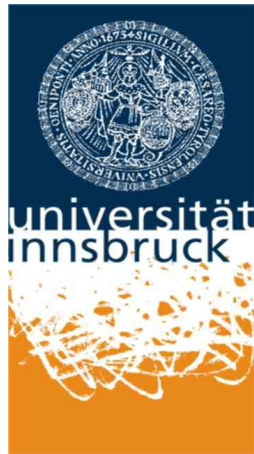


University of Innsbruck



**Working Papers  
in  
Economics and Statistics**

**Individuals and teams in UMTS-license  
auctions**

Matthias Sutter, Martin Kocher  
and Sabine Strauß

2007-23

# Individuals and teams in UMTS-license auctions<sup>#</sup>

*Matthias Sutter<sup>+§</sup>, Martin Kocher<sup>\*+</sup> and Sabine Strauß<sup>+</sup>*

<sup>+</sup> University of Innsbruck

<sup>§</sup> University of Göteborg

<sup>\*</sup> University of Munich

**Abstract:** We examine bidding behaviour of individuals and teams in an experimental auction resembling UMTS-license auctions. Even though in reality teams were largely involved in those auctions, experimental studies on bidding in auctions have so far relied on individual bidders. Our results show that teams stay on average longer in an (ascending sealed-bid English) auction and pay significantly higher prices than individuals. Consequently, teams make smaller profits and suffer more often the winner's curse. The auction's efficiency is nevertheless higher with teams, since the bidders with the highest valuation are more likely to win the auction when teams bid.

**JEL classification:** C91, C92, D44

**Keywords:** UMTS auction, team decision-making, experiment, winner's curse

**This version:** 15 October 2007

---

<sup>#</sup> We would like to thank Klaus Abbink, Bernd Irlenbusch, Paul Klemperer, Wolfgang Luhan, Paul Pezanis-Christou, two anonymous referees and the editor in charge as well as seminar participants in Innsbruck and Jena for many helpful suggestions. Financial support from the *Center for Experimental Economics* (sponsored by *Raiffeisen-Landesbank Tirol*), the *Austrian National Bank* (Jubiläumsfondsprojekt No. 9879) and the *Tyrolean Science Fund* (TWF) is gratefully acknowledged.

<sup>+</sup> Corresponding author. Department of Public Finance, University of Innsbruck, Universitaetsstrasse 15/4, A-6020 Innsbruck, Austria. e-mail: matthias.sutter@uibk.ac.at

# 1 Introduction

In the years 2000 to 2002, many European countries conducted auctions to allocate licenses for operating UMTS mobile telephony (or more general 3G services). These auctions have caught considerable attention from the media, the public as well as the scientific community. Economists have been involved in designing the auctions and have also analyzed the influence of the design, for instance, on the revenues for the auctioneer, the bidding behaviour of bidders, or the efficiency of an auction format (see, e.g., Binmore and Klemperer, 2002; Börgers and Dustmann, 2005; Klemperer 2002a, 2002b; Milgrom, 2004).

In the wake of designing the auctions and when analyzing their outcomes, many researchers have relied on the method of experimental economics in order to study subjects' behaviour under different auction designs (see, e.g., Abbink et al., 2005; Plott and Salmon, 2004; Seifert and Erhart, 2005). Surprisingly enough, all experimental studies on bidding behaviour in UMTS-license auctions have used individual bidders, even though in reality bidding companies typically assembled teams that were responsible for the company's bidding strategy (see, e.g., Börgers and Dustmann, 2005) or hired teams of experts to determine bidding strategies.<sup>1</sup> Even though, finally, a company's binding bid was typically submitted by an authorized company representative, it seems reasonable to assume that teams had an important influence on submitted bids. Consequently, bidding in UMTS-license auctions may have shared many features of team decision-making, with a group of people having to form a joint strategy how to react to competitors' bids and for how long to stay in the auction.

Given that individual decisions and those made in teams have been shown to differ in a broad range of economic situations (see, e.g., Blinder and Morgan, 2005; Cooper and Kagel, 2005; Kocher and Sutter, 2005), it is an open question whether bidding behaviour in UMTS-auctions has been adequately captured by relying on representative individual bidders in previous experimental studies. In view of the huge amount of money that was at stake at the UMTS-auctions and that are at stake in many other large-scale auctions potential differences between the two types of decision-makers may matter a lot in terms of final outcomes.

In this paper, we will present an experimental test of differences in bidding behaviour between individuals and teams. More precisely, we study individual and team bidding

---

<sup>1</sup> Personal communication with members of an expert team from the University of Bonn suggests that company representatives took into account the expert team's proposal on how to bid.

behaviour in an experimental auction which captures some features of the British UMTS-auction and which is based on a previous study by Abbink et al. (2005). We will, in particular, compare individuals and teams as bidders according to (1) the number of bidding rounds, (2) the prices for the auctioned good and, hence, profits, as well as (3) the efficiency of the resulting allocations.

The British UMTS-auction was the first – and by many accounts most successful – European UMTS-auction run in March 2000. It was largely designed by Ken Binmore and Paul Klemperer, and it is probably the best studied auction (see, e.g., Binmore and Klemperer, 2002, Börgers and Dustmann, 2005, Seifert and Ehrhart, 2005). Already before the decision on the details of the auction format, a research team led by Reinhard Selten was commissioned by one potential bidder to run an experimental study in which several design alternatives were analyzed regarding their influence on bidding behaviour, market entry and efficiency. The main results of this commissioned study are published in Abbink et al. (2005) which serves as the starting point for our paper.<sup>2</sup>

Abbink et al. (2005) have analyzed three different types of auctions, a uniform auction as well as a discriminatory auction of the Anglo-Dutch format and an ascending sealed-bid English auction. The main feature of their auction designs is to combine a private and common value component in order to determine a bidder's valuation of the good.<sup>3</sup> The common value component captures the general profit prospects in an industry, whereas the private value component accounts for possible advantages of market incumbents over new market entrants. Since the British UMTS-auction ultimately relied on an English auction-format and since Abbink et al. (2005) have not found significant differences in bidding behaviour across the three different designs considered in their study, we will stick to an ascending English auction to focus on our main research question, i.e. whether individuals and teams exhibit systematically different bidding behaviour in auctions. Assessing this question does not only provide an additional piece of evidence on the British UMTS-auction – that, anyway, can only be matched in the laboratory in a stylized way – but it is also of a more general interest, since UMTS-auctions are not the only example for teams – instead of individuals – making bids in auctions. Oil companies, for instance, typically rely on groups of geologists and managers to formulate bidding strategies for bidding on offshore oil leases (Capen et al., 1971; Hoffman et al., 1991).

---

<sup>2</sup> For the sake of succinctness we do not go into the details of the actual British UMTS-auction, the experimental studies commissioned in its forefront and its result. Overviews are provided in Abbink et al. (2005), Binmore and Klemperer (2002) as well as Börgers and Dustmann (2005).

<sup>3</sup> For a theoretical treatment of auctions with private and common values see also Goeree and Offerman (2003).

Unfortunately, economic theory remains silent on the influence of the type of decision-maker on actual decisions and, therefore, offers no predictions on possible differences between individuals and teams. Thus, it seems reasonable to resort to stylized facts from experimental studies which have found that small unitary teams<sup>4</sup> act differently from individuals in games in which rationality and reasoning are the predominant task characteristics and social preferences are of minor importance. The general pattern emerging from these studies is that teams are more competitive, closer to standard game-theoretic predictions and better in anticipating other players' moves than individuals. Cooper and Kagel (2005) have shown that teams are better in exploiting the strategic opportunities in signalling games. Kocher and Sutter (2005), Kocher et al. (2006) and Sutter (2005) have found teams to be more successful than individuals in beauty-contest games. According to Bornstein et al. (2004) teams exit the centipede game considerably earlier than individuals, mainly because they expect other teams to do the same. This leads to obvious efficiency losses in their team treatments as a consequence of the more competitive behaviour among teams.<sup>5</sup> Findings from social psychology also suggest that teams behave differently than individuals in situations of strategic conflict. Insko and Schopler have established what is known as the “discontinuity effect” (see, e.g., Insko et al. 1987, 1988, 2001; Schopler et al. 2001). It states that teams act more competitively and more selfish when interacting with other teams than when individuals interact with individuals.<sup>6</sup>

If we consider the evidence from experimental economics and the discontinuity effect from social psychology we might expect teams to behave – more competitively in auctions than individuals. A more competitive behaviour obviously implies higher bids in order to win the auction when teams interact with each other. This expectation is actually confirmed by our experimental results. Indeed, (1) teams stay on average longer in the auction than individuals; (2) they pay significantly higher prices and, thus, earn significantly lower profits than individuals; but (3) the allocation of the auctioned goods is more efficient with team bidders,

---

<sup>4</sup> “Unitary” teams are teams that do not face an internal conflict in terms of payoffs and have to come up with a joint decision after a deliberation process.

<sup>5</sup> There is also some evidence that teams are more “rational” players – in the sense of making decisions closer to the standard game-theoretic predictions – in two-person bargaining games (see Bornstein and Yaniv, 1998, on the ultimatum game, and Luhan et al., 2007, on the dictator game). Since there is also contradictory evidence (Cason and Mui, 1997, report teams to be more generous in dictator games) there is no general consensus yet on the possible differences between individual and team decisions when social preferences – like fairness or inequity aversion – play a major role. Note that social preferences are – at most – of only minor importance in auctions.

<sup>6</sup> Social psychologists have come forward with several different explanations for the “discontinuity effect”. As Wildschut et al. (2001, 2003) show, it is very hard to distinguish between different motives that yield the same kind of observable behaviour (i.e. teams being more competitive and selfish).

since the bidders with the higher valuations actually get the licenses significantly more often when teams bid than when individuals bid.

The rest of the paper is organized as follows. In section 2 we introduce the details of the experimental design. Section 3 presents the experimental results. Section 4 discusses our results and concludes the paper.

## 2 Experimental Design

### 2.1 The basic setup

In our experiment we let 4 bidders make bids in 15 consecutive and independent ascending sealed-bid English auctions. The set of 4 bidders will be referred to as a “market” in the following. The only experimental treatment variation is the type of bidders that we consider. In the INDIVIDUALS treatment, the 4 bidders in a market are individuals, whereas in the TEAMS treatment the 4 bidders are teams of three subjects each. In the latter case the three subjects have been seated together to discuss their bids and strategies before they had to enter a joint decision on a computer (using the software z-Tree by Fischbacher, 2007). There has been no time limit for submitting a bid in both treatments. Neither individual bidders nor team bidders have been able to communicate with other bidders in their “market”. In order to keep per-capita incentives constant across treatments, we paid each member of a team the amount that an individual would have won with the same decisions in its market.

Each bidder’s valuation of a license is determined as the sum of a common and a private value component. The *common value component* (*cvc*) is identical for all bidders and is randomly drawn for each auction from the integers in the interval  $[1000; 1500]$ . Note that bidders do not know the actual *cvc* or the interval from which it is drawn when they submit their bids. Rather, each bidder receives a private signal on the common value component, the so-called *estimated common value component* (*ecvc*). Bidders know that this signal is randomly and independently drawn for all bidders from the integers in the interval  $[cvc - 200; cvc + 200]$ .

The *private value component* (*pvc*) for each bidder is an integer number that is also randomly drawn from the interval  $[-100; +100]$ . Its realization depends on a bidder’s type. In each market two of the four bidders are *type A* and two are *type B* bidders, which is common knowledge. The types are randomly assigned to bidders at the beginning of the experiment and remain fixed throughout the whole experiment. The *private value component* for type A

bidders is randomly drawn from the interval  $[0; +100]$  with a probability of 80% and from the interval  $[-100; 0]$  with a probability of 20%. Type B bidders have an 80% chance that the *pvc* is drawn from the interval  $[-100; 0]$  and a 20% chance that it is drawn from the interval  $[0; +100]$ . The different probabilities should reflect the advantages of incumbents (type A bidders) over new market entrants (type B bidders).<sup>7</sup>

In order to keep the experimental conditions identical across our two treatments, we randomly drew the actual common value component (*cvc*), the estimates of the common value component (*ecvc*) and the actual private value component (*pvc*) for each single bidder in a market in advance. Thus, we used a predetermined (yet randomly drawn) set of variables for the 15 auctions in each experimental session. To ensure that our results do not depend on a specific set of variables we drew 10 different sets of variables for the 15 auctions.<sup>8</sup> Each set was used for one market with 4 individual bidders and one market with 4 teams as bidders. The behaviour of individuals and teams in a given set of variables therefore constitutes one matched observation that can be used to test for differences between individuals and teams in a highly controlled setting. In total we had 160 participants in our experimental sessions, 40 in INDIVIDUALS, 120 in TEAMS. Sessions lasted about 1.5 hours. The average payoff per subject was 21.4 €.

