

Economics 101A

(Lecture 22)

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Outline

1. Oligopoly: Cournot
2. Oligopoly: Bertrand
3. Second-price Auction
4. Auctions: eBay Evidence
5. Dynamic Games

1 Oligopoly: Cournot

- Nicholson, Ch. 15, pp. 534-540
- Back to oligopoly maximization problem
- Assume 2 firms, cost $c_i(y_i) = cy_i$, $i = 1, 2$
- Firms choose simultaneously quantity y_i
- Firm i maximizes:

$$\max_{y_i} p(y_i + y_{-i}) y_i - cy_i.$$

- First order condition with respect to y_i :

$$p'_Y(y_i^* + y_{-i}^*) y_i^* + p - c = 0, \quad i = 1, 2.$$

- Nash equilibrium:
 - y_1 optimal given y_2 ;
 - y_2 optimal given y_1 .

- Solve equations:

$$p'_Y (y_1^* + y_2^*) y_1^* + p - c = 0 \text{ and}$$

$$p'_Y (y_2^* + y_1^*) y_2^* + p - c = 0.$$

- Cournot -> Pricing above marginal cost
- Numerical example -> Problem set 5

2 Oligopoly: Bertrand

- Nicholson, Ch. 15, pp. 533-534
- 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!

- Notice:
- To show that something is an equilibrium \rightarrow Show that there is **no** profitable deviation
- To show that something is **not** an equilibrium \rightarrow Show that there is **one** profitable deviation

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

3 Second-price Auction

- Nicholson, Ch. 18, pp. 669–676
- 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 $b_{-i} > v_i$

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

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

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

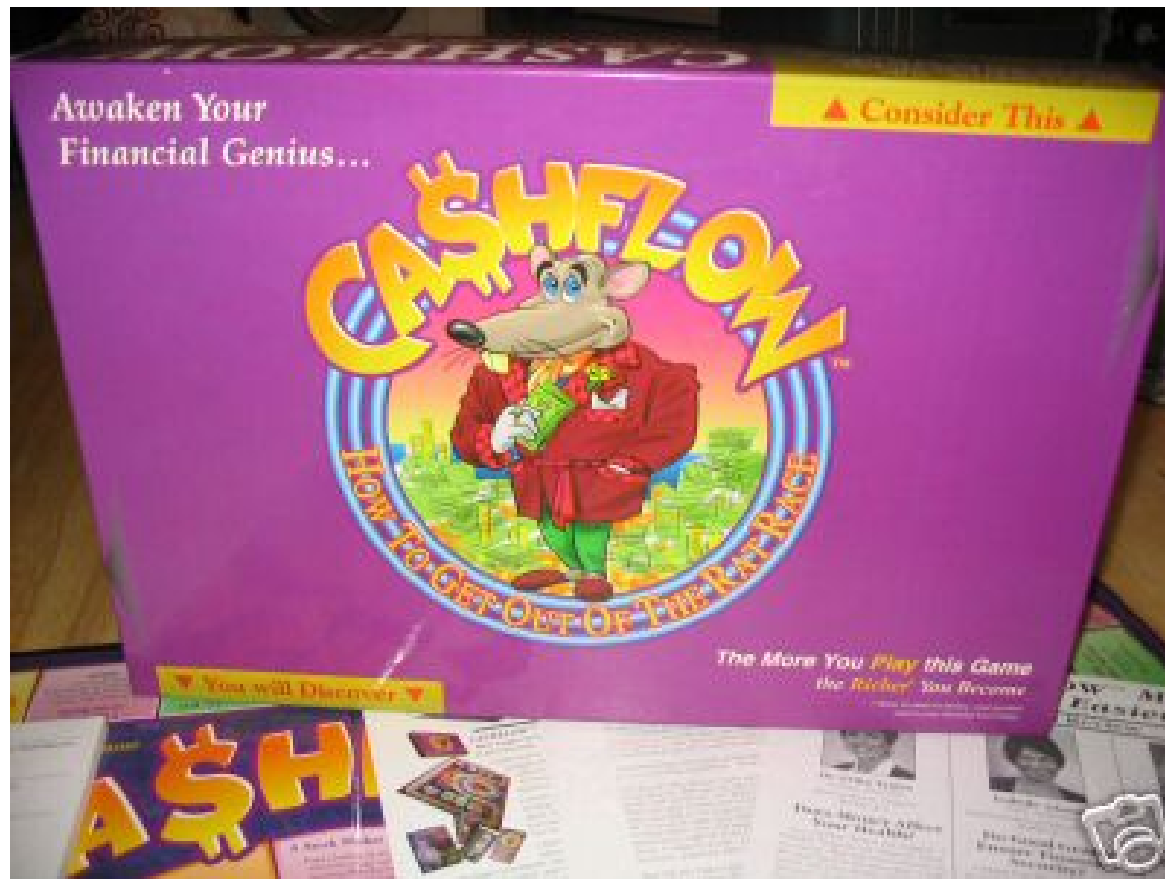
4 Auctions: Evidence from eBay

- 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).
- 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.

