

# Economics 101A

## (Lecture 23)

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## Outline

1. Oligopoly: Bertrand
2. Second-price Auction
3. Auctions: eBay Evidence

# 1 Oligopoly: Bertrand

- Cournot oligopoly: firms choose quantities
- Bertrand oligopoly: firms first choose prices, and then produce quantity demanded by market
- Market demand function  $Y(p)$
- 2 firms
- Profits:

$$\pi_i(p_i, p_{-i}) = \begin{cases} (p_i - c) Y(p_i) & \text{if } p_i < p_{-i} \\ (p_i - c) Y(p_i) / 2 & \text{if } p_i = p_{-i} \\ 0 & \text{if } p_i > p_{-i} \end{cases}$$

- First show that  $p_1 = c = p_2$  is Nash Equilibrium
- Does any firm have a (strict) incentive to deviate?
- Check profits for Firm 1
- Symmetric argument for Firm 2

- Second, show that this equilibrium is unique.
- For each of the next 5 cases at least one firm has a profitable deviation
- Case 1.  $p_1 > p_2 > c$
- Case 2.  $p_1 = p_2 > c$
- Case 3.  $p_1 > c \geq p_2$

- Case 4.  $c > p_1 \geq p_2$
- Case 5.  $p_1 = c > p_2$
- Only Case 6 remains:  $p_1 = c = p_2$ , which is Nash Equilibrium
- It is unique!

- Surprising result of Bertrand Competition
- Marginal cost pricing
- Two firms are enough to guarantee perfect competition!
- Realistic? Price wars between PC makers

## 2 Second-price Auction

- Sealed-bid auction
- Highest bidder wins object
- Price paid is second highest price
  
- Two individuals:  $I = 2$
- Strategy  $s_i$  is bid  $b_i$
- Each individual knows value  $v_i$



- Payoff for individual  $i$  is

$$u_i(b_i, b_{-i}) = \begin{cases} v_i - b_{-i} & \text{if } b_i > b_{-i} \\ (v_i - b_{-i}) / 2 & \text{if } b_i = b_{-i} \\ 0 & \text{if } b_i < b_{-i} \end{cases}$$

- Show: weakly dominant to set  $b_i^* = v_i$
- To show:

$$u_i(v_i, b_{-i}) \geq u_i(b_i, b_{-i})$$

for all  $b_i$ , for all  $b_{-i}$ , and for  $i = 1, 2$ .