## 2.2 Rules for bidding in an auction

### 2.2.1 Minimum bids

At the beginning of each auction bidders are informed about the estimates of the common value component (*ecvc*) and their private value component (*pvc*). Each auction can have several bidding rounds. A bidder can either quit an auction (without the possibility to re-enter in a later round of a given auction) or submit a bid to remain “active” in the auction. In each round a minimum bid has to be met (or exceeded) by any bidder who wants to stay in the

---

<sup>7</sup> Incumbents might have a better knowledge of the market and a better reputation with future customers. Therefore, a UMTS-license might be more valuable for them than for new market entrants. Nevertheless, in our design type B bidders can also receive a positive *pvc*, which reflects the possibility that new entrants could make more efficient use of a license. This design-feature taken from the Abbink et al. (2005)-paper is not undisputed. It seems that in the actual auctions incumbents always had a higher total valuation of a license than new entrants (personal communication with Paul Klemperer; for a theoretical analysis of such a situation, see Klemperer, 1998). In fact, only in the Italian auction it happened that an incumbent was outbid by a new entrant. The assumption about bidders' private values is an important question for designing an auction; it is, however, of minor importance in the context of our research objectives.

<sup>8</sup> A table with all values in the 10 sets as well as the raw data of the actual bids is available upon request.

auction.<sup>9</sup> In the very first round of an auction, the minimum bid is positively correlated with the actual *cvc*. The minimum bid in the first round was determined by taking 80% of the *cvc* and adding a randomly drawn integer from the interval [-100, 100]. Subjects were not aware of this rule. All minimum bids for the first round were also predetermined to make the starting conditions in a given set of variables completely identical in the treatments INDIVIDUALS and TEAMS.

In all subsequent rounds the minimum bid is determined as the third highest bid of the preceding round, plus an increment. The increment depends on the number of bidders still active in the auction and the difference between the current round's minimum bid and the previous round's minimum bid. Table 1 summarizes the rules for determining the increment. Note that the increment is larger when more bidders are still active and when the increase in the minimum bid from the previous to the current round is relatively smaller. This rule prevents an excessive number of bidding rounds when bidders would submit bids that are close or equal to the prevailing minimum bid.

*Table 1: Bidding increments*

<b>Increment</b>	<b>Condition</b>	<b>Number of bidders active in auction</b>
100	Minimum bid <sup>†</sup> in current round $\leq$ minimum bid in previous round + 150	4
50	Minimum bid in current round $>$ minimum bid in previous round + 150	4
25	always	3

<sup>†</sup> The minimum bid in the current round is determined as the third highest bid of the preceding round, plus the increment. The minimum bid in the first round of bidding was set exogenously.

## **2.2.2 End of an auction and determination of the price**

At the beginning of each round bidders are informed about the number of active bidders and about the type of bidders that have already quit the auction. An auction continues until only two bidders are left who have made a valid bid in the current round. Each of these two

---

<sup>9</sup> In the experimental instructions (see Appendix) we informed participants that there is a maximum bid of 2000 which cannot be exceeded. This kind of liquidity constraint prevented bidders from submitting ruinously high bids, possibly made by error. It nevertheless allows overbidding since the maximum bid was well above bidders' valuations in each single case. In fact, we did not observe maximum bids.



bidders receives one of the two licenses and pays the third highest bid from the previous round as the price.<sup>10</sup>

If there are fewer than two bidders active in a given round, then the auction ends, and the active bidder (if any) receives a license. The second license (or both licenses in case all bidders have left the auction in the same round) is allocated randomly to one of the bidders who has submitted a valid bid in the previous round. The price for the license is then the minimum bid of the previous round. If there are fewer than two bidders active after the first round, the bidder with a valid bid gets a license and has to pay the minimum bid of the first round. All other bidders who did not submit a bid in the first round receive nothing.<sup>11</sup>

### 2.2.3 Payoffs in the auction

Bidders who do not get a license receive no payoff for this auction. Bidders who get a license have the following payoff:

$$\text{Payoff} = cvc + pvc - price$$

In the instructions – that did not include any reference to spectrum license auctions – it is pointed out explicitly that negative payoffs are possible if the price of a license exceeds the sum of the private and the actual common value component of a bidder. Losses from one auction can be balanced with profits from other auctions. Bidders have received an initial endowment of 500 points (the experimental currency unit) at the beginning of the session in order to prevent overall losses. All points earned in the 15 auctions have been added up and converted into real money at a rate of 50 points for 1 €.

## 3 Results

### 3.1 Number of bidding rounds and bidding behaviour

In Figure 1 we show the average number of bidding rounds in all 15 auctions. The overall average is 4.74 bidding rounds in INDIVIDUALS and 5.12 bidding rounds in

---

<sup>10</sup> This price is equivalent to the minimum bid in the current round minus the increment.

<sup>11</sup> It never happened that no license was sold in an auction, i.e. that none of the four bidders submitted a bid in the first round, and there was only one case where only one license was auctioned.

TEAMS, which is 8% more. According to a Wilcoxon signed ranks test<sup>12</sup> the difference is not significant, though ( $p > 0.1$ ;  $N = 10$ ).

**Result 1a.** On average, there are more biddings rounds when teams submit bids than when individuals do, but the difference is not significant.

*Figure 1 about here (Number of bidding rounds)*

However, it takes significantly longer until the first bidder quits the auction in TEAMS than in INDIVIDUALS. On average, there are 2.02 bidding rounds in which all 4 bidders submit a bid in the TEAMS condition, but only 1.51 bidding rounds with all bidders involved in the INDIVIDUALS condition ( $p < 0.05$ ; Wilcoxon signed ranks test;  $N = 10$ ). This result indicates that, on average, teams stay longer in an auction, which is in line with our expectation that competition among teams should be stronger than among individuals.

**Result 1b.** It takes significantly more bidding rounds for the first bidder to quit the auction in TEAMS than in INDIVIDUALS.

Another indication of teams being more competitive is the following observation: Within the first five auctions of the experiment, the identity of winning bidders changes weakly significantly more often from auction to auction in TEAMS than in INDIVIDUALS (the relative frequency of changes is 0.51 vs. 0.43;  $p = 0.068$ ; Wilcoxon signed ranks test;  $N = 10$ ). The effect vanishes in the later auctions, however.

Before turning to an analysis of prices paid in the auctions, we would like to analyze bidding behaviour with respect to the minimum bid in a given round. For this purpose we define the *relative bid* as the ratio of a submitted bid to the minimum bid in a given round.<sup>13</sup> For the first two rounds of each auction we do not find any significant difference in the

---

<sup>12</sup> All tests in this paper rely on a two-sided, non-parametric Wilcoxon signed ranks test. Recall that we have 10 different sets of variables (*cvc*, *ecvc*, *pvc*) which yield 10 independent matched pairs of observations where one ‘market’ in the INDIVIDUALS treatment is matched with the corresponding ‘market’ (with the same set of variables) in the TEAMS treatment. For statistical testing, we only consider the overall average across all 15 auctions (concerning, for instance, the number of bidding rounds or the prices) in a given market and treatment and match it with the overall average in the matched market in the other treatment. Such a pair then constitutes one independent matched pair.

<sup>13</sup> Comparing absolute bids only makes sense in the first round of each auction, because after the first round absolute and minimum bids are obviously path-dependent.

relative bids of individuals and teams. From the third to the sixth round<sup>14</sup>, however, teams submit significantly smaller relative bids than individuals ( $p < 0.05$  in each round; Wilcoxon signed ranks test;  $N = 10$ ). Teams obviously recognize faster that it does not make much sense to submit higher bids than the minimum bid (so-called “jump bids”) because it suffices to submit the minimum bid to stay in the auction. Yet, in absolute terms the differences in relative bids are rather small. Relative bids of teams from round 3 on are in the range [1.003, 1.009], whereas individuals’ relative bids are in the range [1.009, 1.021]. On average, teams submit a bid which is about one half percentage point above the minimum bid, and individuals submit a bid about 1.5 percentage points above the minimum bid.

### 3.2 Prices and profits

Figure 2 displays the average prices paid in the 15 auctions. In each single auction teams pay higher prices for the licenses than individuals. The largest price differential amounts to 15.3% in auction 6. Across all 15 auctions, the average price paid by teams is 1247 units of money, but for individuals it is only 1193 units, which is about 4.3% lower. Prices paid by teams are significantly higher ( $p < 0.05$ ; Wilcoxon signed ranks test;  $N = 10$ ).

**Result 2a.** Teams pay significantly and persistently higher prices in the auctions than individuals.

*Figure 2 about here (Average prices)*

Recall that we have perfect control over the common value and private value components for our matched observations of individual and team bidders. Hence, the difference in prices paid by individuals and teams cannot arise from differences in the underlying valuations of the good. It, therefore, indicates that teams are willing to pay more in order to succeed in the auction. It is interesting to note that the size of this effect does not decline in later auctions. Hence, the observed difference is not a transitory phenomenon that vanishes with experience, but seems to reflect a persistent behavioural pattern.<sup>15</sup>

---

<sup>14</sup> Due to the small number of auctions with 7 or more bidding rounds, we did not analyze differences in relative bids in these rounds.

<sup>15</sup> From casual observation of team discussions, we know that teams discussed much more often how to win an auction rather than which price to pay (or bid). Many teams seemed to prefer a rather small expected profit over making no profit at all in the case of quitting the auction.

Closely related to the finding of higher prices paid are significantly lower average profits for teams when they win the auction ( $p < 0.05$ ; Wilcoxon signed ranks test;  $N = 10$ ).<sup>16</sup> Figure 3 displays the average profits in single auctions. Profits for teams start out with an average of 130 units in the first auction and decline to an average *loss* of 6 units in the last auction. Hence, the aggressive bidding of teams strongly diminishes profits, in particular in the last four auctions. The average profits for individuals decline from 148 in the first auction to 83 units in the last auction. Sustaining positive profits even at the end of the experiment indicates that competition among individual bidders is not as strong as competition among team bidders.

**Result 2b.** Teams make significantly smaller profits than individuals. In the course of the experiment competition between teams drives down average profits to zero.

*Figure 3 about here (Average profits)*

A straightforward next step after examining profits is to investigate the relationship between a bidder's bid and her or his estimated valuation of a license, which is the sum of the estimated common value component (*ecvc*) and the private value component (*pvc*). We find that the last bid submitted in TEAMS is in 36% of cases larger than *ecvc* + *pvc*. The corresponding figure for INDIVIDUALS is 26% ( $p < 0.05$ ; Wilcoxon signed ranks test;  $N = 10$ ). This difference in bidding behaviour may be another indication that teams are keener on, actually, winning the auction.

Of course, overbidding the sum of *ecvc* and *pvc* need not necessarily imply an actual loss, since the true common value component (*cvc*) is with a 50% chance larger than *ecvc*. However, real losses do occur in 28% of cases in TEAMS and in 19% of cases in INDIVIDUALS. This difference is not significant, though. If losses were due to errors, the frequency of making losses should go down over time due to more experience. Yet, we observe the contrary. In INDIVIDUALS (TEAMS), the relative frequency of incurring a loss increases from 15% (28%) in auctions 1-5 to 22% (35%) in auctions 11-15.

---

<sup>16</sup> Note that in both treatments type A-bidders (the incumbents) win the auction significantly more often than type B-bidders ( $p < 0.05$  both in INDIVIDUALS and TEAMS; Wilcoxon signed ranks test; here we matched type A-bidders with type B-bidders in a respective treatment). Overall, 57% of type A-bidders win in INDIVIDUALS, and 59% in TEAMS.

**Result 2c.** On average, teams incur losses more often than individuals, but not significantly so.

### 3.3 Efficiency

The efficiency of an auction depends upon whether the bidders with the higher valuations actually get a license. Therefore, we measure efficiency by the relative frequency with which the two bidders with the highest actual valuation succeed in the auction. In TEAMS, 71% of the two highest bidders actually get a license, compared to only 64% in INDIVIDUALS ( $p < 0.05$ ; Wilcoxon signed ranks test;  $N = 10$ ). From this perspective, we may conclude that TEAMS is the better treatment in assigning licenses to the bidders which value them most.<sup>17</sup> The stronger competition in TEAMS – yielding higher prices and lower profits – therefore promotes a more efficient allocation of licenses.<sup>18</sup>

**Result 3.** The allocation of licenses is more efficient in the TEAMS treatment, because there the bidders with the highest valuations win the auction significantly more often than in the INDIVIDUALS treatment.

## 4 Discussion and conclusion

We have analyzed differences in bidding behaviour of individuals and teams in an experimental ascending sealed-bid English auction. This type of auction has some resemblance with the British UMTS-auction in the year 2000, which has caught considerable interest in the scholarly economics literature. In the actual auctions – in Britain as well as in the other European spectrum auctions between 2000 and 2002 – bidding companies typically assembled teams to figure out successful bidding strategies. The premise of this paper has

---

<sup>17</sup> Recall from footnote 16 that the fraction of type A-bidders (the incumbents) who win the auction does not differ between our two treatments. However, type A-bidders who win an auction need not necessarily be the bidders with the highest valuation, because their actual private value component (*pvc*) might be lower than the one of a type B-bidder. If the latter constellation applies, the type B-bidders with the higher valuation get the license more often in TEAMS than in INDIVIDUALS, which causes the higher overall efficiency in TEAMS.

<sup>18</sup> There are several other ways of measuring efficiency. One alternative to our measure could be called *surplus extraction ratio* (SER) which is defined as  $(SV_{act} - SV_{min}) / (SV_{max} - SV_{min})$ , where  $SV_{act}$  denotes the sum of valuations of the two bidders who actually got the license;  $SV_{max}$  ( $SV_{min}$ ) denotes the maximum (minimum) sum of valuations of two out of four bidders. TEAMS yields an SER of 76%, INDIVIDUALS one of 67% ( $p < 0.05$ ; Wilcoxon signed-ranks test).

been the assumption that employing teams has made bidding in the real auctions much more likely to akin a team decision than an individual decision, even though, of course, usually there was an ultimately responsible individual.<sup>19</sup> Since all previous studies on the European spectrum auctions have solely focused on individual decision-making, we argue that they might have missed an important aspect in the analysis of bidding in UMTS-auctions, i.e., the influence of team decision-making.

