Table 7.1. Price Differences: Dutch versus First-Price Auctions

n	First Price	Dutch Price	Difference
3	2.36	1.98	.38
	2.60	2.57	.03
4	5.42	4.98	.44
	5.86	5.68	.18
5	9.15	8.72	.43
	9.13	8.84	.29
6	13.35	13.25	.10
	13.09	12.89	.20
9	31.02	30.32	.70

Source: Cox, Roberson, and Smith 1982, table 7.
Note: Means for paired-comparison auction sequences. Two entries indicate two paired-comparison sequences for that value of *n*.

(cited in Research in Experimental Economics, V. L. Smith, ed., JAI Press)

2.10 Common value auctions: the bidder's view

Suppose each bidder gets a random signal of what the object is worth.

It is called a "signal" because it is a measurement (with error) of the object's value.

Example:

The object is an oil field with unknown production potential. The signal is a geologist's estimate of the oil reserves.

Example:

There are four bidders. Bidder 1 gets a signal s_1, a random number between 0 and 100.

The other bidders receive signals s_2, s_3 and s_4.

Suppose that the true value of the object is the average of the signals:

$$V = \left(s_1 + s_2 + s_3 + s_4\right)/4$$

Without knowing anything about any of the signals, my estimate of V is EV=50.

Suppose that I know my signal is s_1=90. Now what is $E\left(V \mid s_1 = 90\right)$?

$$E(V \mid s_1 = 90) = (90 + 50 + 50 + 50)/4 = 60$$

Should I bid 60?

What if I win?

Suppose that we (all the bidders) are identical. If we get a higher signal, then we make a higher bid.

If I win the auction, I must have made the best bid $\Rightarrow$ I must have had the highest signal.

$$E(V \mid s_1 = 90 \text{ and } W)$$
$$= E(V \mid s_1 = 90 \text{ and } s_2, s_3, s_4 < 90)$$

Result: Suppose that s is uniformly random between 0 and 100. Conditional on knowing that $s<90$, s is uniformly random between 0 and 90.

This implies that $E(s \mid s < 90) = 45$, and

$$E(V \mid s_1 = 90 \text{ and } s_2, s_3, s_4 < 90)$$
$$= (90 + 45 + 45 + 45)/4 = 56.25$$

Should I bid 56.25?

In a first-price or Dutch auction: No.

Suppose the price drops to 56.25 and I call "Mine!." What have I won?

In a second-price auction: Yes.

In an English auction, should I bid up to 56.25?

No. By the time we get up to 56.25, I'll find out something about the other bids.

What is the best strategy?

Now suppose that there were five bidders (including myself).

Then

$$E(V \mid s_1 = 90 \text{ and } W)$$
$$= (90 + 45 + 45 + 45 + 45)/5 = 54$$

So in going from 4 to 5 bidders, I'll drop my bid.

(If my estimate is highest in a field of 100, my overestimate of the true value is worse than if my estimate were highest in a field of 3.)

2.11 Common value auctions: the seller's view

The winner's surplus

Suppose:

- We have two bidders (1 and 2) who get signals s_1 and s_2
- The true value of the object/mine/oil field is the average $V = (s_1 + s_2)/2$.

In a first-price sealed-bid auction, if V were known, the object would sell for V (or close to it).

If each bidder observes only his signal, do economic forces of greed and competition drive the actual sale price to V?

No. Even the winning bid is a guess based on one signal.

In a first-price auction, the optimal bid is:

$$B_1 = \frac{(n-1)}{n}\left(\frac{2+n}{2n}\right)s_1 = \frac{1}{2}s_1$$

(and similarly for bidder 2)

There is no reason why

$$\underbrace{\max\left(\frac{1}{2}s_1, \frac{1}{2}s_2\right)}_{\text{winning bid}} = \frac{s_1 + s_2}{2} = V$$

If we did a million of these auctions, would EFGC drive the average sale price to the average V?