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).

Listing Example (02/12/2004)

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

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

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

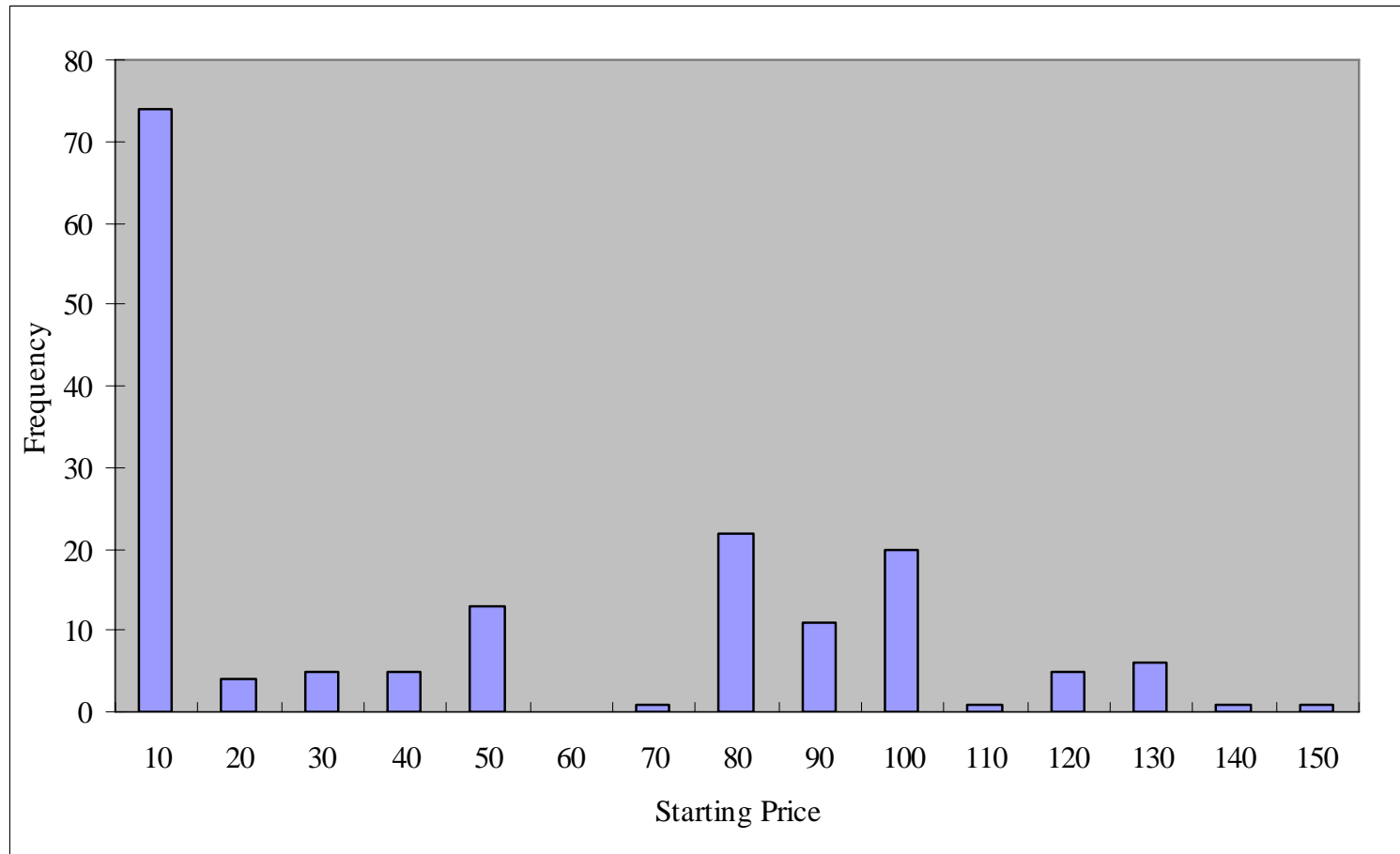


Figure 2. Final Price (*finalprice*)