Our experiment provides conclusive evidence for several differences in the bidding behaviour of individuals and small teams. Teams stay on average longer in an auction, and it takes significantly more time before a team quits an auction. Teams submit bids which are closer to the prescribed minimum bid in most bidding rounds. The latter behaviour seems to support the hypothesis that teams act more “rationally” than individuals, because in our design it suffices to submit exactly the minimum bid in order to stay in an auction. However, due to staying on average longer in the auction, in the end teams pay significantly higher prices and, thus, make significantly smaller profits. This is a consequence of the stronger competition among teams. It even drives down average profits to zero by the end of the experiment in the TEAMS treatment. As a matter of fact, teams also incur losses more often than individuals. Put differently, the lack of precise knowledge of the common value component leads to a more frequent occurrence of the winner’s curse in TEAMS. Finally, our experiment shows that the stronger competition among teams actually is associated with a more efficient allocation of the auctioned goods. The two bidders with the highest actual valuations receive the licenses significantly more often in the TEAMS treatment than in the INDIVIDUALS treatment.

Our results provide important implications both for real-world (license) auctions and for the analysis of general differences between individual and team decision-making. We discuss both implications in turn.

Regarding real-world (license) auctions, our results suggest that the high prices for UMTS-licenses paid in the first auctions in Europe (in particular those in the U.K. and in Germany) might at least partly be due to teams being involved in the bidding process. Given the amounts at stake at large-scale auctions like those on UMTS-spectrum licenses, even seemingly small relative differences in final prices caused by individual or team bidders (of about 4.3% in our design) yield substantial absolute differences in revenues from an auction.

---

<sup>19</sup> One referee noted that teams in the real UMTS-auctions were possibly more important as advice givers to company officials (who were in charge of the final bid) than as decision-makers themselves. This seems a plausible conjecture that could be tested in the future by running experiments where individual decision-makers receive advice from others (see Schotter, 2003, on how advice changes individual behaviour in some simple bargaining games). It would, however, require a design with asymmetric information.

Even though the higher prices paid by teams may have been bad for them – in the experiment teams made losses in single auctions quite often, and in reality the winning contestants have not yet amortized their investments into UMTS-spectrum licenses<sup>20</sup> – the allocation of licenses has been more efficient among teams than among individuals in our experiment.

In the light of our findings it is, of course, important to ask why companies might have been interested in assembling teams instead of relying on a single representative. It is important in this context that we have simplified the decision-making situation by giving all team members the same pieces of information, yet with some uncertainty regarding the real parameters of the auction. In the real-world, teams are usually assembled in order to reflect different fields of expertise. Hence, teams without internal conflicts in terms of payoff may be viewed as units that aggregate valuable private information of the team members quickly and efficiently. Whether the advantage from information aggregation within teams outweighs the disadvantage from more aggressive bidding is beyond the scope of this paper and has to be left to future research. However, it also seems at least possible to supply a single representative with all the necessary information *before* the start of the auction in order to avoid potentially adverse effects from team bidding. Companies probably refrain from this strategy either because they are not aware of the possibly adverse effects of letting teams decide on a bidding strategy or because they believe that individuals are not able to respond adequately to all contingencies in the course of an auction.

Given that it is impossible to derive a theoretical benchmark for our auction design, we cannot infer from our data whether individual or team outcomes are closer to game-theoretic predictions. Taking the frequent occurrence of losses as an indication, however, it seems that teams are worse bidding agents than individuals in large-scale auctions from the viewpoint of companies.

An important complementary finding in that respect comes from Cox and Hayne (2006). In this only other experimental study on the differences between individual and team bidding in auctions that we are aware of Cox and Hayne (2006) show that teams suffer more often from the winner's curse with more information. Hence, their findings for common value auctions surprisingly suggest that more information is even worse for teams than for individuals. Since the auction design of Cox and Hayne (2006) deviates considerably from ours, one has to be cautious in interpreting possible similarities in results. However, they are

---

<sup>20</sup> Note though that it has also been argued (e.g., by Klemperer, 2002a) that at the time of the auctions bidders did not bid more than they believed the licenses were worth to them, and market valuations seemed to confirm these beliefs.

at least able to show that *more* information does not have to be an advantage in bidding from a behavioural point of view.

Our results also add to the recently growing literature on differences between individuals and small teams in economic decision-making.<sup>21</sup> Prime examples for decision-making in teams are families, boards of directors, juries, or committees. Thus, a more profound knowledge of team decisions is clearly desirable in economics, especially in view of the mounting evidence for the actual existence of systematic and persistent differences between individual and team decisions.

It can be considered a stylized fact in the literature that teams are generally closer to game-theoretic predictions than individuals in (interactive) games in which rationality and correct reasoning are the predominant task characteristics.<sup>22</sup> We also know from our results and several earlier studies predominantly on the prisoner's dilemma game that tougher competition exists when teams interact with teams than when individuals interact with individuals (Bornstein, 2003). Teams obviously have a stronger motivation to "win" in strategic interactions than individuals.

It is straightforward that the higher competitiveness of teams can be a two-edged sword for a team's profits, though, depending upon the task. As already mentioned, in signalling games teams are more successful in exploiting the strategic opportunities of signalling a specific type (Cooper and Kagel, 2005). Teams outperform individuals in direct interaction in a beauty-contest game, where teams win the contest almost twice as often as individuals (Kocher and Sutter, 2005; Kocher et al., 2006). In such types of games, teams earn more. In the centipede game, however, teams earn less, because they exit the game earlier than individuals (Bornstein et al., 2004). The same negative effect of team decision-making on teams' profits has been found in our auction experiment. Therefore, our experiment clarifies the relative magnitude of the winning (or competitive) motive against the profit maximization motive among teams in auctions. Obviously, in our setup the higher competitiveness of teams drives up prices and leads to lower profits. Hence, the winning motive is more important in our auction than pure profit maximization considerations. Interestingly, the prevalence of the winning motive has been found to increase the auctions' efficiency in allocating licenses significantly. As a consequence, we conclude that team decision-making is beneficial not only for auctioneers, but also for an auction's overall efficiency. These benefits come at the costs of teams paying higher prices and earning lower profits.

---

<sup>21</sup> Camerer (2003) even rates this issue among the top ten open research questions in behavioural game theory.

<sup>22</sup> We are referring to games with a strong "heureka"-component here, which means that once the correct solution is raised, it is easy to see for anybody (also called the "truth wins"-characteristic).



## References

- Abbink, K., Irlenbusch, B., Pezanis-Christou, P., Rockenbach, B., Sadrieh, A., Selten, R. (2005), An experimental test of design alternatives for the British 3G/UMTS auction. *European Economic Review* 49: 503-530.
- Binmore, K., Klemperer, P. (2002), The biggest auction ever: The sale of the British 3G telecom licenses. *Economic Journal* 112: C74-96.
- Blinder, A.S., Morgan, J. (2005), Are two heads better than one? Monetary policy by committee. *Journal of Money, Credit and Banking* 37: 789-812.
- Börger, T., Dustmann, C. (2002), Rationalizing the UMTS spectrum bids: The case of the UK auction. *ifo-Studien* 48: 77-109.
- Börger, T., Dustmann, C. (2005), Strange bids: Bidding behaviour in the United Kingdom's third generation spectrum auction. *Economic Journal* 115: 551-578.
- Bornstein, G. (2003), Intergroup conflict: Individual, group, and collective interests. *Personality and Social Psychology Review* 7: 129-145.
- Bornstein, G., Yaniv, I. (1998), Individual and group behaviour in the ultimatum game: Are groups more "rational" players? *Experimental Economics* 1: 101-108.
- Bornstein, G., Kugler, T., Ziegelmeyer, A. (2004), Individual and group decisions in the centipede game: Are groups more "rational" players? *Journal of Experimental Social Psychology* 40: 599-605.
- Camerer, C.F. (2003), *Behavioral Game Theory. Experiments in Strategic Interaction*. Princeton: Princeton University Press.
- Capen, E., Clapp, R., Campbell, W. (1971), Competitive bidding in high-risk situations. *Journal of Petroleum Technology* 23: 641-653.
- Cason, T.N., Mui, V.-L. (1997), A laboratory study of group polarisation in the team dictator game. *Economic Journal* 107: 1465-1483.
- Cooper, D.J., Kagel J.H. (2005), Are two heads better than one? Team versus individual play in signaling games. *American Economic Review* 95: 477-509.
- Cox, J.C., Hayne, S.C. (2006), Barking up the right tree: Are small groups rational agents?. *Experimental Economics* 9: 209-222.
- Fischbacher, U. (2007), z-Tree: Zurich toolbox for readymade economic experiments. *Experimental Economics* 10: 171-178.
- Goeree, J., Offerman, T. (2003), Competitive bidding in auctions with private and common values. *Economic Journal* 113: 598-613.

- Hoffman, E., Marsden, J., Saidi, R. (1991), Are joint bidding and competitive common value auctions markets compatible – Some evidence from offshore oil auctions. *Journal of Environmental Economics and Management* 20: 99-112.
- Insko, C., Hoyle, R., Pinkley, R., Hong, G., Slim, R., Dalton, G., Lin, Y., Ruffin, W., Dardis, G., Bernthal, P., Schopler, J. (1988), Individual-group discontinuity: The role of a consensus rule. *Journal of Experimental Social Psychology* 24: 505-519.
- Insko, C., Pinkley, R., Hoyle, R., Dalton, B., Hong, G., Slim, R., Landry, P., Holton, B., Ruffin P., Thibaut, J. (1987), Individual versus group discontinuity: The role of intergroup contact. *Journal of Experimental Social Psychology* 23: 250-267.
- Insko, C., Schopler, J., Gaertner, L., Wildschut, T., Kozar, R., Pinter, B., Finkel, E., Brazil, D., Cecil, C., Montoya, M. (2001), Interindividual-intergroup discontinuity reduction through the anticipation of future interaction. *Journal of Personality and Social Psychology* 80: 95-111.
- Klemperer, P. (1998), Auctions with almost common values: The ‘wallet game’ and its applications. *European Economic Review* 42: 757–769.
- Klemperer, P. (2002a), How (not) to run auctions: The European 3G telecom auctions. *European Economic Review* 46: 829-845.
- Klemperer, P. (2002b), What really matters in auction design. *Journal of Economic Perspectives* 16: 169-189.
- Kocher, M.G., Strauß, S., Sutter, M. (2006), Individual or team decision-making – Causes and consequences of self-selection. *Games and Economic Behavior* 56: 259-270.
- Kocher, M.G., Sutter, M. (2005), The decision-maker matters: Individual versus group behaviour in experimental beauty-contest games. *Economic Journal* 115: 200-223.
- Luhan, W., Kocher, M.G., Sutter, M. (2007), Group polarization in the team dictator game reconsidered. *Experimental Economics*, forthcoming.
- Milgrom, P. (2004), *Putting Auction Theory to Work*, Cambridge University Press: Cambridge.
- Plott, C., Salmon T. (2004), The simultaneous, ascending auction: Dynamics of price adjustments in experiments and in the UK3G spectrum auction. *Journal of Economic Behavior and Organization* 53: 353-383.
- Seifert, S., Erhart, K.-M. (2005), Design of the 3G spectrum auctions in the UK and Germany: an experimental investigation. *German Economic Review* 6: 229-248.
- Schopler, J., Insko, C., Wieselquist, J., Pemberton, M., Witcher, B., Kozar, R., Roddenberry, C., Wildschut, T. (2001), When groups are more competitive than individuals: The

- domain of the discontinuity effect. *Journal of Personality and Social Psychology* 80: 632-644.
- Schotter, A. (2003), Decision making with naïve advice. *American Economic Review, Papers and Proceedings* 93: 196-201.
- Sutter, M. (2005), Are four heads better than two? An experimental beauty-contest game with teams of different size. *Economics Letters* 88: 41-46.
- Wildschut, T., Lodewijkx, H., Insko, C. (2001), Toward a reconciliation of diverging perspectives on interindividual-intergroup discontinuity: The role of procedural interdependence. *Journal of Experimental Social Psychology* 37: 273-285.
- Wildschut, T., Vevea, J., Pinter, B., Insko, C., Schopler, J. (2003), Beyond the group mind: A quantitative review of the interindividual-intergroup discontinuity effect. *Psychological Bulletin* 129: 698-722.