1. Assume  $b_{-i} > v_i$

- $u_i(b_i, b_{-i}) = (v_i - b_{-i}) < 0$  for any  $b_i > b_{-i}$

- $u_i(b_{-i}, b_{-i}) = (v_i - b_{-i}) / 2 < 0$

- $u_i(b_i, b_{-i}) = 0$  for any  $b_i < b_{-i}$

2. Assume now  $b_{-i} = v_i$

3. Assume now  $b_{-i} < v_i$

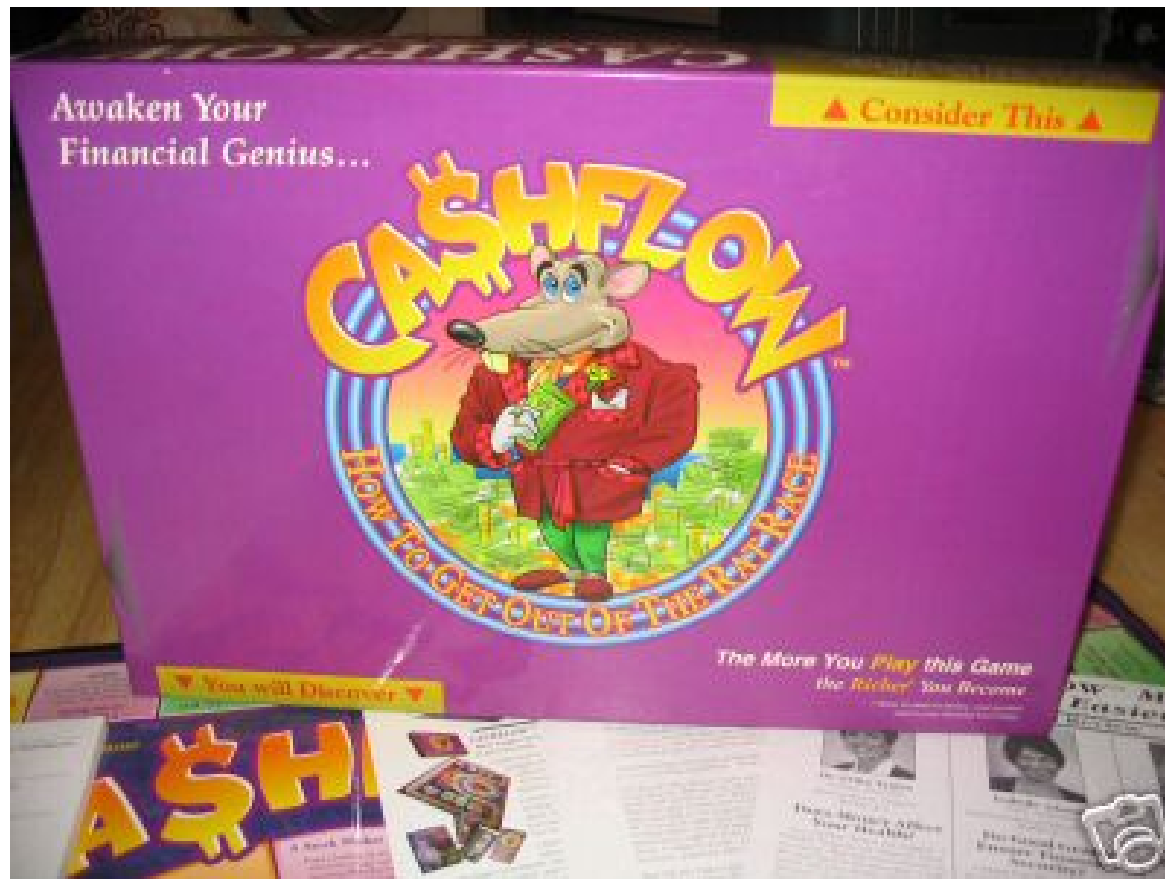
### 3 Auctions: Evidence from eBay

- In second-price auction, optimal strategy is to bid one's own value
- Is this true?
- eBay has proxy system: If you have highest bid, you pay bid of second-highest bidder
- eBay is essentially a second-price auction
- Two deviations:
  1. People bid multiple times – they should not in this theory
  2. People may overbid

## An example: eBay Bidding for a Board Game

- Bidding environment with clear boundary for rational willingness to pay (“buy-it-now price”).
  - Empirical environment unaffected by common-value arguments (presumably bidding for private use; in addition “buy-it-now” price).
  - Still non-negligible amount (\$100-\$200).
- Is there evidence of overbidding?
- If so, can we detect determinants of overbidding?

# The Object



# The Data

- Cashflow 101: board game with the purpose of finance/accounting education.
- Retail price : \$195 plus shipping cost (\$10.75) from manufacturer ([www.richdad.com](http://www.richdad.com)).
- Two ways to purchase Cashflow 101 on eBay
  - Auction (quasi-second price proxy bidding)
  - Buy-it-now
- Hand-collected data of all auctions and Buy-it-now transactions of Cashflow 101 on eBay from 2/19/2004 to 9/6/2004.

## Table 1. Bid Increments

<u>Current Price</u>	<u>Bid Increment</u>
\$0.01- \$0.99	\$0.05
\$1.00- \$4.99	\$0.25
\$5.00- \$24.99	\$0.50
\$25.00- \$99.99	\$1.00
\$100.00- \$249.99	\$2.50
\$250.00- \$499.99	\$5.00
\$500.00- \$999.99	\$10.00
\$1000.00- \$2,499.99	\$25.00
\$2500.00- \$4,999.99	\$50.00
\$5,000.00 and up	\$100.00



# Sample

- Listings
  - 206 by individuals (187 auctions only, 19 auctions with buy-it-now option)
  - 493 by two retailers (only buy-it-now)
- Remove non-US\$, terminated, unsold items and items without simultaneous *professional* buy-it-now listing. → 169 auctions
- Buy-it-now offers of the two retailers
  - Continuously present for all but six days. (Often individual buy-it-now offers present as well; they are often lower.)
  - 100% and 99.9% positive feedback scores.
  - Same prices \$129.95 until 07/31/2004; \$139.95 since 08/01/2004.
  - Shipping cost \$9.95; other retailer \$10.95.
  - New items (with bonus tapes/video).