No. When bidders adjust for the winner's curse, they drop their bids so that the average sale price is *less* than the average value.

$$E\left[\max(s_1, s_2)\right] = \frac{n}{n+1} \times 100 = \frac{2}{3} \times 100 = 67$$

(Klemperer, Appendix D.)

This implies that the expected winning bid is

$$\frac{1}{2} \times 67 = 33 < 50 = E[V]$$

The seller is receiving less than the object is worth. The winning bidder is paying less than the object is worth (Klemperer: "the winner's surplus", section 6).

How to minimize the winner's surplus

Can both signals be revealed and certified in a credible fashion?

⇒ If the seller can do this, she should.

Can the auction induce the bidders to reveal a little of what they know?

In a sealed-bid auction, each bidder knows nothing about the others' bids (and signals).

In an open ascending (English) auction, we know when bidders drop out. From this we may infer their signals.

⇒ An English auction will tend to raise more revenue.

2.12 Evidence on the winner's curse

The tendency for bidders in common value auctions to insufficiently adjust for error in their appraisals and estimates.

- Prior to receiving any appraisal, I start with some belief about value.
- If my estimate is high, I expect that this is partially due to error. I adjust downwards.
- The winner's curse arises because I don't take into account the error *conditional on winning the auction*.

If I win the auction, I know that my estimate was the highest in the field (and therefore likely to be the most erroneous).

Thaler (1988b)

Experimental evidence (Behavior)

- Bazerman & Samuelson (1983, discussed in Thaler)

  Auctions of jars of coins; value of each jar = $8

  Subjects asked to guess the value ($2 prize to best guess)

  Mean estimate = $5.13 (downward bias)

  In sealed-bid first-price auctions for the jars:

  Average winning bid = $10.13 (for a $2.13 loss)

  The low estimates do not lead to low winning bids.

- Weiner, Bazerman & Carroll (1987, discussed in Thaler)

  There is a Target firm ("T") with an uncertain value.

  Under bidder firm A's management, T is worth 50% move (of its uncertain value).

  There are "gains from trade" here.

  The stockholders of T know T's true value.

  A makes a bid; T's stockholders can accept or reject it.

  What is A's optimal bid?

  Result: it is easy for A's management to determine the expected value of T.

  But the expected value of T conditional on the bid being accepted is zero.

  Game was played by 69 Kellogg MBA students. Each student played the game 20 times.

  "Of the 69 subjects, 5 learned to bid one dollar or less by the end of the experiment.

  For these subjects, the average trial at which they began to bid one dollar or less was trial 8.

  There was no sign of learning among the others…"

Structure is similar to class bargaining exercise in which the "buyer of the bicycle" made a bid, not knowing whether the value was $50 or $150. The "seller of the bicycle" knew the value.

- Dyer, Kagel & Levin (1987, discussed in Thaler)

Common-value auction experiments with construction firm managers (bidding experts)

On average the managers did no better than the students.

"We believe that in the field, managers have learned a set of situation specific rules of thumb which enable them to avoid the winner's curse in the field, but could not be applied in the laboratory."

Field evidence (Thaler)

Find overbidding in:

- auctions for off-shore oil leases.
- auctions for book rights.
- corporate takeover bids

More recently, we see overbidding in the auctions for communications spectrum rights (by the telecoms)

2.13 Risk aversion

Most of our analysis to this point has assumed risk-neutral bidders. How does bidding behavior change with risk aversion?

Easiest to consider independent private values setting.

The profits to a bidder are $\underbrace{\pi}_{\text{Profit}} = \underbrace{V}_{\text{Value}} - \underbrace{P}_{\text{Price paid}}$ if the bidder wins; zero otherwise.

The only uncertainty is whether or not the bidder will win the auction.

Relative to a risk-neutral person, a risk-averse person will accept a lower payoff if he is more likely to receive it.

A risk-averse person will bid higher in a first-price (or Dutch auction).