## Figures

Figure 1. Average number of bidding rounds

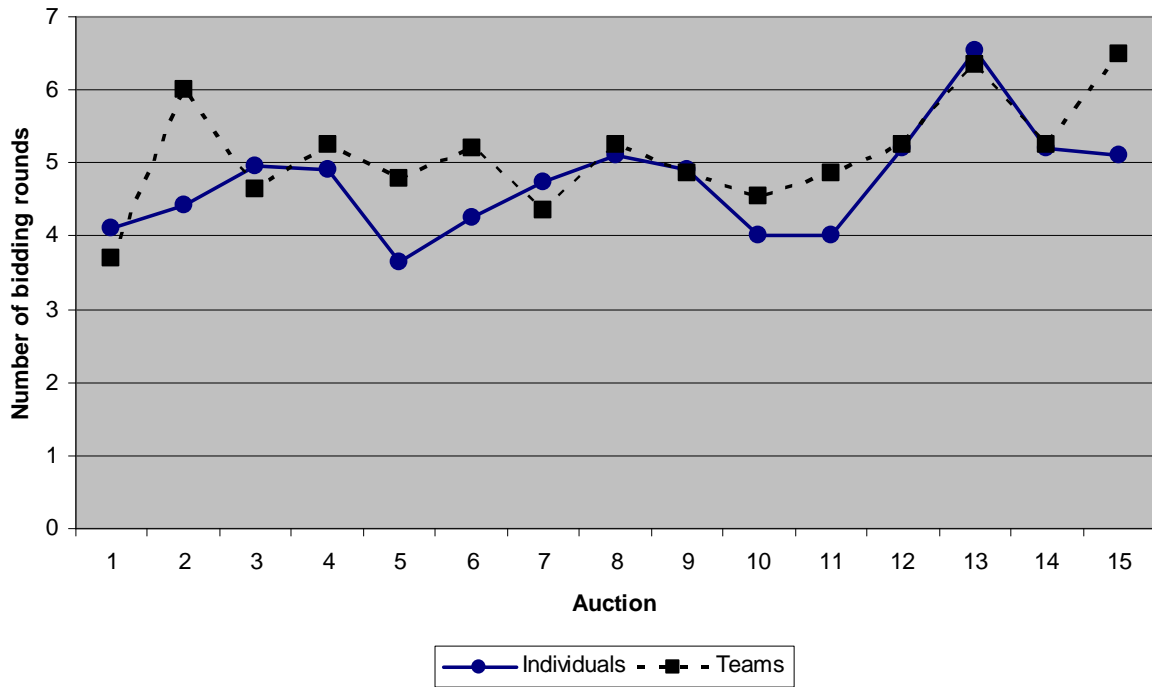


Figure 2. Average prices

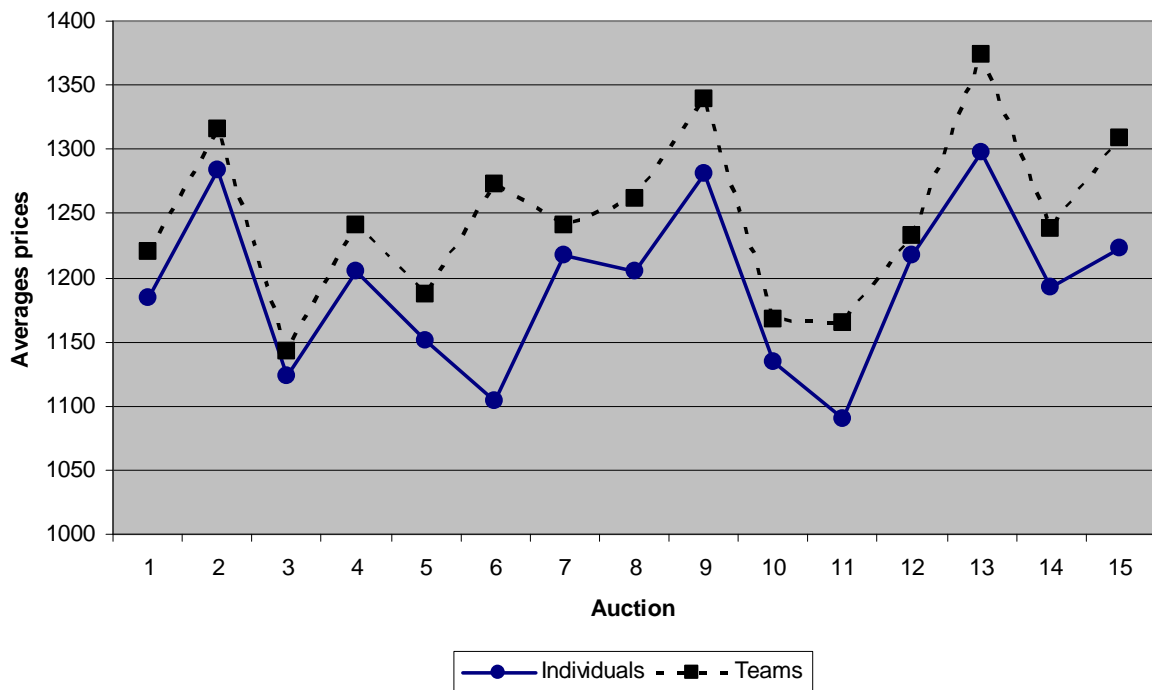
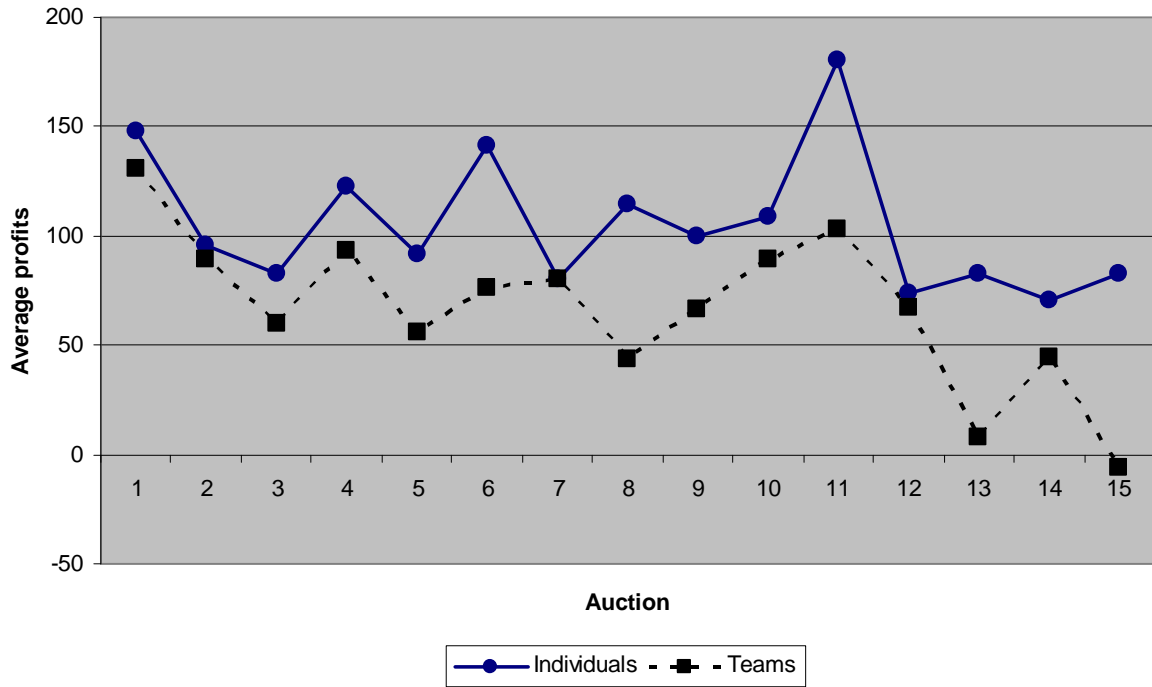


Figure 3. Average profits



## Appendix – Instructions for TEAMS (not necessarily for publication)

*(Instructions were the same for individual bidders and bidder teams; we only used the expression “bidder” instead of “bidder group” in the INDIVIDUALS instructions.)*

Welcome to the experiment and thank you for your participation!

Please do not talk with other participants from now on!

### Instructions

This experiment analyzes economic decision-making. During the experiment you and the other participants will make decisions and you will earn money. The amount of money you earn depends on your own decisions as well as the decisions of the other participants and is determined by the rules of the game that will be explained in the following paragraphs. At the end of the experiment your total profit will be paid to you privately in cash.

The whole experiment will last about 2 hours. If you have any questions after reading the instructions please raise your hand. One of the experimenters will come to you and answer your questions privately. All participants receive the same instructions.

You are member of one of **4 bidder groups** who participate in an auction. Each bidder group consists of 3 members and has a bidder number that remains the same for the whole experiment. Each bidder group receives an endowment of € 10 (= 500 points) per member. We assign participants randomly to the groups.

In the auction **2 identical goods** are auctioned. The goods are not divisible. Each bidder group can only buy one of the goods in each auction. There will be **15 auctions**. Each auction consists of several rounds. You will make your decisions together with the same other two subjects in a bidder group in all 15 auctions. The composition of the other 3 bidder groups also remains the same during the experiment. Your bidder group is also linked with the same 3 bidder groups during the whole experiment.

There are **2 types of bidder groups**, type A and type B. Bidder groups with numbers 1 and 2 are of type A, bidder groups 3 and 4 of type B. You will be informed about your type and your bidder number at the beginning of the experiment in the heading line on the screen. Your bidder number and therefore your type remains the same for all 15 auctions.

### Common value of the goods

Each good has a *common value*. This value is identical for both goods. The bidder groups do not know the common value of the goods during the auction. However, each bidder group receives an *estimation of the common value* that is determined by adding a integer randomly drawn from the interval [-200; + 200] to the real common value. That means that the estimation of the common value is at most 200 points higher or lower than the real common value. The estimation of the common value is different for the four bidder groups, but the real common value is the same for the 4 bidder groups. Each bidder group gets its estimation for the common value at the beginning of each auction.

### Private value of the goods

Each bidder group will be informed about its private value of the goods at the beginning of each auction. This value is different for each bidder group. The private value for each bidder group is randomly drawn from the interval [-100; +100] in the following way.

For bidder groups of **type A** (bidder 1 and 2) the private value is randomly drawn from the interval [0; + 100] with a probability of 80 %. With a probability of 20 % the private value is from the interval [-100; 0]. That means that in 8 out of 10 cases the private value of bidder groups of type A is positive, in the remaining 2 cases it is negative.

For bidder groups of **type B** (bidder 3 and 4) the private value is randomly drawn from the interval [0; + 100] with a probability of 20 %. With a probability of 80 % the private value is from the interval [-100; 0]. That means that in 8 out of 10 cases the private value of bidder groups of type B is negative, in the remaining 2 cases it is positive.

### Rounds in each auction

At the beginning of each auction you will be informed about your private value and your estimation of the common value.

At the beginning of each round you will additionally be informed about the *current price* in the auction and the status of the other bidder groups, i.e. if the particular group is still participating in the auction or if it has already quit the auction.

In the first round the current price equals the *minimum sales bid*. The minimum sales bid is randomly drawn. From the second round on the current price is the third highest bid from the preceding round. That means that for example in round 3 the current price is the third highest bid from round 2.

The *minimum bid* that is valid for this particular round is announced at the beginning of each round. In the first round the minimum bid equals the minimum sales bid. From round 2 on the minimum bid rises according to a fixed scheme:

$$\text{Minimum bid} = \text{current price} + \text{increment}$$

Increment	Condition	Number of bidders left in auction
100	Current price this round $\leq$ (current price preceding round + 150)	4
50	Current price this round $>$ (current price preceding round + 150)	4
25	always	3

Each bidder group can decide to either make a bid that is at least as high as the minimum bid or to quit the auction. The maximum bid is 2000 points. If a group has quit the auction it can only participate again in the next auction but not at the remaining rounds of the current auction. Therefore, getting back into an auction after having quit once is not possible.

### End of the auction

The auction ends if there are exactly 2 bidder groups left who make a valid bid. Each of these groups gets one of the goods and pays the current price for it.

If a group has quit the auction it usually cannot buy a good anymore. However, if there are less than 2 bidder groups left who have made a valid bid in a particular round this rule is not applied. In this case, a group gets one of the goods if it has made a valid bid. The remaining good (respectively goods if nobody has made a bid in this round) is randomly allocated to one

(two) group(s) who has (have) made a valid bid in the preceding round. All bidder groups who receive a good pay the current price of the last round for it.

Exception: If less than 2 bidder groups have made a valid bid already in round 1, the group who has made a valid bid gets a good and pays the minimum sales bid. Therefore, it is possible that in this case only one or even no good is sold.

### **Payoff**

Common value, estimation of common value, private value, current price, increment, minimum sales bid and minimum bid are all given in points. Also bids have to be made in points. The conversion ratio is:

$$100 \text{ points} = 2 \text{ Euro}$$

Note that each group member receives the stated number of points earned during the whole experiment plus the initial endowment of € 10 (500points) as final payoff.

A bidder group who buys one of the goods receives the following payoff in the respective auction:

$$\text{Payoff} = \text{common value} + \text{private value} - \text{price for the good}$$

Note that the private value may be negative.

A bidder group who did not buy a good in an auction does not get any payoff in the respective auction.

### **Attention!**

Note that losses are possible in this auction! If you pay a higher amount for one of the goods in an auction than the sum of real common value and private value, your payoff will be negative in this auction!

Note especially that your estimation of the common value can be higher than the real common value. You will be informed about your private value at the beginning of each auction. If your private value is negative it will be subtracted from the common value if you buy a good.

Losses will be subtracted from profits you have made so far and the initial endowment of 500 points. If you have made a total loss at the end of the 15 auctions, this loss has to be paid to the experimenters!