**Table II. Retailers' Information**

**Seller X**

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Feedback Score:	2849
Positive Feedback:	100%
Members who left positive feedback:	2849
Members who left negative feedback:	0
All positive feedback received:	2959

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Recent Feedback:	Past Month	Past 6 Months	Past 12 Months
positive	52	365	818
neutral	0	1	1
negative	0	0	0

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**Seller Y**

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Feedback Score :	3107
Positive Feedback:	99.90%
Members who left a positive:	3111
Members who left a negative :	4
All positive feedback received:	3333

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Recent Feedback:	Past Month	Past 6 Months	Past 12 Months
positive	112	666	1316
neutral	0	2	2
negative	0	0	1

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# Listing Example (02/12/2004)

<a href="#">Rich Dad's Cashflow Quadrant, Rich dad ...</a>	\$12.50	4	1d 00h 14m
<a href="#">Rich Dad's Cashflow Quadrant by Robert T. ...</a>	\$9.00	9	1d 00h 43m
<a href="#">Real Estate Investment Cashflow Software \$\$\$!</a>	\$10.49	2	1d 04h 36m
<a href="#">CASHFLOW® 101 202 Robert Kiyosaki Best Pak \$</a>	\$207.96	<i>=Buy It Now</i>	1d 06h 47m
TRY IT TODAY, WITH ABSOLUTELY NO RISK,			
<a href="#">CASHFLOW® 101 Robert Kiyosaki Plus Bonuses!</a>	\$129.95	<i>=Buy It Now</i>	1d 08h 02m
Your satisfaction is GUARANTEED, 100% \$ back			
<a href="#">MINT Cashflow 101 *Robert Kiyosaki Game NR!</a>	\$140.00	13	1d 08h 04m
It's easy to be rich. Brand New. Still sealed			
<a href="#">cashflow Hard Money Funding 101 real estate</a>	\$14.99	<i>=Buy It Now</i>	1d 09h 28m
<a href="#">BRANDNEW RICHDAD CASHFLOW FOR KIDS E-GAME</a>	\$20.00	1	1d 13h 54m
<a href="#">CASHFLOW® 101 Robert Kiyosaki Plus Bonuses!</a>	\$129.95	<i>=Buy It Now</i>	1d 14h 17m
Your satisfaction is GUARANTEED, 100% \$ back			
<a href="#">CASHFLOW® 101 202 Robert Kiyosaki Best Pak \$</a>	\$207.96	<i>=Buy It Now</i>	1d 15h 47m
TRY IT TODAY, WITH ABSOLUTELY NO RISK,			

# Listing Example – Magnified

[CASHFLOW® 101 202 Robert Kiyosaki Best Pak \\$](#)  

\$207.96 *Buy It Now*

TRY IT TODAY, WITH ABSOLUTELY NO RISK,

**Pricing:**

**[Buy Now]**

**\$129.95**

[CASHFLOW® 101 Robert Kiyosaki Plus Bonuses!](#)  

\$129.95 *Buy It Now*

Your satisfaction is GUARANTEED, 100% \$ back

**Pricing:**

**\$140.00**

[MINT Cashflow 101 ^Robert Kiyosaki Game NR!](#)  

\$140.00

It's easy to be rich. Brand New. Still sealed

# Example of the description

Shipping, payment details and return policy

**Description**  
*Item Specifics - Textbooks, Education*  
Product Type: **Game, Video & Tapes**  
Category: **Education, Teaching**  
Educational Level: **Adult & Age 10 & up**  
Publication Year: --  
Condition: **Used**

## CASHFLOW 101 Game, video & Cassette Tapes by Rich Dad Robert Kiyosaki

- Like-new CASHFLOW 101 game - \$195 retail. Opened but in mint condition.
- A 3 audio cassette album titled "It's Easy to Be Rich ... if you have a strong financial education."
- A video tape titled "The Secrets of the Rich" that gives you information about the game.
- Game sheets, playing cards, cash, instructions, etc. Everything that comes with the game is included
- CASHFLOW® 101 is an educational program that teaches accounting, finance, and investing at the same time and makes learning fun. Learn how to get out of the rat race and onto the fast track where your money works for you instead of you working hard for your money.

CASHFLOW 101 is recommended for adults and children age 10 and older.

# Bidding history of an item

Item title: CASHFLOW 101 Board Game Rich Dad Poor Dad  
Time left: **Auction has ended.**

Only actual bids (not automatic bids generated up to a bidder's maximum) are shown. Automatic bids may be placed days or hours before a listing ends. Learn more about [bidding](#).

