Econ 219B
Psychology and Economics: Applications
(Lecture 12)

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Outline

1. Market Reaction to Biases: Pricing
2. Methodology: Markets and Non-Standard Behavior
3. Market Reaction to Biases: Behavioral Finance
4. Market Reaction to Biases: Political Economy

1 Market Reaction to Biases: Pricing

- Consider now the case in which consumers purchasing products have biases

- Firm maximize profits

- Do consumer biases affect profit-maximizing contract design?

- How is consumer welfare affected by firm response?

- Analyze first the case of consumers with $\left(\beta, \hat{\beta}, \delta\right)$ preferences

1.1 Self-Control I

MARKET (I). INVESTMENT GOODS

- Monopoly
- Two-part tariff: L (lump-sum fee), p (per-unit price)
- Cost: set-up cost K, per-unit cost a

Consumption of investment good

Payoffs relative to best alternative activity:

- Cost c at $t = 1$, stochastic
  - non-monetary cost
  - experience good, distribution $F(c)$
- Benefit $b > 0$ at $t = 2$, deterministic

FIRM BEHAVIOR. Profit-maximization

$$\max_{L,p} \delta \left\{ L - K + F\left(\beta\delta b - p\right)\left(p - a\right) \right\}$$

$$\text{s.t. } \beta\delta \left\{ -L + \int_{-\infty}^{\hat{\beta}\delta b - p} \left(\delta b - p - c\right) dF\left(c\right) \right\} \geq \beta\delta\overline{u}$$

- Notice the difference between β and $\hat{\beta}$
- Substitute for L to maximize

$$\max_{L,p} \delta \left\{ \int_{-\infty}^{\hat{\beta}\delta b - p} \left(\delta b - p - c\right) dF\left(c\right) + F\left(\beta\delta b - p\right)\left(p - a\right) - K - \beta\delta\overline{u} \right\}$$

Solution for the per-unit price p^*:

$$
\begin{aligned}
p^* &= a && \text{[exponentials]} \\
&- \left(1-\hat{\beta}\right)\delta b \frac{f\left(\hat{\beta}\delta b - p^*\right)}{f\left(\beta\delta b - p^*\right)} && \text{[sophisticates]} \\
&- \frac{F\left(\hat{\beta}\delta b - p^*\right) - F\left(\beta\delta b - p^*\right)}{f\left(\beta\delta b - p^*\right)} && \text{[naives]}
\end{aligned}
$$

Features of the equilibrium

1. *Exponential agents* ($\beta = \hat{\beta} = 1$).
   Align incentives of consumers with cost of firm
   $\Longrightarrow$ marginal cost pricing: $p^* = a$.

$$
\begin{aligned}
p^* &= a && \text{[exponentials]} \\
&\quad - \left(1 - \hat{\beta}\right) \delta b \frac{f\left(\hat{\beta}\delta b - p^*\right)}{f\left(\beta\delta b - p^*\right)} && \text{[sophisticates]} \\
&\quad - \frac{F\left(\hat{\beta}\delta b - p^*\right) - F\left(\beta\delta b - p^*\right)}{f\left(\beta\delta b - p^*\right)} && \text{[naives]}
\end{aligned}
$$

2. *Hyperbolic agents.* Time inconsistency $\Longrightarrow$ below-marginal cost pricing: $p^* < a$.

   (a) *Sophisticates* ($\beta = \hat{\beta} < 1$): commitment.

   (b) *Naives* ($\beta < \hat{\beta} = 1$): overestimation of consumption.

MARKET (II). LEISURE GOODS

Payoffs of consumption at $t = 1$:

- Benefit at $t = 1$, stochastic
- Cost at $t = 2$, deterministic

$\Longrightarrow$ Use the previous setting: $-c$ is "current benefit", $b < 0$ is "future cost."

Results:

1. *Exponential agents.*

   Marginal cost pricing: $p^* = a$, $L^* = K$ (PC).

2. *Hyperbolic agents* tend to overconsume. $\Longrightarrow$

   Above-marginal cost pricing: $p^* > a$. Initial bonus $L^* < K$ (PC).

EXTENSIONS

- *Perfect Competition.* Can write maximization problem as

$$\max_{L,p} -L + \int_{-\infty}^{\hat{\beta}\delta b - p} (\delta b - p - c)\, dF(c)$$
$$\text{s.t. } \delta \{L - K + F(\beta\delta b - p)(p - a)\} = 0$$

  – Implies the same solution for p^*.