The common value, your estimation of the common value and your private value are randomly and completely independent drawn at the beginning of each auction from the respective intervals. That means that these values usually differ between the auctions.

Bidder numbers and type remain the same for all auctions.

### **Summary of values**

- Common value

Value of each of the goods. Is unknown during the auction, but you will be informed about it at the end of each auction. It is used to calculate the payoff.

- Estimation of the common value

Each bidder group is informed about it at the beginning of each auction and it is randomly taken from the interval [-200; + 200] around the common value.

- Private value

Each bidder group receives information about it at the beginning of each auction. It is added to (subtracted from) the common value when calculating payoffs. It lies in the interval [-100;



+100]. For bidder groups of type A it is positive with a probability of 80 %, for type B-bidders this probability is 20 %.

- Minimum sales bid

Minimum bid in the first round. It is randomly determined and will be announced at the beginning of each auction.

- Current price

Third highest bid from the preceding round (except round 1 where the minimum sales bid applies)

- Minimum bid

The minimum acceptable bid from round 2 on.  $\text{Minimum bid} = \text{current price} + \text{increment}$  (increments are calculated according to the table on page 3 of the instructions).

If you still have questions, please raise your hand. One of the experimenters will come to you and answer your question(s) privately.

Thank you for participating!

# Supplement – Sets of variables and raw data

(for referees' convenience – not for publication)

The 10 different sets of variables (column “Set”) were randomly drawn before running the experimental sessions. Each set consists of 15 auctions (“Auction”) in which four bidders (“Bidder”) of two different types (“Type”) are assigned a common value component (not revealed until the end of an auction; “cvc”), an estimated common value component (known to bidders; “ecvc”) and a private value component (“pvc”) before starting to bid. The actual bids in the various bidding rounds are included under the labels “R1”, “R2” ... 14 rounds was the maximum number. A “0” indicates that a bidder did not submit a bid. If the last bidding round has more than two active bidders, it means that none of them submitted a bid in the next round.

## Treatment INDIVIDUALS – Set 1

Set	Auction	Bidder	Type	cvc	ecvc	pvc	Bidding round (R)													
							R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
1	1	1	A	1110	999	-65	0													
1	1	2	A	1110	1158	-87	0													
1	1	3	B	1110	1255	-61	900													
1	1	4	B	1110	946	-64	898													
1	2	1	A	1318	1514	92	1100	1270	1250											
1	2	2	A	1318	1489	98	1100	0	0											
1	2	3	B	1318	1294	-83	1070	1170	0											
1	2	4	B	1318	1410	-41	1080	1180	1195											
1	3	1	A	1420	1310	72	1250	1330	1450	1470	1490									
1	3	2	A	1420	1550	6	1230	1331	0	0	0									
1	3	3	B	1420	1409	42	1250	1330	1430	1455	0									
1	3	4	B	1420	1488	-4	1230	1330	1430	1455	0									
1	4	1	A	1423	1343	-78	1180	1280	0											
1	4	2	A	1423	1321	80	1175	0	0											
1	4	3	B	1423	1232	67	1200	1275	0											
1	4	4	B	1423	1571	-70	1180	1280	1380											
1	5	1	A	1240	1418	55	950	1050	1150	1250	1275									
1	5	2	A	1240	1384	7	930	1035	1135	1255	1280									
1	5	3	B	1240	1328	-99	1000	1100	1170	0	0									
1	5	4	B	1240	1412	-54	930	1030	1200	1300	0									
1	6	1	A	1328	1340	42	1150	1240	0											
1	6	2	A	1328	1259	17	1140	1240	0											
1	6	3	B	1328	1229	20	1150	1240	1340											
1	6	4	B	1328	1252	-36	1140	1240	0											
1	7	1	A	1025	1035	14	776	876	976	0										
1	7	2	A	1025	1031	12	776	876	976	1001										
1	7	3	B	1025	880	-35	776	880	0	0										
1	7	4	B	1025	1131	-27	850	900	980	1002										
1	8	1	A	1315	1509	-60	1000	1100	1125	1125	1150									
1	8	2	A	1315	1401	83	975	1075	1100	1125	1150									
1	8	3	B	1315	1171	-7	1000	1100	1100	1125	0									
1	8	4	B	1315	1157	-100	1000	0	0	0	0									
1	9	1	A	1209	1227	21	1037	0												
1	9	2	A	1209	1118	-8	1037	0												
1	9	3	B	1209	1348	-61	1150	1200												
1	9	4	B	1209	1357	-83	1100	1140												
1	10	1	A	1448	1548	24	1141	1241	1341											
1	10	2	A	1448	1397	2	1141	1241	1341											
1	10	3	B	1448	1352	-79	1200	1280	1341											
1	10	4	B	1448	1393	-66	1200	1250	1341											
1	11	1	A	1285	1381	21	1071	1171	1196	1221	1246	0								
1	11	2	A	1285	1102	20	1071	0	0	0	0	0								
1	11	3	B	1285	1219	55	1100	1200	1200	1250	1270	1280								
1	11	4	B	1285	1435	-31	1300	1300	1200	1250	1250	1280								
1	12	1	A	1262	1146	13	915	1015	0	0	0									
1	12	2	A	1262	1236	61	915	1015	1115	1140	1165									
1	12	3	B	1262	1208	-13	1000	1100	1200	1150	1185									
1	12	4	B	1262	1205	-49	1000	1100	1120	1140	0									
1	13	1	A	1393	1444	-56	1106	1206	1306	1331	1356									
1	13	2	A	1393	1286	33	1106	1206	0	0	0									
1	13	3	B	1393	1382	-45	1250	1250	1350	1350	0									
1	13	4	B	1393	1285	-11	1110	1210	1310	1340	0									
1	14	1	A	1405	1221	22	1090	1190	0	0	0									
1	14	2	A	1405	1341	65	1090	1190	1290	1315	0									
1	14	3	B	1405	1289	30	1200	1250	1300	1350	1340									
1	14	4	B	1405	1464	-7	1200	1200	1400	1320	1350									
1	15	1	A	1495	1433	25	1147	1247	1347	0										
1	15	2	A	1495	1355	68	1147	1247	1347	0										
1	15	3	B	1495	1441	81	1300	1300	1400	1450										
1	15	4	B	1495	1583	91	1300	1300	1400	1500										



# Supplement

## Treatment INDIVIDUALS – Set 3

Set	Auction	Bidder	Type	cvc	ecvc	pvc	Bidding round (R)														
							R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	
3	1	9	A	1457	1499	-94	1200	0	0	0	0	0	0	0	0						
3	1	10	A	1457	1647	46	1184	1440	1440	1260	1285	1310	1335	1360							
3	1	11	B	1457	1569	-26	1300	1300	1250	1270	1290	1315	1340	1360							
3	1	12	B	1457	1384	68	1183	1209	1234	1259	1284	1309	1334	0							
3	2	9	A	1231	1091	80	960	1060	1160	0											
3	2	10	A	1231	1326	-77	958	1059	1159	0											
3	2	11	B	1231	1161	47	999	1060	1160	0											
3	2	12	B	1231	1170	-54	957	1058	1158	1258											
3	3	9	A	1141	1182	65	1000	1070	1170												
3	3	10	A	1141	953	4	966	1066	0												
3	3	11	B	1141	1202	-81	965	1065	0												
3	3	12	B	1141	946	-10	965	1065	0												
3	4	9	A	1406	1407	34	1144	1244	1268	1293	1318	0									
3	4	10	A	1406	1249	-6	1250	1243	1269	1293	1318	1343									
3	4	11	B	1406	1451	-63	1143	0	0	0	0	0									
3	4	12	B	1406	1563	-91	1142	1243	1268	1293	1318	1343									
3	5	9	A	1299	1150	-4	969	1069	0	0	0										
3	5	10	A	1299	1417	43	969	1069	1169	1194	1219										
3	5	11	B	1299	1438	-18	975	1070	1169	1194	0										
3	5	12	B	1299	1405	-31	969	1069	1169	1194	1219										
3	6	9	A	1367	1556	-28	1111	1211	1236												
3	6	10	A	1367	1274	33	1111	1211	1236												
3	6	11	B	1367	1336	-20	1111	0	0												
3	6	12	B	1367	1441	-37	1111	1211	0												
3	7	9	A	1444	1631	78	1128	1228	1328	1353	1378	1403									
3	7	10	A	1444	1644	-36	1128	1228	1328	1353	1378	1403									
3	7	11	B	1444	1431	-18	1128	1228	0	0	0	0									
3	7	12	B	1444	1563	-57	1128	1228	1328	1353	1378	0									
3	8	9	A	1006	1011	93	738	762													
3	8	10	A	1006	1190	45	737	762													
3	8	11	B	1006	908	-67	737	0													
3	8	12	B	1006	838	-87	0	0													
3	9	9	A	1494	1635	61	1100	1200	1225												
3	9	10	A	1494	1511	12	1100	1200	1225												
3	9	11	B	1494	1356	-37	1100	0	0												
3	9	12	B	1494	1336	-52	1100	1200	0												
3	10	9	A	1456	1653	33	1100	1200	1225												
3	10	10	A	1456	1356	-58	1100	0	0												
3	10	11	B	1456	1365	-27	1100	1200	0												
3	10	12	B	1456	1289	-68	1100	1200	0												
3	11	9	A	1360	1374	-84	1158	1258	0												
3	11	10	A	1360	1491	72	1158	1258	1358												
3	11	11	B	1360	1447	-50	1158	0	0												
3	11	12	B	1360	1423	73	1158	1258	1358												
3	12	9	A	1297	1428	46	1054	1154	1254	1279											
3	12	10	A	1297	1453	98	1054	1154	1254	1279											
3	12	11	B	1297	1135	-13	1054	1154	0	0											
3	12	12	B	1297	1382	-35	1054	1154	1254	0											
3	13	9	A	1296	1404	80	989	1089	1189												
3	13	10	A	1296	1318	-81	989	1089	0												
3	13	11	B	1296	1409	-65	989	1089	1189												
3	13	12	B	1296	1231	-95	989	1089	0												
3	14	9	A	1073	1223	33	864	963	988	1013											
3	14	10	A	1073	1090	4	863	963	988	0											
3	14	11	B	1073	1028	-94	863	0	0	0											
3	14	12	B	1073	1263	-83	863	963	988	1013											
3	15	9	A	1147	998	100	914	0													
3	15	10	A	1147	1250	89	914	1014													
3	15	11	B	1147	1086	-22	914	0													
3	15	12	B	1147	1162	-56	914	1014													

















# Supplement

Bidders were teams of three subjects each in the TEAMS treatment. “Bidder” in this treatment therefore refers to a team. The values for “cvc”, “ecvc” and “pvc” are identical for INDIVIDUALS and TEAMS for a given set.

## Treatment TEAMS – Set 1

Set	Auction	Bidder	Type	cvc	ecvc	pvc	Bidding round (R)													
							R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
1	1	41	A	1110	999	-65	950	926												
1	1	42	A	1110	1158	-87	900	0												
1	1	43	B	1110	1255	-61	900	940												
1	1	44	B	1110	946	-64	0	0												
1	2	41	A	1318	1514	92	1200	1200	1250	1301	1350	1352	1363	1400	1420	1445	1470			
1	2	42	A	1318	1489	98	1100	1250	1275	1300	1330	1350	1370	1391	1420	1450	1470			
1	2	43	B	1318	1294	-83	1075	0	0	0	0	0	0	0	0	0	0			
1	2	44	B	1318	1410	-41	1111	1257	1257	1281	1311	1337	1363	1389	1415	1441	0			
1	3	41	A	1420	1310	72	1230	1360	0	0	0	0								
1	3	42	A	1420	1550	6	1250	1360	1470	1499	1525	0								
1	3	43	B	1420	1409	42	1280	1365	1467	1501	1526	1555								
1	3	44	B	1420	1488	-4	1281	1381	1481	1501	1551	1551								
1	4	41	A	1423	1343	-78	1200	1300	1400	0										
1	4	42	A	1423	1321	80	1174	1281	1386	0										
1	4	43	B	1423	1232	67	1180	1290	1390	0										
1	4	44	B	1423	1571	-70	1201	1286	1401	1491										
1	5	41	A	1240	1418	55	950	1030	1130	1230	1255	1280	1320	1330	1355	1379	1406	1440		
1	5	42	A	1240	1384	7	928	1029	1129	1229	1254	1279	1304	1329	1354	1379	1404	0		
1	5	43	B	1240	1328	-99	930	1030	1130	0	0	0	0	0	0	0	0	0		
1	5	44	B	1240	1412	-54	929	1101	1131	1231	1255	1281	1305	1331	1355	1380	1405	1430		
1	6	41	A	1328	1340	42	1137	1237	1262	1287	1312	1337								
1	6	42	A	1328	1259	17	1137	1237	1262	1287	1312	1337								
1	6	43	B	1328	1229	20	1140	1240	1263	1290	1315	1341								
1	6	44	B	1328	1252	-36	1138	0	0	0	0	0								
1	7	41	A	1025	1035	14	776	876	976	1001	1026	1051								
1	7	42	A	1025	1031	12	776	876	976	1001	1026	1051								
1	7	43	B	1025	880	-35	780	876	0	0	0	0								
1	7	44	B	1025	1131	-27	777	877	977	1002	1027	0								
1	8	41	A	1315	1509	-60	975	1075	1100	1125	1150	1176	1200							
1	8	42	A	1315	1401	83	975	1075	1100	1125	1150	1175	1200							
1	8	43	B	1315	1171	-7	980	1090	1105	1130	1155	1180	0							
1	8	44	B	1315	1157	-100	976	0	0	0	0	0	0							
1	9	41	A	1209	1227	21	1037	1137	1237	0										
1	9	42	A	1209	1118	-8	1037	1137	1237	1337										
1	9	43	B	1209	1348	-61	1040	1140	1240	1340										
1	9	44	B	1209	1357	-83	1038	1138	1238	0										
1	10	41	A	1448	1548	24	1141	1241	1341	1366										
1	10	42	A	1448	1397	2	1141	1241	1341	1366										
1	10	43	B	1448	1352	-79	1145	1245	0	0										
1	10	44	B	1448	1393	-66	1142	1242	1342	0										
1	11	41	A	1285	1381	21	1071	1171	1271	0	0									
1	11	42	A	1285	1102	20	1071	1171	1271	1371	0									
1	11	43	B	1285	1219	55	1080	1180	1275	1375	0									
1	11	44	B	1285	1435	-31	1072	1172	1272	1372	1397									
1	12	41	A	1262	1146	13	915	1015	1115	0										
1	12	42	A	1262	1236	61	915	1015	1115	1215										
1	12	43	B	1262	1208	-13	918	1020	1116	1216										
1	12	44	B	1262	1205	-49	916	1016	1116	0										
1	13	41	A	1393	1444	-56	1106	1206	1306	1331	1356									
1	13	42	A	1393	1286	33	1106	1206	1306	1331	1356									
1	13	43	B	1393	1382	-45	1115	1210	1310	1332	0									
1	13	44	B	1393	1285	-11	1107	1207	0	0	0									
1	14	41	A	1405	1221	22	1090	1190	1290	0										
1	14	42	A	1405	1341	65	1090	1190	1290	1390										
1	14	43	B	1405	1289	30	1100	1200	1300	0										
1	14	44	B	1405	1464	-7	1091	1191	1291	1391										
1	15	41	A	1495	1433	25	1147	1247	1347	1447	1547	1572								
1	15	42	A	1495	1355	68	1147	1247	1347	1447	1547	0								
1	15	43	B	1495	1441	81	1150	1250	1350	1450	0	0								
1	15	44	B	1495	1583	91	1148	1248	1348	1448	1548	1573								