User ID	Bid Amount	Date of bid
<a href="#">beezebugs</a> (21 ★)	US \$152.50	Aug-11-04 09:51:21 PDT
<a href="#">mkdir-half</a> (21 ★)	US \$150.00	Aug-11-04 06:39:53 PDT
<a href="#">beezebugs</a> (21 ★)	US \$140.00	Aug-08-04 12:06:05 PDT
<a href="#">dj_orbit</a> (86 ★)	US \$130.01	Aug-09-04 23:49:02 PDT
<a href="#">successbroker</a> (931 ★) <b>me</b>	US \$110.00	Aug-08-04 19:56:26 PDT
<a href="#">successbroker</a> (931 ★) <b>me</b>	US \$105.00	Aug-06-04 17:18:21 PDT
<a href="#">002la</a> (1)	US \$102.50	Aug-06-04 17:11:31 PDT
<a href="#">successbroker</a> (931 ★) <b>me</b>	US \$100.00	Aug-05-04 15:41:40 PDT
<a href="#">002la</a> (1)	US \$99.00	Aug-06-04 17:10:48 PDT
<a href="#">002la</a> (1)	US \$95.00	Aug-06-04 17:10:21 PDT
<a href="#">12-gauge</a> (29 ★)	US \$88.00	Aug-05-04 09:13:30 PDT
<a href="#">lindyque</a> (110 ★)	US \$58.00	Aug-05-04 10:47:33 PDT
<a href="#">lindyque</a> (110 ★)	US \$45.00	Aug-05-04 10:45:41 PDT
<a href="#">lindyque</a> (110 ★)	US \$40.00	Aug-05-04 10:45:08 PDT
<a href="#">bearsnbulls22</a> (3)	US \$31.00	Aug-05-04 06:49:19 PDT
<a href="#">75lon</a> (1)	US \$30.00	Aug-04-04 19:46:54 PDT
<a href="#">bearsnbulls22</a> (3)	US \$28.00	Aug-05-04 06:48:28 PDT
<a href="#">bearsnbulls22</a> (3)	US \$25.00	Aug-05-04 06:48:01 PDT

If you and another bidder placed the same bid amount, the earlier bid takes priority.

**Table III. Summary Statistics**

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Number of Bids	168	17.1	9.2	1	39
Feedback Score Buyer	169	35.6	102.1	0	990
Feedback Score Seller	169	251.6	1419.5	0	14,730
Positive Feedback Percentage Seller	168	62.1	48.3	0	100
Ln(Feedback Score Buyer + 1)	169	2.0	1.7	0	6.9
Ln(Feedback Score Seller + 1)	169	2.4	2.4	0	9.6
Auction Length [in days]	169	6.25	1.70	1	10
one day	169	0.01	0.11	0	1
three days	169	0.12	0.32	0	1
five days	169	0.17	0.38	0	1
seven days	169	0.65	0.48	0	1
ten days	169	0.05	0.21	0	1
Auction Ending Weekday					
Monday	169	0.124	0.331	0	1
Tuesday	169	0.077	0.267	0	1
Wednesday	169	0.154	0.362	0	1
Thursday	169	0.118	0.324	0	1
Friday	169	0.095	0.294	0	1
Saturday	169	0.183	0.388	0	1
Sunday	169	0.249	0.433	0	1
Auction Ending Hour	169	14.8	5.2	0	23
Prime Time	169	0.331	0.472	0	1
Delivery Insurance	169	0.373	0.485	0	1
Bonus Tapes/Video	169	0.284	0.452	0	1
Explicit195	169	0.320	0.468	0	1

# Hypotheses

Given the information on the listing website:

- (H1) An auction should never end at a price above the concurrently available purchase price.
- (H2) Mentioning of higher outside prices should not affect bidding behavior.



Figure 1. Starting Price (*startprice*)