A risk-neutral seller facing risk-averse buyers will prefer a first-price/Dutch auction to an English or second-price auction.

A risk-neutral buyer competing against risk-averse buyers will also have to bid more aggressively. He will also lose relatively often.

2.14 Reserve prices

A reserve (reservation) price is set by the seller.
The item is not sold below the reserve price.

A reserve price is not a bid.
It can't be "revised upwards" while the auction is in process.

Bergstrom & Miller example: seller announces the reserve price.
When the reserve price is announced, this is the same as specifying a minimum bid.

Ebay reserve prices are not preannounced.
But when the bidding has exceeded the reserve price, this fact is announced.

In traditional (wine, art) auctions, auctioneer maintains secrecy about whether reserve price has been hit.

Uses of reserve prices

- Raising the sale price in an English auction.

  In an English open outcry auction, suppose that 2 high bidders have valuations of 100 and 20.

  No reserve price: item would sell for 20 (the second highest bid).

  With a reserve price P between 20 and 100, the item will sell for P.

  With a reserve price of 40, the second-highest-value-bidder will drop out at 20. The high-value bidder will keep calling out a price until 40 is reached (which will be the sale price).

- Learning about demand.

  I don't want to sell my Ming vase, but I would like to know what it is worth.

  Auction it with a very high reserve price.

Disadvantages of reserve prices

It the reserve price is not met, the item won't sell.

Potential bidders will ignore auctions by sellers who have reputations for very high reserve prices.

Reserve prices in sealed-bid auctions

The best strategy for a seller is to set her reserve price honestly – at her reservation price, i.e., the price at which she would just be willing to part with the object.

From the seller's viewpoint, the auction outcome is random.

Suppose that her true reservation price is $R^{True} = \$30$.

She believes that the auction bids will be somewhere between \$20 and \$50.

Suppose that she sets the auction reserve price to $R^{Auction} = \$40$.

If the best bid in the auction is \$35, the object won't sell: someone was willing to pay \$35 for something that she only valued at \$30 $\Rightarrow$ Regret.

Suppose that the high bid is \$45. Was there any advantage to setting the reserve price to \$40 instead of \$45?

In many situations, we'd like an honest estimate of seller's reservation prices. We can set up a game in which they are the sellers and get to specify a reserve price.

Valuing a security

In some settings, we'd like to know how people might value a security.

Example: An H-option will pay \$2 if the toss of a coin comes up heads, and zero otherwise.

The expected value of the payoff is \$1.

How much would you pay for the option?

If you had the option, what would you sell it for?

That is, you trade the risky option for a certain payoff (the sale price).

Most people would accept less than $1 for the option (due to risk aversion).

If my reservation price is $0.95, this means that I'm indifferent between $0.95 for certain and $0/$2 coin toss.

How can someone find out my reservation price?

- Ask me directly?
- Make me successive offers?

  "Would you take eighty cents?",
  "Would you take eighty-one cents?",
  etc.

OR

- Set up an "auction". The "high bid" in the auction will be a random number between $0.50 and $1.00.

Tell me that I can auction your option AND set a reserve price, R. If the randomly drawn bid B is > R, you receive B. If B≤R, I keep the option.

The best strategy is to set an honest reservation price.

Suppose my true reservation price is $0.95, and I bluff. I set R=$0.98.

If the randomly drawn number is $0.97, I keep the option (which I value at $0.95), even though I could have received $0.97 for it. Who did I fool?

2.15 Estimates

In traditional (wine, art) auctions, estimates used to provide indicative prices to potential bidders.

Should you believe them?

Estimates in wine auctions are roughly correct (Ashenfelter (1989))

Current practice: estimates are low. (NY Times, Jan 13, 2000)

2.16 Multiple unit auctions

Note: some multiple unit auctions are referred to as "Dutch" auctions

One simultaneous auction or many (sequential) auctions.