# Supplement

## Treatment TEAMS – Set 2

Set	Auction	Bidder	Type	cvc	ecvc	pvc	Bidding round (R)													
							R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
2	1	45	A	1438	1442	-78	1230	1400	1400											
2	1	46	A	1438	1420	44	1171	1300	1390											
2	1	47	B	1438	1618	-58	1162	1263	1400											
2	1	48	B	1438	1288	-99	1163	1288	1400											
2	2	45	A	1487	1330	48	1250	1351	1451	1476	0									
2	2	46	A	1487	1527	-88	1300	1360	0	0	0									
2	2	47	B	1487	1684	-8	1350	1400	1460	1480	1506									
2	2	48	B	1487	1383	89	1222	1351	1451	1477	1502									
2	3	45	A	1338	1184	81	1069	1100	1122	1184										
2	3	46	A	1338	1226	96	1110	1101	1125	1150										
2	3	47	B	1338	1146	-74	0	0	0	0										
2	3	48	B	1338	1153	-38	1071	1096	1122	0										
2	4	45	A	1175	1059	-80	1059	0	0											
2	4	46	A	1175	1153	2	1015	1121	0											
2	4	47	B	1175	1136	75	1055	1150	1150											
2	4	48	B	1175	1308	22	1020	1121	1151											
2	5	45	A	1090	953	78	890	991	1092	1193										
2	5	46	A	1090	1191	16	900	1000	1091	0										
2	5	47	B	1090	1141	-52	950	1020	1100	0										
2	5	48	B	1090	1140	-98	877	991	1093	1193										
2	6	45	A	1410	1214	100	1214	1315	1415											
2	6	46	A	1410	1228	25	1214	1314	0											
2	6	47	B	1410	1411	54	1300	1350	0											
2	6	48	B	1410	1454	-36	1214	1316	1416											
2	7	45	A	1355	1262	8	1170	1300	1287											
2	7	46	A	1355	1265	82	1162	1262	1287											
2	7	47	B	1355	1358	-96	1170	0	0											
2	7	48	B	1355	1178	-92	1163	1263	0											
2	8	45	A	1500	1639	36	1400	1440	1540	1633	0									
2	8	46	A	1500	1649	53	1330	1440	1532	1633	1733									
2	8	47	B	1500	1654	-90	1350	1450	1535	1635	0									
2	8	48	B	1500	1544	-94	1229	1431	1533	1634	0									
2	9	45	A	1456	1619	84	1100	1140	1240	1340	1440									
2	9	46	A	1456	1290	59	1039	1139	1240	1340	0									
2	9	47	B	1456	1373	-15	1111	1150	1250	1350	0									
2	9	48	B	1456	1342	36	1039	1141	1242	1342	1441									
2	10	45	A	1487	1492	86	1282	1383	1483	1508	1533	1558								
2	10	46	A	1487	1545	44	1285	1383	1483	1508	1533	1558								
2	10	47	B	1487	1680	-39	1300	1400	1500	1520	1534	0								
2	10	48	B	1487	1341	-40	1283	1385	0	0	0	0								
2	11	45	A	1029	938	65	803	904	929	954	979	1010	0							
2	11	46	A	1029	1196	36	804	904	929	954	979	1004	1029							
2	11	47	B	1029	944	-72	850	0	0	0	0	0	0							
2	11	48	B	1029	1117	-42	806	910	930	955	981	1005	1032							
2	12	45	A	1150	1145	72	930	1024	1124	1149	1174	1199	1224							
2	12	46	A	1150	1278	90	924	1024	1124	1149	1174	1199	1224							
2	12	47	B	1150	1081	-19	950	1049	0	0	0	0	0							
2	12	48	B	1150	1318	-71	930	1025	1125	1150	1175	1200	0							
2	13	45	A	1439	1487	50	1174	1274	1374	1399	1424	1449	1474	1499	1524	1549	1574			
2	13	46	A	1439	1577	33	1174	1274	1374	1399	1424	1449	1474	1499	1524	1549	1574			
2	13	47	B	1439	1633	-4	1300	1300	1374	1399	1424	1450	1474	1499	1524	1550	0			
2	13	48	B	1439	1320	-59	1179	1275	0	0	0	0	0	0	0	0	0			
2	14	45	A	1131	1061	80	969	1069	1169	1194	0									
2	14	46	A	1131	1227	75	969	1069	1169	1194	1219									
2	14	47	B	1131	1285	-6	1100	1100	1169	1200	1219									
2	14	48	B	1131	1068	-62	971	1070	0	0	0									
2	15	45	A	1477	1629	16	1117	1217	1317	1417	1517									
2	15	46	A	1477	1314	97	1117	1217	1317	1417	0									
2	15	47	B	1477	1556	-2	1400	1400	1401	1450	1517									
2	15	48	B	1477	1334	-17	1118	1220	1318	1418	0									

# Supplement

## Treatment TEAMS – Set 3

Set	Auction	Bidder	Type	cvc	ecvc	pvc	Bidding round (R)													
							R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
3	1	49	A	1457	1499	-94	1200	0	0	0	0	0	0							
3	1	50	A	1457	1647	46	1183	1283	1308	1333	1393	1385								
3	1	51	B	1457	1569	-26	1223	1290	1310	1335	1360	0								
3	1	52	B	1457	1384	68	1200	1283	1308	1333	1358	1383								
3	2	49	A	1231	1091	80	957	1057	1082	1107	1132	1157	1182							
3	2	50	A	1231	1326	-77	1000	1100	1082	1108	1132	1165	1182							
3	2	51	B	1231	1161	47	959	1058	1083	1108	1133	1158	0							
3	2	52	B	1231	1170	-54	957	0	0	0	0	0	0							
3	3	49	A	1141	1182	65	965	1065												
3	3	50	A	1141	953	4	965	0												
3	3	51	B	1141	1202	-81	966	1066												
3	3	52	B	1141	946	-10	965	0												
3	4	49	A	1406	1407	34	1142	1242	1342											
3	4	50	A	1406	1249	-6	1145	1242	0											
3	4	51	B	1406	1451	-63	1143	1243	1342											
3	4	52	B	1406	1563	-91	1142	1242	0											
3	5	49	A	1299	1150	-4	969	1069	0	0	0	0	0	0	0	0	0	0	0	
3	5	50	A	1299	1417	43	990	1100	1170	1194	1219	1244	1269	1294	1319	0				
3	5	51	B	1299	1438	-18	969	1069	1169	1194	1219	1244	1269	1294	1319	1344				
3	5	52	B	1299	1405	-31	969	1069	1169	1194	1219	1244	1269	1294	1319	1344				
3	6	49	A	1367	1556	-28	1111	1211	1311	1336	1361									
3	6	50	A	1367	1274	33	1111	1211	1311	1336	0									
3	6	51	B	1367	1336	-20	1111	1211	0	0	0									
3	6	52	B	1367	1441	-37	1111	1211	1311	1336	1361									
3	7	49	A	1444	1631	78	1128	1228	1328	1428	1528									
3	7	50	A	1444	1644	-36	1128	1228	1328	1428	1528									
3	7	51	B	1444	1431	-18	1128	1228	1328	1428	0									
3	7	52	B	1444	1563	-57	1128	1228	1328	1428	0									
3	8	49	A	1006	1011	93	737	837	937	1037										
3	8	50	A	1006	1190	45	737	837	937	1037										
3	8	51	B	1006	908	-67	737	837	937	0										
3	8	52	B	1006	838	-87	737	837	937	0										
3	9	49	A	1494	1635	61	1100	1200	1300	1400	1500									
3	9	50	A	1494	1511	12	1100	1200	1300	1400	1500									
3	9	51	B	1494	1356	-37	1100	1200	1300	1400	0									
3	9	52	B	1494	1336	-52	1100	1200	1300	1400	0									
3	10	49	A	1456	1653	33	1100	1200	1300	1400	1425									
3	10	50	A	1456	1356	-58	1100	1200	1300	0	0									
3	10	51	B	1456	1365	-27	1100	1200	1300	1400	1425									
3	10	52	B	1456	1289	-68	1100	1200	1300	1400	0									
3	11	49	A	1360	1374	-84	1158	1258	0	0	0	0	0	0	0	0	0	0	0	
3	11	50	A	1360	1491	72	1158	1258	1358	1383	1408	1433	1485	1483	1508	1533				
3	11	51	B	1360	1447	-50	1158	1258	1358	1383	1408	1433	1458	1483	1508	0				
3	11	52	B	1360	1423	73	1158	1258	1358	1383	1408	1433	1458	1483	1508	1533				
3	12	49	A	1297	1428	46	1054	1154	1254	1354	1379	1404	1429	1454	1479					
3	12	50	A	1297	1453	98	1054	1154	1254	1354	1379	1404	1429	1454	1479					
3	12	51	B	1297	1135	-13	1054	1154	1254	0	0	0	0	0	0					
3	12	52	B	1297	1382	-35	1054	1154	1254	1354	1379	1404	1429	1454	0					
3	13	49	A	1296	1404	80	989	1089	1189	1289	1389	1414								
3	13	50	A	1296	1318	-81	989	1089	1189	1289	0	0								
3	13	51	B	1296	1409	-65	989	1089	1189	1289	1389	1414								
3	13	52	B	1296	1231	-95	989	1089	1189	1289	1389	0								
3	14	49	A	1073	1223	33	863	963	1063	1163	1188	1213	1238	1263						
3	14	50	A	1073	1090	4	863	963	1063	1163	1188	1213	1238	0						
3	14	51	B	1073	1028	-94	863	963	1063	0	0	0	0	0						
3	14	52	B	1073	1263	-83	863	963	1063	1163	1188	1213	1238	0						
3	15	49	A	1147	998	100	914	1014	1114	1214	0									
3	15	50	A	1147	1250	89	914	1014	1114	1214	1239									
3	15	51	B	1147	1086	-22	914	1014	1114	0	0									
3	15	52	B	1147	1162	-56	914	1014	1114	1214	1239									