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

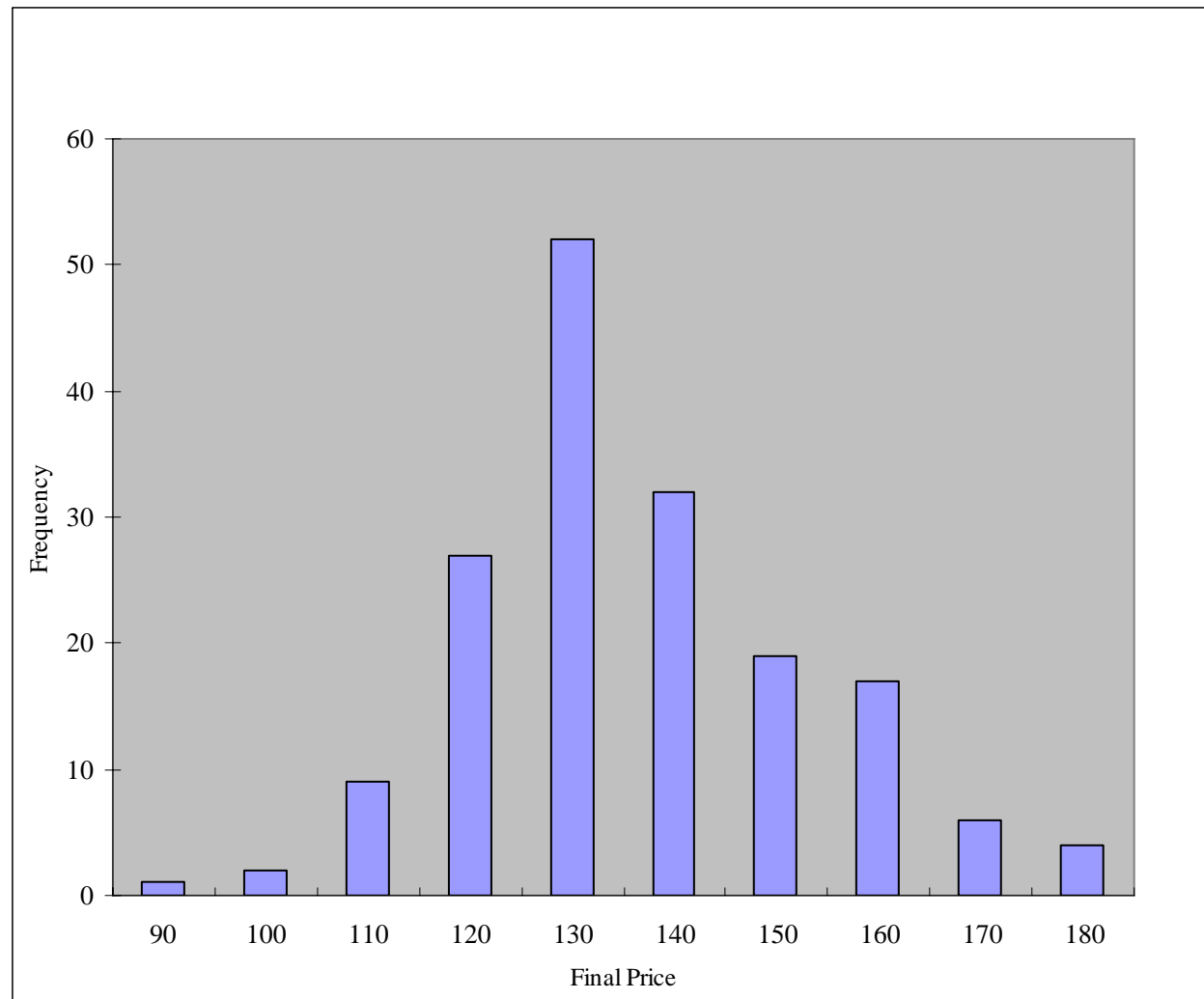
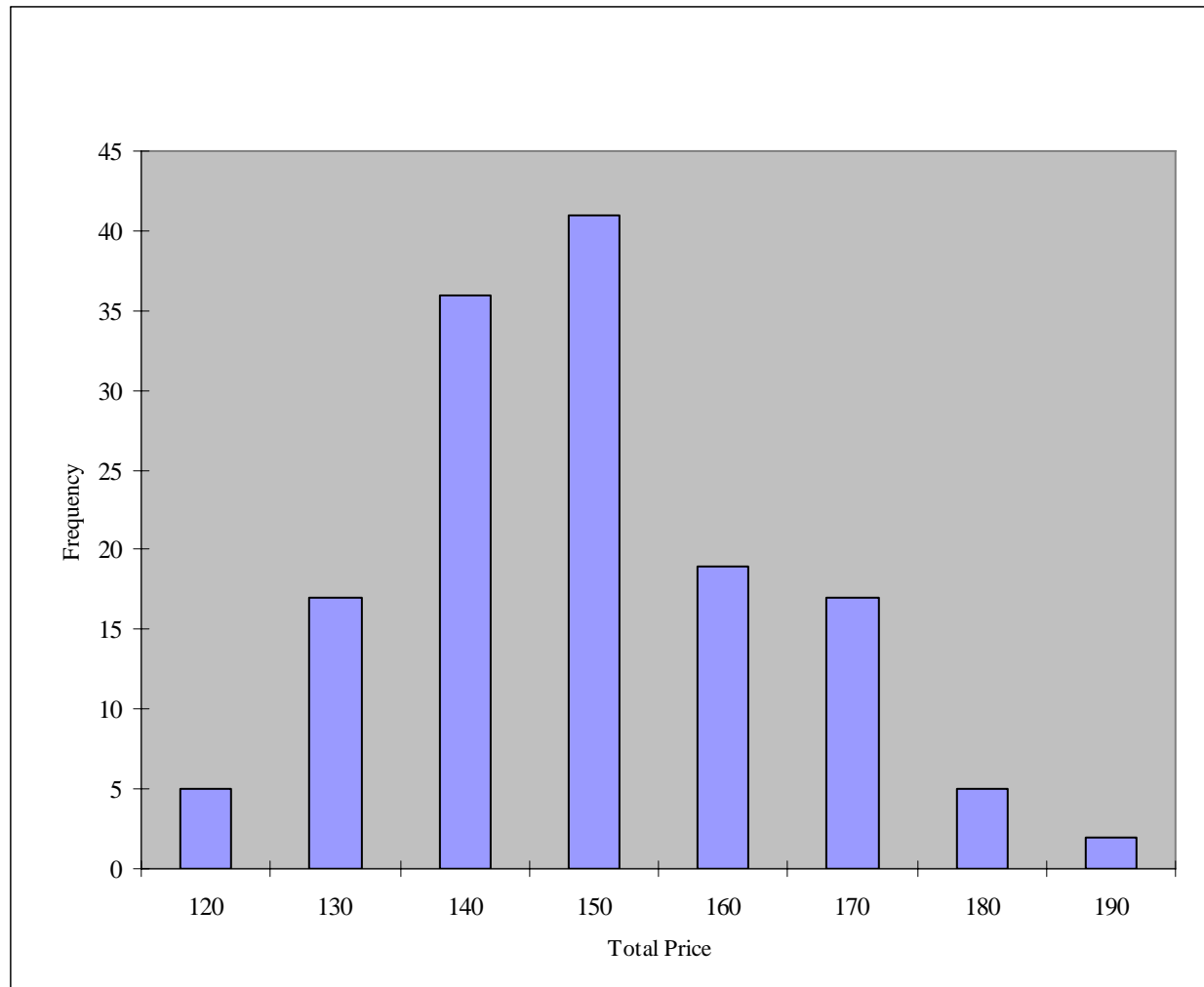