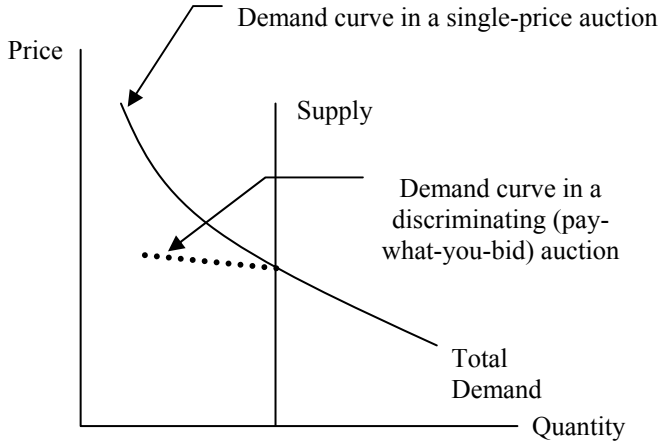
When the number of units is small, sequential auctions are feasible (e.g., wine)

In sequential auctions, prices tend to drop with successive auctions.

For larger numbers (e.g. securities) we need a simultaneous auction procedure.

Discriminating and single-price auctions

In a (price) discriminating multiple-unit auction, you pay what you bid (if you're among the winners).



In an open-outcry pay-what-you-bid auction (where bids are visible) we expect to see a flattening of demand.

Until about 1990 US Treasury securities were sold via a discriminating price auction.

A single-price auction is currently used.

2.17 Internet Auctions

Merchant sites (vendor sells through auction)

Listing-agent sites

Specialized (www.sportsauction.com)

General (eBay)

English auction is dominant format, but descending price, first-price sealed bid and second-price sealed bid are also used.

Features of internet auctions: stopping times

Recall results for bargaining with a deadline.

In auctions, competitive bids are rarely entered early.

Why give competitor's a chance to reflect on a counterbid?

When should we stop the auction? Fixed vs. flexible closing times.

Fixed closing time (e.g., 4pm Pacific time) converts final bids into sealed bids. *This effectively changes the format of the auction.*

Flexible closing time: After (e.g.) 4pm Pacific time, the auction will remain open until five minutes have passed without a bid. *This requires a longer attention span for the bidders.*

Note: some markets use random stopping times.

In the past, many internet auction sites experimented with flexible closing times.

Currently the two biggest sites (eBay and Yahoo) have fixed closing times.

Features of internet auctions: *Automatic bidding* (Yahoo) or *proxy bidding* (eBay)

A buyer made submit a maximum price (which is not disclosed to the seller or other buyers)

When the buyer is outbid, the system automatically generates a new bid (up to the maximum price).

At the end of the auction, if all the remaining players are using this feature, the auction becomes a second-price sealed-bid auction.

Is it safe to reveal your maximum price?

2.18 Common manipulations

- Seller manipulations

Shilling: Bidding up by the seller (or by persons in collusion with the seller)

- Buyer manipulations: Bid shielding

  John puts in a low bid, e.g., $20.

  His friend Susan immediately puts in a high bid, e.g., $200

  The visible $200 price discourages other bidders.

  Right before the auction is to end, Susan cancels her bid, leaving John's $20 as the high bid.

- Buyer manipulations: Bidding rings

  Recent investigations (within the last ten years) have found antique dealers practicing "knock-out" sales.

  From NYT (6/3/1997):

  Under the practice, a ring of dealers chooses a single dealer to bid on an object. The dealers then hold a private auction among themselves.

  They often split the profit among themselves that arises out of the difference between the low price paid by the individual dealer and the higher price paid at the private auction.

  Sometimes dealers simply give other dealers a commission for not bidding against them on an artwork.

Collusion by auction houses (rare)

Christies and Sotheby's are recently settled claims that they colluded to keep the premiums charged to sellers high.

2.19 What really matters in auction design? (Klemperer (2002))

Background

Increasingly, auctions are being used to privatize government assets.