# Supplement

## Treatment TEAMS – Set 4

Set	Auction	Bidder	Type	cvc	ecvc	pvc	Bidding round (R)													
							R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
4	1	53	A	1167	1305	-99	0	0	0	0										
4	1	54	A	1167	1265	-90	1030	1055	1078	0										
4	1	55	B	1167	1315	86	1030	1053	1078	1103										
4	1	56	B	1167	1242	-38	1028	1054	1100	1103										
4	2	53	A	1209	1155	-45	870	969	1068	1093	0									
4	2	54	A	1209	1406	78	1000	1000	1200	1100	1200									
4	2	55	B	1209	1135	-92	868	968	0	0	0									
4	2	56	B	1209	1368	21	1000	1000	1160	1160	1200									
4	3	53	A	1083	1272	3	827	927	1028	1128	1153	1178	1203							
4	3	54	A	1083	1187	14	1000	960	1030	1130	1153	1178	1203							
4	3	55	B	1083	1116	-80	830	930	1030	0	0	0	0							
4	3	56	B	1083	1163	-82	827	928	1030	1130	1153	1185	0							
4	4	53	A	1121	976	3	837	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4	54	A	1121	1202	-58	1200	937	962	987	1012	1037	1062	1087	1112	1137	0			
4	4	55	B	1121	988	68	840	940	964	990	1015	1040	1063	1090	1115	1140	1165			
4	4	56	B	1121	1216	-46	840	937	962	990	1012	1040	1065	1087	1112	1140	1165			
4	5	53	A	1193	1102	-71	874	974	0	0										
4	5	54	A	1193	1024	-46	1500	1500	1100	0										
4	5	55	B	1193	1216	-11	880	975	1075	1100										
4	5	56	B	1193	1072	-4	874	974	1074	1100										
4	6	53	A	1433	1474	12	1186	1286	1311											
4	6	54	A	1433	1625	-27	1500	1300	1400											
4	6	55	B	1433	1341	-32	1186	1287	0											
4	6	56	B	1433	1335	-45	1186	0	0											
4	7	53	A	1415	1249	-38	1040	1140	1240	0										
4	7	54	A	1415	1534	76	1100	1200	1300	1340										
4	7	55	B	1415	1336	0	1050	1142	1244	0										
4	7	56	B	1415	1599	-78	1040	1140	1240	0										
4	8	53	A	1200	1069	96	1025	0	0											
4	8	54	A	1200	1228	-68	1025	1125	0											
4	8	55	B	1200	1248	62	1027	1128	1153											
4	8	56	B	1200	1340	71	1025	1125	1150											
4	9	53	A	1278	1292	26	1292	1150	1175	1200										
4	9	54	A	1278	1387	16	2000	2000	1200	1200										
4	9	55	B	1278	1287	-6	1050	1153	1177	0										
4	9	56	B	1278	1197	-66	1022	0	0	0										
4	10	53	A	1112	1095	-72	984	0												
4	10	54	A	1112	1083	-46	984	1084												
4	10	55	B	1112	1101	-38	986	0												
4	10	56	B	1112	1058	-46	984	1084												
4	11	53	A	1231	1121	93	1069	1094	1119	1144										
4	11	54	A	1231	1059	60	1069	1094	1119	1144										
4	11	55	B	1231	1084	-72	0	0	0	0										
4	11	56	B	1231	1223	-51	1069	1094	1119	0										
4	12	53	A	1271	1112	-74	923	0	0	0	0	0	0	0	0	0	0			
4	12	54	A	1271	1263	-12	1000	1023	1050	1073	1100	1123	1150	1173	1200	0				
4	12	55	B	1271	1340	-3	980	1027	1052	1076	1102	1126	1153	1178	1200	1228				
4	12	56	B	1271	1328	29	923	1023	1048	1073	1098	1123	1148	1173	1200	1225				
4	13	53	A	1041	1177	14	864	964	1064	1089	1114	1139	1164							
4	13	54	A	1041	991	70	900	970	1064	1089	1114	1139	0							
4	13	55	B	1041	984	-25	866	968	0	0	0	0	0							
4	13	56	B	1041	1062	-14	864	964	1064	1089	1114	1139	0							
4	14	53	A	1336	1236	-99	1139	1164												
4	14	54	A	1336	1492	38	1139	1164												
4	14	55	B	1336	1165	-46	1140	0												
4	14	56	B	1336	1142	-42	0	0												
4	15	53	A	1432	1576	2	1104	1204	1304	1404	1504	1529	1554	1579						
4	15	54	A	1432	1591	16	1104	1204	1304	1404	1504	1530	1554	1579						
4	15	55	B	1432	1587	-54	1109	1208	1315	1415	1508	1531	1556	0						
4	15	56	B	1432	1333	11	1104	1204	1304	1404	0	0	0	0						

# Supplement

## Treatment TEAMS – Set 5

Set	Auction	Bidder	Type	cvc	ecvc	pvc	Bidding round (R)													
							R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
5	1	57	A	1278	1115	-16	949	0												
5	1	58	A	1278	1082	57	950	1051												
5	1	59	B	1278	1260	-96	987	0												
5	1	60	B	1278	1189	50	1000	1051												
5	2	57	A	1348	1475	23	1275	1200	1150	1130	1154	1180	1205	1230	1255					
5	2	58	A	1348	1317	14	1050	1076	1102	1128	1154	1181	1210	1231	1260					
5	2	59	B	1348	1346	-97	1100	1125	1125	1128	1156	1180	1206	1230	0					
5	2	60	B	1348	1377	-93	0	0	0	0	0	0	0	0	0					
5	3	57	A	1073	1015	-18	929	954	0											
5	3	58	A	1073	1172	-27	930	960	980											
5	3	59	B	1073	1246	-11	940	955	980											
5	3	60	B	1073	1067	-58	0	0	0											
5	4	57	A	1266	1191	90	1029	1054	1079	1104	1129	1154								
5	4	58	A	1266	1186	95	1030	1060	1080	1110	1130	1156								
5	4	59	B	1266	1095	-69	0	0	0	0	0	0								
5	4	60	B	1266	1206	99	1030	1055	1080	1106	1130	0								
5	5	57	A	1013	928	14	893	918												
5	5	58	A	1013	1146	98	900	920												
5	5	59	B	1013	825	-25	895	0												
5	5	60	B	1013	897	-25	0	0												
5	6	57	A	1034	1207	8	800	900	1000											
5	6	58	A	1034	852	85	802	902	0											
5	6	59	B	1034	1161	-61	820	910	1007											
5	6	60	B	1034	1029	-12	800	900	0											
5	7	57	A	1454	1356	92	1258	1283	1308	1333	1358									
5	7	58	A	1454	1651	-8	1260	1290	1310	1340	1360									
5	7	59	B	1454	1534	-23	1260	1284	1310	1335	0									
5	7	60	B	1454	1470	-83	0	0	0	0	0									
5	8	57	A	1415	1560	32	1207	1307	1407	1507										
5	8	58	A	1415	1401	20	1210	1310	1408	0										
5	8	59	B	1415	1486	-41	1210	1308	1407	0										
5	8	60	B	1415	1573	-14	1208	1310	1410	0										
5	9	57	A	1491	1307	68	1186	1286	1386	1486	0									
5	9	58	A	1491	1481	94	1190	1290	1390	1487	1590									
5	9	59	B	1491	1533	94	1186	1288	1386	1486	1586									
5	9	60	B	1491	1634	-28	1190	1290	1390	1490	0									
5	10	57	A	1139	1055	-60	828	928	0											
5	10	58	A	1139	985	-37	829	929	0											
5	10	59	B	1139	1133	-10	828	928	1028											
5	10	60	B	1139	1282	-25	830	930	1030											
5	11	57	A	1126	1217	18	925	950	975	1000	1025									
5	11	58	A	1126	965	48	930	951	976	1001	0									
5	11	59	B	1126	1098	45	925	950	975	1000	1025									
5	11	60	B	1126	954	-7	0	0	0	0	0									
5	12	57	A	1433	1614	70	1231	1331	1356	1381										
5	12	58	A	1433	1292	-49	1240	0	0	0										
5	12	59	B	1433	1462	-69	1231	1331	1356	0										
5	12	60	B	1433	1588	-79	1232	1332	1360	1383										
5	13	57	A	1397	1446	64	1045	1070	1095	1120	1145	1170	1195	1220	1245	1270				
5	13	58	A	1397	1507	-77	1050	1080	1100	1130	1150	1180	1200	1230	1250	0				
5	13	59	B	1397	1506	-53	1045	1070	1095	1120	1145	1170	1195	1220	1245	1270				
5	13	60	B	1397	1302	-78	0	0	0	0	0	0	0	0	0	0				
5	14	57	A	1210	1253	22	1029	1129	1229	1254										
5	14	58	A	1210	1332	-9	1030	1130	1230	1260										
5	14	59	B	1210	1369	-53	1029	1129	1229	0										
5	14	60	B	1210	1313	-11	1030	1130	0	0										
5	15	57	A	1338	1526	99	1113	1138	1163	1188	1213	1238	1263	1288	1313	1338	1363			
5	15	58	A	1338	1521	50	1120	1140	1170	1200	1220	1250	1270	1300	1330	1340	1370			
5	15	59	B	1338	1368	61	1113	1138	1163	1188	1213	1238	1263	1288	1313	1338	0			
5	15	60	B	1338	1205	-80	0	0	0	0	0	0	0	0	0	0	0			



# Supplement

## Treatment TEAMS – Set 6

Set	Auction	Bidder	Type	cvc	ecvc	pvc	Bidding round (R)													
							R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
6	1	61	A	1428	1410	77	1150	1300	1500	1380										
6	1	62	A	1428	1335	62	1200	1250	1350	0										
6	1	63	B	1428	1551	-100	1200	1250	0	0										
6	1	64	B	1428	1424	-36	1202	1303	1450	1375										
6	2	61	A	1496	1359	-72	1200	0	0	0	0	0								
6	2	62	A	1496	1427	98	1199	1300	1325	1350	1376	1405								
6	2	63	B	1496	1418	-37	1200	1300	1330	1360	1380	0								
6	2	64	B	1496	1422	39	1201	1301	1351	1352	1385	1405								
6	3	61	A	1016	907	-30	829	930	955	980	1005	0								
6	3	62	A	1016	837	-22	828	0	0	0	0	0								
6	3	63	B	1016	1172	-91	1000	1000	1000	1000	1050	1050								
6	3	64	B	1016	1188	32	999	1001	1011	1050	1061	1062								
6	4	61	A	1488	1634	-28	1175	1280	1380	1405	1430									
6	4	62	A	1488	1673	75	1200	1280	1380	1407	1450									
6	4	63	B	1488	1473	-60	1200	1280	1400	1410	0									
6	4	64	B	1488	1352	-2	1202	1280	0	0	0									
6	5	61	A	1202	1331	77	1060	1160												
6	5	62	A	1202	1091	11	1060	0												
6	5	63	B	1202	1054	49	1060	0												
6	5	64	B	1202	1320	-17	1060	1220												
6	6	61	A	1489	1419	-97	1135	1235	1335	0	0	0								
6	6	62	A	1489	1598	-9	1200	1250	1335	1435	1460	1485								
6	6	63	B	1489	1448	-14	1200	1250	1350	1450	1500	0								
6	6	64	B	1489	1556	85	1165	1250	1350	1475	1495	1506								
6	7	61	A	1171	1158	-52	1032	1057												
6	7	62	A	1171	1074	-99	0	0												
6	7	63	B	1171	1061	-61	1032	0												
6	7	64	B	1171	1296	-72	1035	1065												
6	8	61	A	1231	1299	42	910	1010	1110	1210	1310	1410	0							
6	8	62	A	1231	1296	63	910	1010	1110	1210	1310	1410	1435							
6	8	63	B	1231	1269	-38	1100	1100	1200	1220	1320	0	0							
6	8	64	B	1231	1363	-41	920	1030	1160	1225	1333	1421	1446							
6	9	61	A	1286	1450	81	1120	1220	1320	1345	1370	1395								
6	9	62	A	1286	1233	36	1116	1220	0	0	0	0								
6	9	63	B	1286	1443	-82	1350	1350	1350	1350	1400	0								
6	9	64	B	1286	1211	87	1125	1240	1340	1355	1381	1402								
6	10	61	A	1184	1051	4	883	983	1083	0										
6	10	62	A	1184	1166	52	883	983	1083	1108										
6	10	63	B	1184	1159	-84	1000	1000	1100	0										
6	10	64	B	1184	1102	-65	890	995	0	0										
6	11	61	A	1306	1136	32	1091	1191	0											
6	11	62	A	1306	1342	48	1091	1192	1216											
6	11	63	B	1306	1186	-92	1100	0	0											
6	11	64	B	1306	1161	-6	1101	1202	1229											
6	12	61	A	1008	1170	69	797	897	997	1022										
6	12	62	A	1008	1004	9	797	897	997	0										
6	12	63	B	1008	913	-55	800	900	0	0										
6	12	64	B	1008	1017	-47	800	909	1017	1031										
6	13	61	A	1462	1433	68	1078	1178	1278	1387	1487	1512								
6	13	62	A	1462	1419	10	1078	1178	1287	1387	0	0								
6	13	63	B	1462	1549	-84	1400	1400	1400	1400	1500	0								
6	13	64	B	1462	1487	3	1200	1199	1299	1399	1499	1521								
6	14	61	A	1194	1304	43	983	1083	1183											
6	14	62	A	1194	1100	51	983	1083	0											
6	14	63	B	1194	1311	-30	1200	1200	1200											
6	14	64	B	1194	1232	-79	1100	1111	0											
6	15	61	A	1296	1144	48	1024	1124	1149	1174	1199	1224	1249	1274	1299	0				
6	15	62	A	1296	1109	-15	1024	0	0	0	0	0	0	0	0	0				
6	15	63	B	1296	1461	-6	1400	1400	1200	1200	1200	1225	1250	1275	1300	1325				
6	15	64	B	1296	1307	-24	1050	1133	1166	1199	1212	1235	1266	1299	1305	1333				