➔ 45% below \$20; mean=\$46; SD=43.88

➔ only 6 auctions with first bid (not price) above buy-it-now

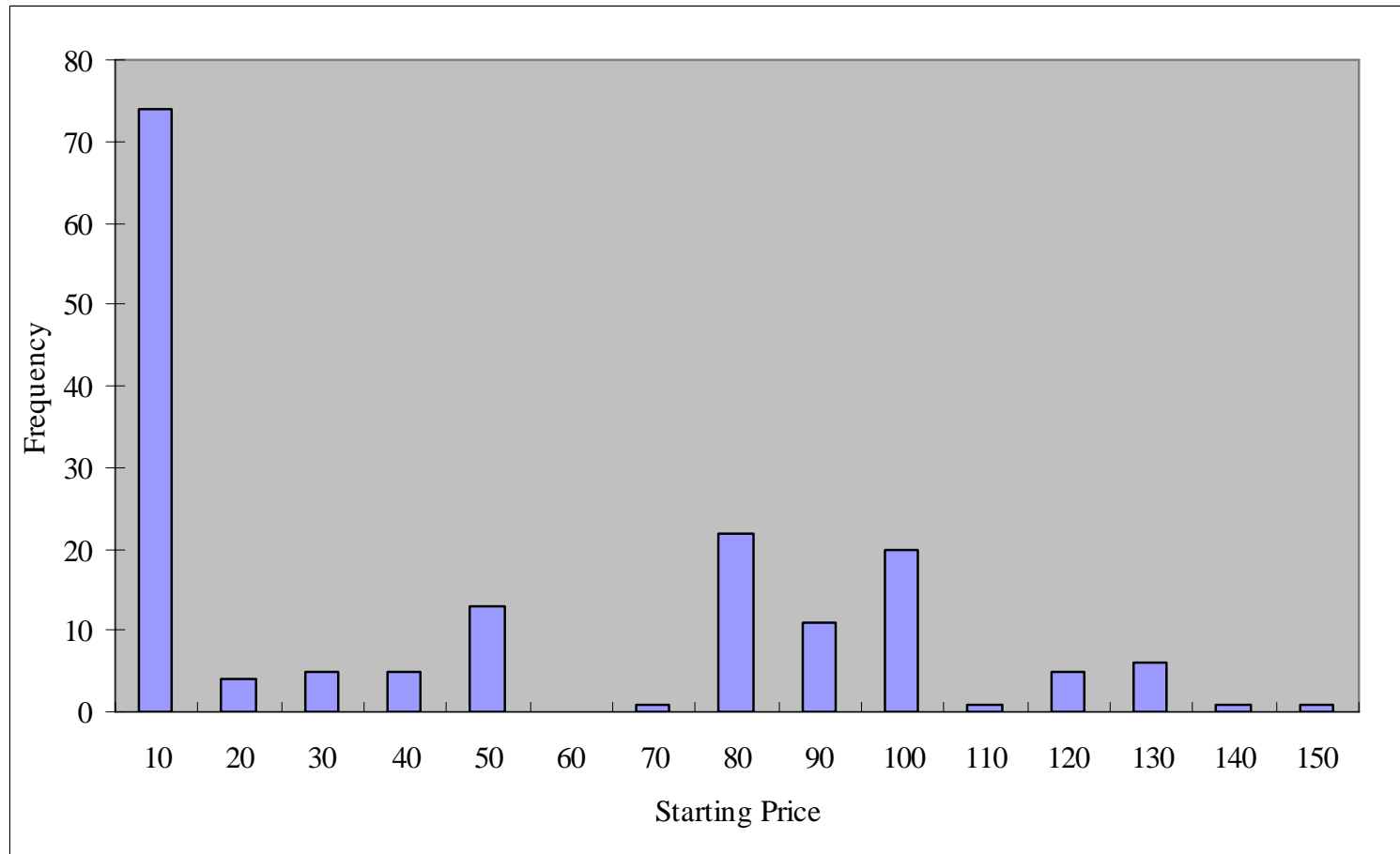


Figure 2. Final Price (*finalprice*)

➔ 41% are above “buy-it-now” (mean \$132; SD 16.83)