- *Heterogeneity.* Simple case of heterogeneity:

  – Share μ of fully naive consumers ($\beta < \hat{\beta} = 1$)

  – Share $1 - \mu$ of exponential consumers ($\beta = \hat{\beta} = 1$)

  – At $t = 0$ these consumers pool on same contract, given no immediate payoffs

- Maximization (with Monopoly):

$$\max_{L,p} \delta \{L - K + [\mu F(\beta\delta b - p) + (1-\mu)(\delta b - p)](p - a)\}$$
$$\text{s.t.} \quad -L + \int_{-\infty}^{\delta b - p} (\delta b - p - c)\, dF(c) \geq \overline{u}$$

- Solution:

$$\begin{aligned} p^* &= a \\ &\quad -\mu \frac{F(\delta b - p) - F(\beta\delta b - p)}{\mu f(\beta\delta b - p) + (1-\mu) f(\delta b - p)} \end{aligned}$$

- The higher the fraction of naives μ, the higher the underpricing of p

EMPIRICAL PREDICTIONS

Two predictions for time-inconsistent consumers:

1. Investment goods (Proposition 1):
   (a) Below-marginal cost pricing
   (b) Initial fee (Perfect Competition)
2. Leisure goods (Corollary 1)
   (a) Above-marginal cost pricing
   (b) Initial bonus or low initial fee (Perfect Competition)

FIELD EVIDENCE ON CONTRACTS

- US Health club industry ($11.6bn revenue in 2000)
  - monthly and annual contracts
  - Estimated marginal cost: $3-$6 + congestion cost
  - Below-marginal cost pricing despite small transaction costs and price discrimination
- Vacation time-sharing industry ($7.5bn sales in 2000)
  - high initial fee: $11,000 (RCI)
  - minimal fee per week of holiday: $140 (RCI)

- Credit card industry ($500bn outstanding debt in 1998)
  - Resale value of credit card debt: 20% premium (Ausubel, 1991)
  - No initial fee, bonus (car / luggage insurance)
  - Above-marginal-cost pricing of borrowing

- Gambling industry: Las Vegas hotels and restaurants:
  - Price rooms and meals below cost, at bonus
  - High price on gambling

WELFARE EFFECTS

Result 1. Self-control problems + Sophistication $\Rightarrow$ First best

- Consumption if $c \leq \beta\delta b - p^*$
- Exponential agent:
  - $p^* = a$
  - consume if $c \leq \delta b - p^* = \delta b - a$
- Sophisticated time-inconsistent agent:
  - $p^* = a - (1 - \beta)\delta b$
  - consume if $c \leq \beta\delta b - p^* = \delta b - a$
- Perfect commitment device
- Market interaction maximizes joint surplus of consumer and firm

Result 2. Self-control + Partial naiveté $\Rightarrow$ Real effect of time inconsistency

- $p^* = a - [F(\delta b - p^*) - F(\beta\delta b - p^*)]/f(\beta\delta b - p^*)$

- Firm sets p^* so as to accentuate overconfidence

- Two welfare effects:
  - Inefficiency: $\text{Surplus}_{\text{naive}} \leq \text{Surplus}_{\text{soph.}}$
  - Transfer (under monopoly) from consumer to firm

- Profits are increasing in naivete' $\hat{\beta}$ (monopoly)

- $\text{Welfare}_{\text{naive}} \leq \text{Welfare}_{\text{soph.}}$

- Large welfare effects of non-rational expectations

1.2 Self-Control II

- Kfir and Spiegler (2006), Contracting with Diversely Naive Agents.

- Extend DellaVigna and Malmendier (2004):
  - incorporate heterogeneity in naiveté
  - allow more flexible functional form in time inconsistency
  - different formulation of naiveté

- Setup:

  1. Actions:
     - Action $a \in [0, 1]$ taken at time 2
     - At time 1 utility function is $u(a)$
     - At time 2 utility function is $v(a)$

  2. Beliefs: At time 1 believe:
     - Utility is $u(a)$ with probability θ
     - Utility is $v(a)$ with probability $1 - \theta$
     - Heterogeneity: Distribution of types θ

  3. Transfers:
     - Consumer pays firm $t(a)$
     - Restrictive assumption: no cost to firm of providing a

- Therefore:
  - Time inconsistency ($\beta < 1$) –> Difference between u and v
  - Naiveté ($\hat{\beta} > \beta$) –> $\theta > 0$
  - Partial naiveté here modelled as stochastic rather than deterministic
  - Flexibility in capturing time inconsistency (self-control, reference dependence, emotions)