# Supplement

## Treatment TEAMS – Set 8

Set	Auction	Bidder	Type	cvc	ecvc	pvc	Bidding round (R)													
							R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
8	1	69	A	1462	1341	87	1200	0	0	0	0	0	0							
8	1	70	A	1462	1278	89	1194	1294	1319	1344	1369	0								
8	1	71	B	1462	1400	-56	1244	1344	1344	1344	1369	0								
8	1	72	B	1462	1337	-7	1194	1294	1319	1344	1369	1394								
8	2	69	A	1380	1215	21	1100	1190	0	0	0	0	0							
8	2	70	A	1380	1360	3	1100	1187	1287	1312	1337	1362	0							
8	2	71	B	1380	1390	34	1424	1200	1300	1320	1340	1390	1390							
8	2	72	B	1380	1415	28	1087	1187	1287	1312	1337	1362	1387							
8	3	69	A	1201	1303	-44	1333	1250	1250											
8	3	70	A	1201	1220	-99	1050	0	0											
8	3	71	B	1201	1147	-86	1100	1200	0											
8	3	72	B	1201	1191	-4	1191	1200	1225											
8	4	69	A	1408	1478	47	1300	1200	1255	1355	1455	0								
8	4	70	A	1408	1271	95	1150	1154	1254	1354	1454	0								
8	4	71	B	1408	1563	-58	1300	1160	1300	1400	1460	1554								
8	4	72	B	1408	1507	-25	1054	1154	1254	1354	1454	0								
8	5	69	A	1321	1281	18	1150	1174	1274	0	0									
8	5	70	A	1321	1343	1	1100	1173	1273	1373	1398									
8	5	71	B	1321	1367	-35	1100	1180	1280	1380	0									
8	5	72	B	1321	1404	80	1073	1173	1273	1373	1398									
8	6	69	A	1040	1225	51	900	920	1020	1045	1100	1095	1120							
8	6	70	A	1040	968	6	820	968	0	0	0	0	0							
8	6	71	B	1040	1083	28	900	950	1020	1045	1070	1095	1120							
8	6	72	B	1040	1174	-91	820	920	1020	1045	1070	1095	0							
8	7	69	A	1466	1502	43	1273	1374	1399	1424	1449	0								
8	7	70	A	1466	1423	52	1300	1373	1398	1423	1448	1473								
8	7	71	B	1466	1387	-74	1280	0	0	0	0	0								
8	7	72	B	1466	1522	-75	1272	1373	1398	1423	1448	1473								
8	8	69	A	1176	1179	58	950	1050	1150	0										
8	8	70	A	1176	1066	92	1000	1049	1149	1249										
8	8	71	B	1176	1135	-33	1000	1049	1149	2000										
8	8	72	B	1176	1177	-2	949	1049	1149	0										
8	9	69	A	1327	1271	93	1084	1184	1284	0										
8	9	70	A	1327	1338	5	1100	1184	1284	1309										
8	9	71	B	1327	1165	-53	2000	2000	0	0										
8	9	72	B	1327	1146	-4	1084	1184	1284	0										
8	10	69	A	1247	1075	7	974	0	0	0										
8	10	70	A	1247	1382	-58	973	1073	1098	1123										
8	10	71	B	1247	1116	-85	2000	2000	2000	0										
8	10	72	B	1247	1229	-8	973	1073	1098	1123										
8	11	69	A	1238	1322	52	981	1082	1181	1281										
8	11	70	A	1238	1376	68	1000	1081	1181	1281										
8	11	71	B	1238	1079	-88	2000	1081	1181	0										
8	11	72	B	1238	1049	-12	981	1081	1181	0										
8	12	69	A	1318	1157	-51	1062	0	0	0										
8	12	70	A	1318	1314	28	1062	1162	1262	1262	0									
8	12	71	B	1318	1344	31	2000	1162	1262	1287										
8	12	72	B	1318	1352	83	1062	1162	1262	1287										
8	13	69	A	1437	1499	61	1233	1333	1434	1458										
8	13	70	A	1437	1447	5	1233	1333	1433	0										
8	13	71	B	1437	1304	-78	2000	1333	0	0										
8	13	72	B	1437	1549	-86	1233	1333	1433	1458										
8	14	69	A	1445	1255	47	1096	1196	0	0	0	0								
8	14	70	A	1445	1269	78	1100	1196	1296	1321	1346	1371	1396							
8	14	71	B	1445	1502	-61	1096	1196	1296	1321	1346	1371	0							
8	14	72	B	1445	1524	-39	1096	1196	1296	1321	1346	1371	1396							
8	15	69	A	1397	1413	-79	1022	1122	1222	1322	0									
8	15	70	A	1397	1592	27	1022	1122	1222	1322	1422									
8	15	71	B	1397	1370	-22	1022	1122	1222	1322	1422									
8	15	72	B	1397	1290	-37	1022	1122	1222	1322	0									

# Supplement

## Treatment TEAMS – Set 9

Set	Auction	Bidder	Type	cvc	ecvc	pvc	Bidding round (R)													
							R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
9	1	73	A	1426	1436	14	1195	1295	1395											
9	1	74	A	1426	1369	45	1195	1295	1395											
9	1	75	B	1426	1300	-25	1300	1300	0											
9	1	76	B	1426	1393	-21	1401	1301	0											
9	2	73	A	1452	1618	99	1252	1353	1454	1554	1579									
9	2	74	A	1452	1552	5	1300	1400	1454	1554	1579									
9	2	75	B	1452	1524	-84	1255	1355	1456	0	0									
9	2	76	B	1452	1374	-14	1253	1354	1460	1560	0									
9	3	73	A	1411	1255	1	1097	1197	0	0	0	0								
9	3	74	A	1411	1357	36	1200	1200	1297	1322	1347	1372	0							
9	3	75	B	1411	1445	-95	1097	1198	1300	1325	1350	1372	0							
9	3	76	B	1411	1453	-89	1100	1200	1300	1322	1347	1372	1397							
9	4	73	A	1443	1396	71	1174	1274	1374	1474										
9	4	74	A	1443	1420	45	1300	1350	1400	0										
9	4	75	B	1443	1335	-15	1174	1275	1377	0										
9	4	76	B	1443	1479	-40	1174	1274	1374	0										
9	5	73	A	1283	1331	-13	1075	1175	1275	0										
9	5	74	A	1283	1419	-81	1300	1400	1275	1375										
9	5	75	B	1283	1187	81	1075	1177	1280	1380										
9	5	76	B	1283	1337	-60	1075	1175	1275	0										
9	6	73	A	1483	1502	47	1144	1244	1344	1444	1544	0								
9	6	74	A	1483	1544	99	1200	1244	1344	1444	1544	1644								
9	6	75	B	1483	1502	-82	1144	1244	1344	1444	1544	0								
9	6	76	B	1483	1660	42	1144	1244	1344	1444	1544	1644								
9	7	73	A	1207	1120	77	1052	1152	1252	1352	1377									
9	7	74	A	1207	1325	52	1100	1200	1252	1352	1377									
9	7	75	B	1207	1260	-77	1052	1152	1252	0	0									
9	7	76	B	1207	1362	-80	1300	1200	1300	1352	0									
9	8	73	A	1317	1463	52	1053	1154	1254	1354	1454	1479								
9	8	74	A	1317	1485	33	1299	1170	1254	1354	1454	1480								
9	8	75	B	1317	1330	-35	1055	1155	1255	1354	1454	0								
9	8	76	B	1317	1271	70	1054	1154	1254	1354	0	0								
9	9	73	A	1416	1545	38	1112	1212	1312	1412	1512	1642								
9	9	74	A	1416	1481	54	1113	1212	1313	1413	1512	0								
9	9	75	B	1416	1519	22	1112	1212	1312	1412	1512	1612								
9	9	76	B	1416	1528	-86	1200	1212	1312	1412	1512	0								
9	10	73	A	1037	1111	-25	0	0	0	0	0									
9	10	74	A	1037	920	91	898	923	948	973	998									
9	10	75	B	1037	1000	-85	898	923	948	973	0									
9	10	76	B	1037	1086	-53	898	923	948	973	998									
9	11	73	A	1130	1165	92	901	1001	1101											
9	11	74	A	1130	1296	78	1100	1100	1101											
9	11	75	B	1130	950	-64	901	1001	0											
9	11	76	B	1130	1003	-62	901	1001	0											
9	12	73	A	1367	1228	22	1108	1208	1308	0										
9	12	74	A	1367	1275	93	1109	1209	1308	0										
9	12	75	B	1367	1326	67	1108	1208	1308	1408										
9	12	76	B	1367	1382	-90	1108	1208	1308	0										
9	13	73	A	1452	1488	-18	1106	1206	1306	1406	0									
9	13	74	A	1452	1390	-13	1107	1207	1307	0	0									
9	13	75	B	1452	1438	-68	1106	1206	1306	1406	1431									
9	13	76	B	1452	1648	25	1106	1206	1306	1406	1431									
9	14	73	A	1186	998	22	930	1030	0											
9	14	74	A	1186	1076	1	930	1030	1130											
9	14	75	B	1186	1237	-79	930	1030	1130											
9	14	76	B	1186	1075	-63	930	1030	0											
9	15	73	A	1114	1124	42	931	1031	1131	1231	0									
9	15	74	A	1114	1143	46	1100	1031	1131	0	0									
9	15	75	B	1114	1257	31	931	1031	1131	1231	1256									
9	15	76	B	1114	1258	-46	931	1031	1131	1231	1256									



## University of Innsbruck – Working Papers in Economics and Statistics

### Recent papers

- 2007-23 **Matthias Sutter, Martin Kocher and Sabine Strauß:** Individuals and teams in UMTS-license auctions.
- 2007-22 **Jesus Crespo Cuaresma, Adusei Jumah and Sohbet Karbuz:** Modelling and Forecasting Oil Prices: The Role of Asymmetric Cycles.
- 2007-21 **Uwe Dulleck and Rudolf Kerschbamer:** Experts vs. discounters: Consumer free riding and experts withholding advice in markets for credence goods.
- 2007-20 **Christiane Schwieren and Matthias Sutter:** Trust in cooperation or ability? An experimental study on gender differences. *Conditionally accepted for publication in: Economics Letters.*
- 2007-19 **Matthias Sutter and Christina Strassmair:** Communication, cooperation and collusion in team tournaments – An experimental study.
- 2007-18 **Michael Hanke, Jürgen Huber, Michael Kirchler and Matthias Sutter:** The economic consequences of a Tobin-tax – An experimental analysis.
- 2007-17 **Michael Pfaffermayr:** Conditional beta- and sigma-convergence in space: A maximum likelihood approach.
- 2007-16 **Anita Gantner:** Bargaining, search, and outside options. *Revised version forthcoming in: Games and Economic Behavior.*
- 2007-15 **Sergio Currarini and Francesco Feri:** Bilateral information sharing in oligopoly.
- 2007-14 **Francesco Feri:** Network formation with endogenous decay.
- 2007-13 **James B. Davies, Martin Kocher and Matthias Sutter:** Economics research in Canada: A long-run assessment of journal publications. *Revised version forthcoming in: Canadian Journal of Economics.*
- 2007-12 **Wolfgang Luh, Martin Kocher and Matthias Sutter:** Group polarization in the team dictator game reconsidered. *Revised version forthcoming in: Experimental Economics.*
- 2007-11 **Onno Hoffmeister and Reimund Schwarze:** The winding road to industrial safety. Evidence on the effects of environmental liability on accident prevention in Germany.
- 2007-10 **Jesus Crespo Cuaresma and Tomas Slacik:** An “almost-too-late” warning mechanism for currency crises.
- 2007-09 **Jesus Crespo Cuaresma, Neil Foster and Johann Scharler:** Barriers to technology adoption, international R&D spillovers and growth.
- 2007-08 **Andreas Brezger and Stefan Lang:** Simultaneous probability statements for Bayesian P-splines.
- 2007-07 **Georg Meran and Reimund Schwarze:** Can minimum prices assure the quality of professional services?.
- 2007-06 **Michal Brzoza-Brzezina and Jesus Crespo Cuaresma:** Mr. Wicksell and the global economy: What drives real interest rates?.
- 2007-05 **Paul Raschky:** Estimating the effects of risk transfer mechanisms against floods in Europe and U.S.A.: A dynamic panel approach.
- 2007-04 **Paul Raschky and Hannelore Weck-Hannemann:** Charity hazard - A real hazard to natural disaster insurance.
- 2007-03 **Paul Raschky:** The overprotective parent - Bureaucratic agencies and natural hazard management.
- 2007-02 **Martin Kocher, Todd Cherry, Stephan Kroll, Robert J. Netzer and Matthias Sutter:** Conditional cooperation on three continents.
- 2007-01 **Martin Kocher, Matthias Sutter and Florian Wakolbinger:** The impact of naive advice and observational learning in beauty-contest games.

**University of Innsbruck**

**Working Papers in Economics and Statistics**

2007-23

Matthias Sutter, Martin Kocher and Sabine Strauß

Individuals and teams in UMTS-license auctions

**Abstract**

We examine bidding behaviour of individuals and teams in an experimental auction resembling UMTS-license auctions. Even though in reality teams were largely involved in those auctions, experimental studies on bidding in auctions have so far relied on individual bidders. Our results show that teams stay on average longer in an (ascending sealed-bid English) auction and pay significantly higher prices than individuals. Consequently, teams make smaller profits and suffer more often the winner's curse. The auction's efficiency is nevertheless higher with teams, since the bidders with the highest valuation are more likely to win the auction when teams bid.

ISSN 1993-4378 (Print)  
ISSN 1993-6885 (Online)