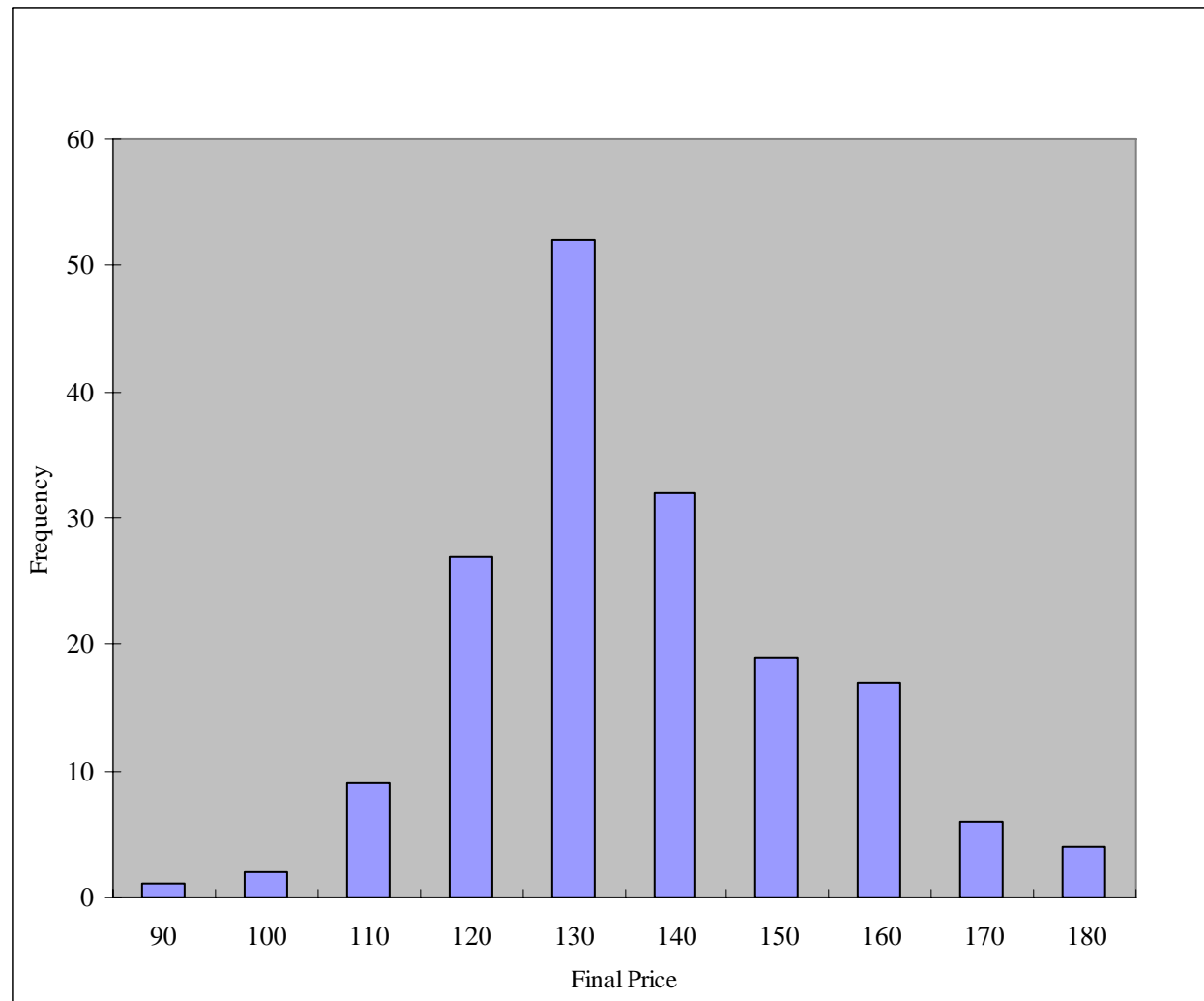
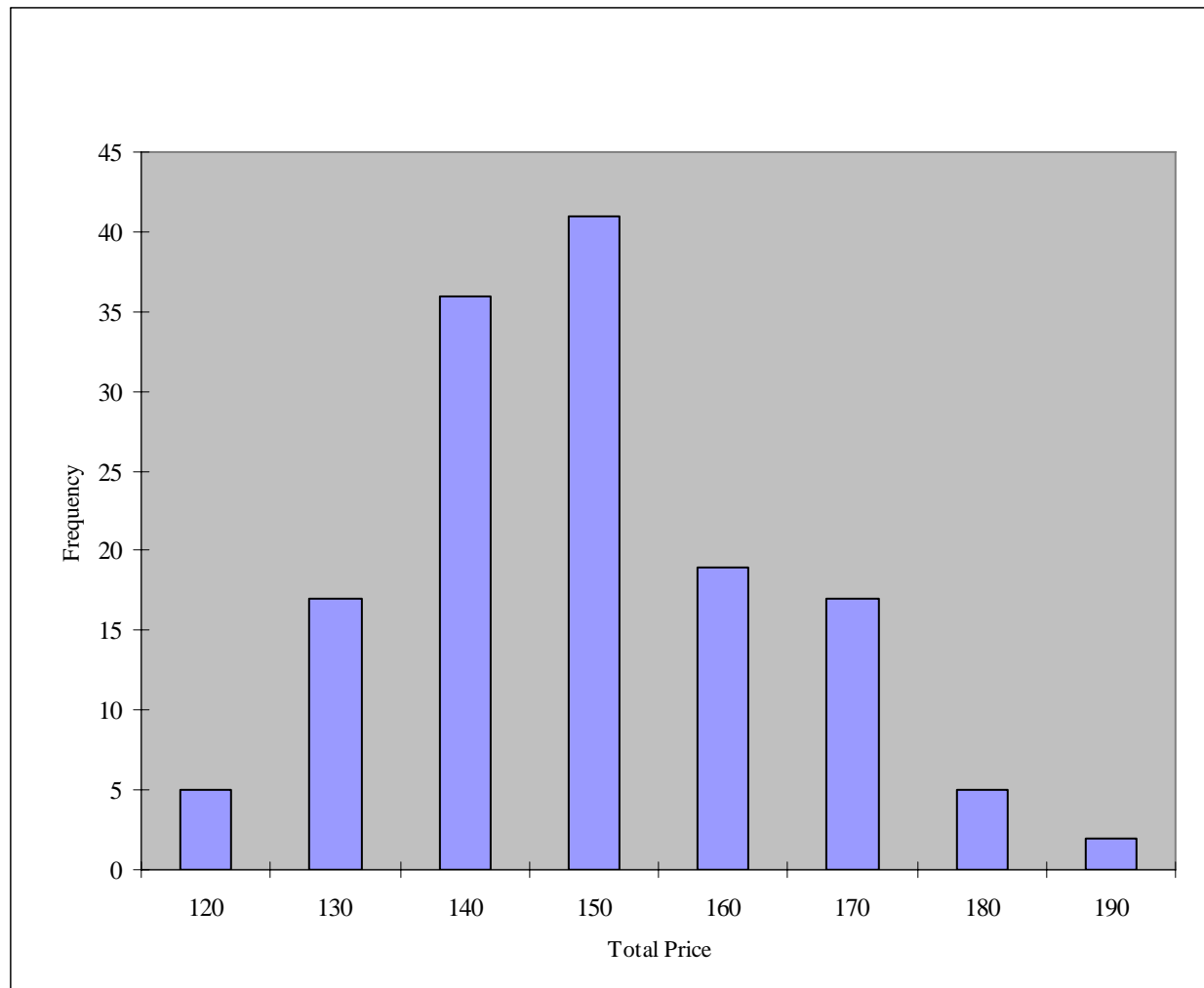