- Main result:
- **Proposition 1.** There are two types of contracts:
  1. Perfect commitment device for sufficiently sophisticated agents ($\theta < \underline{\theta}$)
  2. Exploitative contracts for sufficiently naive agents ($\theta > \underline{\theta}$)

- Commitment device contract:
  - Implement $a_\theta = \mathsf{max}_a\, u(a)$
  - Transfer:
    * $t(a_\theta) = \mathsf{max}_a\, u(a)$
    * $t(a) = \infty$ for other actions

  - Result here is like in DM: Implement first best

- Exploitative contract:
  - Agent has negative utility:

$$u\left(a_\theta^v\right) - t\left(a_\theta^v\right) < 0$$

  - Maximize overestimation of agents:

$$a_\theta^u = \arg\max\left(u\left(a\right) - v\left(a\right)\right)$$

1.3 Bounded Rationality

- Gabaix and Laibson (2003), *Competition and Consumer Confusion*
- Non-standard feature of consumers:
  - Limited ability to deal with complex products
  - imperfect knowledge of utility from consuming complex goods
- Firms are aware of bounded rationality of consumers
  $\longrightarrow$ design products & prices to take advantage of bounded rationality of consumers

Example: Checking account. Value depends on

- interest rates
- fees for dozens of financial services (overdrafts, more than x checks per months, low average balance, etc.)
- bank locations
- bank hours
- ATM locations
- web-based banking services
- linked products (e.g. investment services)

Given such complexity, consumers do not know the exact value of products they buy.

Model

- Consumers receive noisy, *unbiased* signals about product value.
  - Agent a chooses from n goods.
  - True utility from good i:

$$Q_i - p_i$$

  - Utility signal

$$U_{ia} = Q_i - p_i + \sigma_i \varepsilon_{ia}$$

    σ_i is complexity of product i.

    ε_{ia} is zero mean, iid across consumers and goods, with density f and cumulative distribution F.

    (Suppress consumer-specific subscript a;
    $U_i \equiv U_{ia}$ and $\varepsilon_i \equiv \varepsilon_{ia}$.)

- Consumer decision rule: Picks the one good with highest signal U_i from $(U_i)_{i=1}^n$.

Market equilibrium with exogenous complexity. Bertrand competition with

- Q_i : quality of a good,

  σ_i : complexity of a good,

  c_i : production cost

  p_i : price

- Simplification: Q_i, σ_i, c_i identical across firms. (*Problem: How should consumers choose if all goods are known to be identical?*)

- Firms maximize profit $\pi_i = (p_i - c_i)\, D_i$

- Symmetry reduces demand to

$$D_i = \int f(\varepsilon_i)\, F\left(\frac{p_j - p_i + \sigma\varepsilon_i}{\sigma}\right)^{n-1} d\varepsilon_i$$

Example of demand curves

Gaussian noise $\varepsilon \sim N\left(0{,}1\right)$, 2 firms

Demand curve faced by firm 1:

$$\begin{aligned} D_1 &= P\left(Q - p_1 + \sigma\varepsilon_1 > Q - p_2 + \sigma\varepsilon_2\right) \\ &= P\left(p_2 - p_1 > \sigma\sqrt{2}\eta\right) \text{ with } \eta = \left(\varepsilon_2 - \varepsilon_1\right)/\sqrt{2} \text{ N(0,1)} \\ &= \Phi\left(\frac{p_2 - p_1}{\sigma\sqrt{2}}\right) \end{aligned}$$

Usual Bertrand case $(\sigma = 0)$: infinitely elastic demand at $p_1 = p_2$

$$D_1 \in \left\{ \begin{array}{ccc} 1 & \text{if} & p_1 < p_2 \\ [0,1] & \text{if} & p_1 = p_2 \\ 0 & \text{if} & p_1 > p_2 \end{array} \right\}$$

Complexity case ($\sigma > 0$) : Smooth demand curve, no infinite drop at $p_1 = p_2$. At $p_1 = p_2 = p$ demand is $1/2$.

$$\max_{p_1} \Phi\left(\frac{p_2 - p_1}{\sigma\sqrt{2}}\right)[p_1 - c_1]$$

$$f.o.c. : -\frac{1}{\sigma\sqrt{2}}\phi\left(\frac{p_2 - p_1}{\sigma\sqrt{2}}\right)[p_1 - c_1] + \Phi\left(\frac{p_2 - p_1}{\sigma\sqrt{2}}\right) = 0$$

Intuition for non-zero mark-ups: Lower elasticity increases firm mark-ups and profits. Mark-up proportional to complexity σ.

