for a long time. Applications in C2C-trade, awarding of contracts in the B2B-sector, allocation of telecommunication licenses, and applications in central bank refinancing operations give an impressive illustration of the power of modern complex auctioning schemes.

Furthermore, auctions can be used to gain information. The auction method enables the auctioneer to outsource the process of searching and generating information. In this context, we have presented several cases in which applying auction procedures is advantageous compared to other transaction methods. However, the use of auctions demands that the participants be educated about them. Uneducated bidders, for example, run the risk of not only harming their competitors but also themselves even more severely. If the seller intends to learn through the auctions, it is in his best interest to have skilled bidders. Finally, we have to point out that the auction method is not a panacea.

References

Ausubel, L.M. and P.C. Cramton (1998): Demand Reduction and Inefficiency in Multi-Unit Auctions, Working Paper, University of Maryland.

Binmore, K. and P. Klemperer (2002): The Biggest Auction Ever: the Sale of the British 3G Telecom Licences, *Economic Journal*, 112, C74–C96.

Cassidy, R. (1967): *Auctions and Auctioneering*, University of California Press.

Ehrhart, K.-M. (2001): European Central Bank Operations: Experimental Investigation of the Fixed Rate Tender, *Journal of International Money and Finance*, 20, 871–893.

Ehrhart, K.-M., C. Hoppe, J. Schleich, and S. Seifert (2003): Strategic Aspects of CO_2-Emissions Trading: Theoretical Concepts and Empirical Findings, *Energy and Environment*, 14, 579–597.

Holt, C. (1980): Competitive Bidding for Contracts under Alternative Auction Procedures, *Journal of Political Economy*, 88, 433–445.

Klemperer, P. (1999): Auction theory: A guide to the literature. *Journal of Economic Surveys* 13, 227–286.

Klemperer, P. (2002): How (Not) to Run Auctions: the European 3G Telecom Auctions, *European Economic Review*, 46, 829–45.

Krishna, V. (2002): *Auction Theory*, Academic Press, San Diego.

Maskin, E. and J. Riley (2000): Asymmetric Auctions, *Review of Economic Studies*, 67, 413–438.

McAfee, R.P. and J. McMillan (1987): Auctions and Bidding, *Journal of Economic Literature*, 25, 699–738.

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

Myerson, R. (1981): Optimal Auction Design, *Mathematics and Operations Research*, 6, 58–73.

Ott, M. (2002): B2B-Internet-Einkaufsauktionen, diploma thesis, University of Karlsruhe.

Persico, N. (2000): Information Acquisition in Auctions, *Econometrica*, 68, 135–48.

Riley, J. and W. Samuelson (1981): Optimal Auctions, *American Economic Review*, 71, 381–392.

Roth, A.E. and A. Ockenfels (2002): Last-Minute Bidding and the Rules for Ending Second-Price Auctions: Evidence from eBay and Amazon Auctions on the Internet, *American Economic Review*, 92, 1093-1103.

Seifert, S. and K.-M. Ehrhart (2003): Design of the 3G Spectrum Auctions in the UK and in Germany, *German Economic Review* (forthcoming).

Vickrey, W. (1961): Counterspeculation, Auctions, and Competitive Sealed Tenders, *Journal of Finance*, 16, 8–37.

Nr.	Author	Title
04-05	Karl-Martin Ehrhart Marion Ott	Auctions, Information, and New Technologies
04-04	Alexander Zimper	On the Existence of Strategic Solutions for Games with Security- and Potential Level Players
04-03	Alexander Zimper	A Note on the Equivalence of Rationalizability Concepts in Generalized Nice Games
04-02	Martin Hellwig	The Provision and Pricing of Excludable Public Goods: Ramsey-Boiteux Pricing versus Bundling
04-01	Alexander Klos Martin Weber	Portfolio Choice in the Presence of Nontradeable Income: An Experimental Analysis
03-39	Eric Igou Herbert Bless	More Thought - More Framing Effects? Framing Effects As a Function of Elaboration
03-38	Siegfried K. Berninghaus Werner Gueth Annette Kirstein	Trading Goods versus Sharing Money - An Experiment Testing Wether Fairness and Efficiency are Frame Dependent
03-37	Franz Urban Pappi Thomas Gschwend	Partei- und Koalitionspräferenzen der Wähler bei der Bundestagswahl 1998 und 2002
03-36	Martin Hellwig	A Utilitarian Approach to the Provision and Pricing of Excludable Public Goods
03-35	Daniel Schunk	The Pennsylvania Reemployment Bonus Experiments: How a survival model helps in the analysis of the data
03-34	Volker Stocké Bettina Langfeldt	Umfrageeinstellung und Umfrageerfahrung. Die relative Bedeutung unterschiedlicher Aspekte der Interviewerfahrung für die generalisierte Umfrageeinstellung
03-33	Volker Stocké	Measuring Information Accessibility and Predicting Response-Effects: The Validity of Response-Certainties and Response-Latencies