Figure 4. Total Price (incl. shipping cost)

➔ 51% are above “buy-it-now” plus its shipping cost  
(mean=\$144.20; SD=15.00)



# Testing H2

- Dummy for explicit mentioning of retail price of \$195 (*Explicit195*).
- Controlling for quality: extras such as bonus tapes, video.
- Potential upward bias: cannot control perfectly for quality; correlation with old/new?
- Potential downward bias: any seller mentioning the retail price in one of the ads the bidder studies, e.g. when submitting the first bid.

## Table IV. Determinants of “Abnormal Total Price”

	ATP	ATP
Explicit195	8.566** (2.63)	6.480* (2.96)
Shipping Cost	0.282 (0.36)	0.271 (0.37)
Auction Length	1.289 (0.68)	1.317 (0.69)
Starting Price	0.025 (0.028)	0.018 (0.03)
Ln(Feedback Score Buyer + 1)	-0.341 (0.73)	-0.721 (0.84)
Ln(Feedback Score Seller + 1)	0.220 (0.58)	0.098 (0.60)
(Feedback Score Buyer)*Explicit195		0.030 (0.03)
Prime Time		1.039 (2.69)
Delivery Insurance		2.455 (2.64)
Bonus Tapes/Video		2.344 (2.86)
Constant	-12.574 (7.22)	-12.846 (7.48)
<i>N</i>	142	142
<i>R</i> <sup>2</sup>	.1	.12

Standard errors appear in parentheses.

Asterisks denote statistical significance at the 1%(\*\*) or 5%(\*) level.