Figure 4. Total Price (incl. shipping cost)

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



5 Dynamic Games

- Nicholson, Ch. 8, pp. 268-277
- Dynamic games: one player plays after the other
- Decision trees
 - Decision nodes
 - Strategy is a plan of action at each decision node

- Example: battle of the sexes game

She \ He	Ballet	Football
Ballet	2, 1	0, 0
Football	0, 0	1, 2

- Dynamic version: she plays first

- **Subgame-perfect equilibrium.** At each node of the tree, the player chooses the strategy with the highest payoff, given the other players' strategy
- Backward induction. Find optimal action in last period and then work backward
- Solution

- Example 2: Entry Game

1 \ 2	Enter	Do not Enter
Enter	-1, -1	10, 0
Do not Enter	0, 5	0, 0

- Exercise. Dynamic version.

- Coordination games solved if one player plays first

- Can use this to study finitely repeated games
- Suppose we play the prisoner's dilemma game ten times.

$1 \setminus 2$	D	ND
D	$-4, -4$	$-1, -5$
ND	$-5, -1$	$-2, -2$

- What is the subgame perfect equilibrium?

- The result differs if infinite repetition with a probability of terminating
- Can have cooperation
- Strategy of repeated game:
 - Cooperate (ND) as long as opponent always cooperate
 - Defect (D) forever after first defection
- Theory of repeated games: Econ. 104

6 Next lecture

- General Equilibrium
- Barter