Early examples: off-shore oil extraction rights

Current: rights to segments of electromagnetic spectrum (for communications purposes)

Spectrum auctions are complicated because

- Amounts at stake are large
- Small number of potential bidders
- Revenue maximization is not the only objective.
- Other: industry structure after the auction, political perceptions of fairness and efficiency, etc.

To run a successful auction, K suggests taking care to:

- deter collusion
- minimize barriers to and costs of entry

Collusion mechanisms: Signaling and punishment

- 1999 German spectrum auction specified a bidding increment of at least 10%.

  Mannesmann put in a bid at 18.18 [18.18 + 10% = 20]

  T-Mobil read this as "if you [T-Mobil] put in a bid at 20, we won't go higher *providing that you stay out of 'our' auction"*.

- 1996-97 US spectrum auction

  US West and McLeod competing for Rochester MN.

  US West put in bids at $313,378 and $62,378 for Iowa lots in which McLeod was previously the sole bidder.

Entry Deterrence

If the (probable) eventual winner is identified early on, potential bidders don't bother.

Probable winner pays a low price.

- 1991 UK sale of television franchises.

  Winning bids in most regions were in the range of 9-16£ per capita.

Only bid in the Midlands region was the incumbent: <0.01£/capita.

- 1994 auction for cell telephone rights in California

  Lyndon Daniels, president of Pacific Telesis's cellular unit, won't comment on how much he's willing to pay, but suggests all comers should be prepared for stiff bidding. "If somebody takes California away from us, they'll never make any money," Mr. Daniels said in an interview on Friday. (WSJ, 10/31/1994)

Other considerations

A low reserve price makes it cheap for a dominant bidder to win the auction. Increases the incentives for intimidation.

Swiss spectrum auction

"Political" difficulties of overpaying or underpaying

Brazil privatization of a Banespa (a bank) via a first-price sealed-bid auction.

Winning bid ≈ $3.6B; second highest < 1/3 of this.

NZ spectrum auction (second-price, sealed bid)

Winner bid NZ$ 7 million; next-highest bid NZ$ 5,000.

Generalizations and Solutions

- (Open) ascending auctions

  Benefits:

  - Winner is usually the person who values the object most highly ("allocational efficiency")
  - With common values, seeing others' bids will partially reveal their information, leading to better information all around (and higher revenues).

  Problems:

  - Early rounds (low prices, little chance of winning) may facilitate communication and collusion.

- If there is a dominant bidder, other potential bidders may figure they have no chance of winning. So why bother ⇒ dominant bidder wins at a low price.

- Sealed-bid auctions

  Benefits:

  - Weaker bidders are encouraged to enter. They have *some* chance of winning. The dominant bidder can't intimidate them (within the context of the auction).
  - Collusion is difficult. (There are no visible bids to use in communication.)

  Problems:

  - Since everyone is bidding blind, outcomes can be very unpredictable.

Klemperer's suggestion: the Anglo-Dutch auction

Open bidding until two are left, followed by one-round sealed bid.

2.20 Security Auctions

Inherently multiple-unit.

Initial placement is the *primary market*

Subsequent trading in the *secondary market*

Strong "common value" components

New information revealed over time during the auction process.

Instances

US Govt Securities

Municipal bonds

Equity IPO's

US Treasury Securities

All US Treasury debt is issued by single-price Dutch auction.

Bid types:

Noncompetitive bids specify an amount, but not a price. The actual price (yield) is set in the auction. Noncompetitive bids may be tendered via Internet

Competitive bids specify a price (yield) and quantity. Must be tendered in paper form.

Results for 10-year note auction, Feb 12, 2004:

High Yield: 4.060% Price: 99.511

All noncompetitive and successful competitive bidders were awarded securities at the high yield. Tenders at the high yield were allotted 85.61%. All tenders at lower yields were accepted in full.