# Table VIII. Probit/Logit Model of Overbidding

	Logit	Logit	Probit	Probit
Explicit195	0.651 (.40)	0.580 (.42)	0.406 (.25)	0.356 (.26)
Shipping Cost	0.000 (.05)	-0.015 (.06)	0.002 (.03)	-0.007 (.03)
Auction Length	0.253 (.10)	0.259 (.11)	0.158 (.06)	0.160 (.07)
Starting Price	0.001 (.00)	0.001 (.00)	0.001 (.00)	0.001 (.00)
Ln(Feedback Score Buyer + 1)	0.084 (.11)	-0.097 (.11)	-0.050 (.07)	-0.059 (.07)
Ln(Feedback Score Seller + 1)	0.066 (.09)	-0.074 (.09)	-0.040 (.05)	-0.046 (.05)
Prime Time	0.192 (.39)	0.215 (.39)	0.111 (.24)	0.135 (.24)
Delivery Insurance	0.254 (.38)	0.226 (.39)	0.155 (.23)	0.138 (.24)
Bonus Tapes/Videa	0.483 (.41)	0.602 (.43)	0.307 (.25)	0.386 (.27)
Weekday Dummies		X		X
Constant	-1.668 (1.09)	-1.198 (1.34)	-1.076 (.67)	-0.768 (.82)
<i>N</i>	142	142	142	142
<i>Pseudo-R</i> <sup>2</sup>	.06	.08	.06	.08

# Summary

1. Bidders fail to adjust their willingness to pay to lower readily available outside prices.
2. Bidders adjust their willingness to pay to the mention of higher outside prices (here the description “retail price is \$195”) → Anchoring

# Who are the overbidders?

- Less experienced?
  - No. (Not significantly, see last table.)
- Repeated bids?
  - Sometimes.
  - Data to be completed.
- What about the first bid?
  - First bid overall in auction typically below “buy-it-now”.
  - First bid of a bidder in an ongoing auction not necessarily below “buy-it-now” though typically inducing a price below “buy-it-now”.



# Survey

	Full Sample	MBA class	Behavioral lab (mostly undergraduates)
Sample size	306	75	231
Number (percent) of subjects who have <u>ever</u> used eBay for a purchase ("eBay users")	154 (50.83%)	35 (47.95%)	119 (51.74%)
Number (percent) of subjects who bought on eBay <u>during the last month</u>	40 (14.49%)	9 (12.86%)	37 (17.96%)
<b><i>Demographics</i></b>			
Female	154 (50.99%)	16 (21.92%)	138 (60.26%)
Age: mean	22.53	20.71	28.21
Age: median	21	20	28
Age: min/max	18/53	18/53	22/41
Citizen: US	253 (84.33%)	43 (58.11%)	210 (92.92%)
English: below average speaking ability	4 (1.32%)	6 (8.00%)	1 (0.44%)

# Survey

<i>Subsample of eBay users</i>			
Number of purchases during the last year			
mean	4.15	5	3.9
median	2	2	2
min/max	0/50	0/50	0/44
standard deviation	6.94	8.83	6.29
Search behavior			
online other sites in addition to eBay	125 (81.70%)	27 (79.41%)	98 (82.35%)
offline in addition to eBay	85 (55.56%)	13 (38.24%)	72 (60.50%)
online or offline	137 (89.54%)	29 (85.29%)	108 (90.76%)
First step of search on eBay			
type core word (e.g. `Cashflow 101`)	136 (88.89%)	34 (100%)	102 (85.71%)
select category (e.g. `boardgame`)	14 (9.15%)	0 (0%)	14 (11.76%)

# Survey Results

- 52% log on to watch the last-minute bidding
- 40% admit that they sometimes bid more than they originally wanted. Why?
  - “Competition”
  - “Last minute bidding frenzy for highly desired item”
  - “I really wanted the item and my price wasn't that far from the original (about 2 dollars)”
- No concerns about buy-it-now features (if anything marginally better experience).

# Implications

- Firms can increase profits with simple strategies
- Mention higher prices (outside prices, former prices in sales, etc.)
- Generate “lock-in” effect: Get (potential) buyer involved into the transaction, e.g., by submitting bid

# Firm Response

- Overbidding and anchoring appear to be easy to induce and to have a large impact on revenues.
  - Online bidding technology tailored towards individual biases, e.g. “You have been outbid!” messages
- **Behavioral IO** (Industrial Organization):  
Firm response to consumer biases.

# The Other Lesson?

Some unsolicited eBay advice.

- Can make money by selling “Cashflow 101” to those who aspire to become financially smart, and overpay for the board game!
- Sellers : add exaggerated retail price, pay 20 cents extra (now 40 cents) for 10 day listing!
- Buyers : check out the “buy-it-now” price before you bid!

## 4 Next lecture

- Mixed Strategy Equilibria
- Dynamic Games
- Stackelberg duopoly