Nr.	Author	Title
03-32	Siegfried K. Berninghaus Christian Korth Stefan Napel	Reciprocity - an indirect evolutionary analysis
03-31	Peter Albrecht Cemil Kantar	Random Walk oder Mean Reversion? Eine statistische Analyse des Kurs/Gewinn-Verhältnisses für den deutschen Aktienmarkt
03-30	Jürgen Eichberger David Kelsey Burkhard Schipper	Ambiguity and Social Interaction
03-29	Ulrich Schmidt Alexander Zimper	Security And Potential Level Preferences With Thresholds
03-28	Alexander Zimper	Uniqueness Conditions for Point-Rationalizable Solutions of Games with Metrizable Strategy Sets
03-27	Jürgen Eichberger David Kelsey	Sequential Two-Player Games with Ambiguity
03-26	Alain Chateauneuf Jürgen Eichberger Simon Grant	A Simple Axiomatization and Constructive Representation Proof for Choquet Expected Utility
03-25	Volker Stocké	Informationsverfügbarkeit und Response-Effects: Die Prognose von Einflüssen unterschiedlich kategorisierter Antwortskalen durch Antwortsicherheiten und Antwortlatenzen
03-24	Volker Stocké	Entstehungsbedingungen von Antwortverzerrungen durch soziale Erwünschtheit. Ein Vergleich der Prognosen der Rational-Choice Theorie und des Modells der Frame-Selektion
03-23	Daniel Schunk	Modeling the Use of Nonrenewable Resources Using a Genetic Algorithm
03-22	Brian Deal Daniel Schunk II	Spatial Dynamic Modeling and Urban Land Use Transformation: An Ecological Simulation Approach to Assessing the Costs of Urban Sprawl

Nr.	Author	Title
03-21	Thomas Gschwend Franz Urban Pappi	Stimmensplitting und Koalitionswahl
03-20	Thomas Langer Martin Weber	Does Binding or Feeback Influence Myopic Loss Aversion - An Experimental Analysis
03-19	Peter Albrecht Carsten Weber III	Asset/Liability Management of German Life Insurance Companies: A Value-at-Risk Approach in the Presence of Interest Rate Guarantees
03-18	Markus Glaser	Online Broker Investors: Demographic Information, Investment Strategy, Portfolio Positions, and Trading Activity
03-17	Markus Glaser Martin Weber	September 11 and Stock Return Expectations of Individual Investors
03-16	Siegfried K. Berninghaus Bodo Vogt	Network Formation and Coordination Games
03-15	Johannes Keller Herbert Bless	When negative expectancies turn into negative performance: The role of ease of retrieval.
03-14	Markus Glaser Markus Nöth Martin Weber	Behavioral Finance
03-13	Hendrik Hakenes	Banks as Delegated Risk Managers
03-12	Elena Carletti	The Structure of Bank Relationships, Endogenous Monitoring and Loan Rates
03-11	Isabel Schnabel	The Great Banks‘ Depression - Deposit Withdrawals in the German Crisis of 1931
03-10	Alain Chateauneuf Jürgen Eichberger Simon Grant	Choice under Uncertainty with the Best and Worst in Mind: Neo-additive Capacities.
03-09	Peter Albrecht Carsten Weber	Combined Accumulation- and Decumulation-Plans with Risk-Controlled Capital Protection