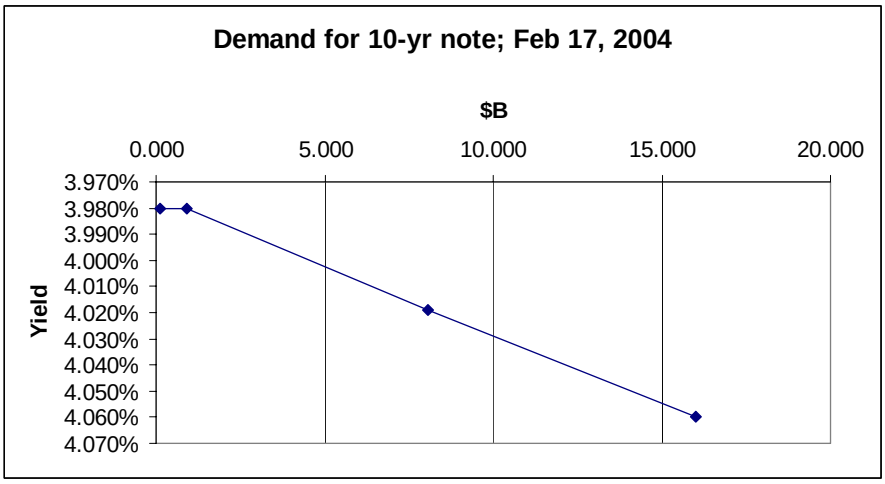
Accrued interest of $ 0.21978 per $1,000 must be paid for the period from February 15, 2004 to February 17, 2004.

AMOUNTS TENDERED AND ACCEPTED (in thousands)

Tender Type	Tendered	Accepted
Competitive	$ 31,847,227	$ 15,866,431
Noncompetitive	133,629	133,629
FIMA (noncompetitive)	0	0
SUBTOTAL	31,980,856	16,000,060 1/
Federal Reserve	1,072,420	1,072,420
TOTAL	$ 33,053,276	$ 17,072,480

Median yield 4.019%: 50% of the amount of accepted competitive tenders was tendered at or below that rate. Low yield 3.980%: 5% of the amount of accepted competitive tenders was tendered at or below that rate.

Constructed demand curve:



2.21 Auction problems

1. I'm selling my Dali lithograph by an open-outcry English auction and I'm trying to set a reserve price R. Consider the highest bid H and the second highest bid SH. Ignoring equalities, there are three possibilities: (1) R<SH<H; (2) SH<R<H; and (3) SH<H<R. In each of these ranges, how does my reserve price affect the auction outcome? If I know H and SH, where would I set R?

2. As the seller in a sealed-bid first-price auction, is there any advantage to specifying a reserve price *lower* than your honest reservation price?

3. Assume that the setup is an independent private-values descending-price Dutch auction with identical bidders. My aunt Florence can't be at present, so I'll be representing her in the bidding for a Tiffany lamp. I ask:

   (a) "If this were an English auction, what's the highest you'd bid?"
   Aunt Florence: "$800"

   (b) "If this were a second-price sealed-bid auction, what would you bid?"
   Aunt Florence: "$850"

   (c) "If this were a first-price sealed-bid auction, what would you bid?"
   Aunt Florence: "$750"

   Are Aunt Florence's response consistent? Which answer should come closest to AF's true value for the lamp? Which answer should come closest to the price at which (in the actual auction) I should claim the lamp?

4. Buyers on eBay can use a proxy bidder. To do so, they set a maximum price. The proxy bidder keeps bidding just high enough to be the best bid (up to where the maximum price is hit). It has been stated that the proxy bidder transforms the format of eBay's English auction. In what sense is this true?

5. On the eBay web site it is stated, "We will thoroughly investigate bid retractions, and abuse of this feature may result in the suspension of your eBay account." Why does eBay take such a hard line on retractions?

6. On the eBay web site, it is stated, "eBay originally allowed sellers to bid on their own auctions as a way to close their auction without selling to the highest bidder." This is no longer allowed. Why not?

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