Endogenous complexity

- Consider Normal case –> For $\sigma \to \infty$

$$\max_{p_1} \Phi\left(\frac{p_2 - p_1}{\sigma\sqrt{2}}\right)[p_1 - c_1] \to \max_{p_1} \frac{1}{2}[p_1 - c_1]$$

Set $\sigma \to \infty$ and obtain infinite profits by letting $p_1 \to \infty$

(Choices are random, Charge as much as possible)

- Gabaix and Laibson: Concave returns of complexity $Q_i(\sigma_i)$

  Firms increase complexity, unless "clearly superior" products in model with heterogenous products.

In a nutshell: market does not help to overcome bounded rationality. Competition may not help either

- More work on Behavioral IO:
- **Heidhus-Koszegi (2006, 2007)**
  - Incorporate reference dependence into firm pricing
  - Assume reference point rational exp. equilibrium (**Koszegi-Rabin**)
  - Results on
    * Price compression (consumers hate to pay price higher than reference point)
    * But also: Stochastic sales
- **Gabaix-Laibson (1996)**
  - Consumers pay attention to certain attributes, but not others (Shrouded attributes)

  - Form of limited attention

  - Firms charge higher prices on shrouded attributes (add-ons)

  - Similar to result in **DellaVigna-Malmendier (2004)**: Charge more on items consumers do not expect to purchase

- **Ellison (2006):** Early, very concise literature overview

- Future work: *Empirical Behavioral IO*

  - Document non-standard behavior

  - Estimate structurally

  - Document firm response to non-standard feature

2 Methodology: Markets and Non-Standard Behavior

- Why don't market forces eliminate non-standard behavior?
- Common Chicago-type objection
- **Argument 1.** Experience reduces non-standard behavior.
  - Experience appears to mitigate the endowment effect (List, 2003 and 2004).
  - Experience improves ability to perform backward induction (Palacios-Huerta and Volji, 2007 and 2008)
  - BUT: Maybe experience does not really help (Levitt, List, and Reiley, 2008)

- What does experience imply in general?

  * Feedback is often infrequent (such as in house purchases) or noisy (such as in financial investments) –>not enough room for experience

  * Experience can exacerbate a bias if individuals are not Bayesian learners (Haigh and List 2004)

  * Not all non-standard features should be mitigated by experience. Example: social preferences

  * Debiasing by experienced agents can be a substitute for direct experience. However, as Gabaix and Laibson (2006) show, experienced agents such as firms typically have little or no incentive to debias individuals

- *Curse of Debiasing* (Gabaix-Laibson 2006)
  - Credit Card A teaser fees on $1000 balance:
    - $0 for six months
    - $100 fee for next six months
  - Cost of borrowing to company $100 –> Firm makes 0 profit in Perfectly Competitive market
  - Naive consumer:
    - Believes no borrowing after 6 months
    - Instead keeps borrowing
    - Expects cost of card to be $0, instead pays $100

- Can Credit Card B debias consumers and profit from it?
  - Advertisement to consumers: ‘You will borrow after 6 months!’
  - Offer rate of
    - $50 for six months
    - $50 for next six months
- What do consumers (now sophisticated) do?
  - Stay with Card A
    - Borrow for 6 months at $0
    - Then switch to another company
- No debiasing in equilibrium

- System of transfers:
  - Firms take advantage of naive consumers
  - Sophisticated consumers benefit from naive consumers
- Related: Suppose Credit Card B can identify naive consumer
  - What should it do?
  - If debias, then lose consumer
  - Rather, take advantage of consumer

- **Argument 2.** Even if experience or debiasing do not eliminate the biases, the biases will not affect aggregate market outcomes
  - Arbitrage –> Rational investors set prices
  - However, limits to arbitrage (DeLong et al., 1991) –> individuals with non-standard features affect stock prices
  - In addition, in most settings, there is no arbitrage!
    * Example: Procrastination of savings for retirement
    * (Keep in mind SMRT plan though)
  - Behavioral IO: Non-standard features can have a disproportionate impact on market outcomes
    * Firms focus pricing on the biases
    * Lee and Malmendier (2007) on overbidding in eBay auctions

eBay Auctions

- Proxy bidding
  - Bidders submit “maximum willingness to pay”
  - Quasi-second price auction: price outstanding increased to prior leading maximum willingness to pay + increment (see Table 1).
- Fixed prices (“Buy-it-now”)
  - Immediate purchase.
  - Listing on same webpage, same list, same formatting.
  - About 1/3 of eBay listings

→ Key ingredient for analysis.

→ Persistent presence of buy-it-now price as a (conservative) upper limit of bids

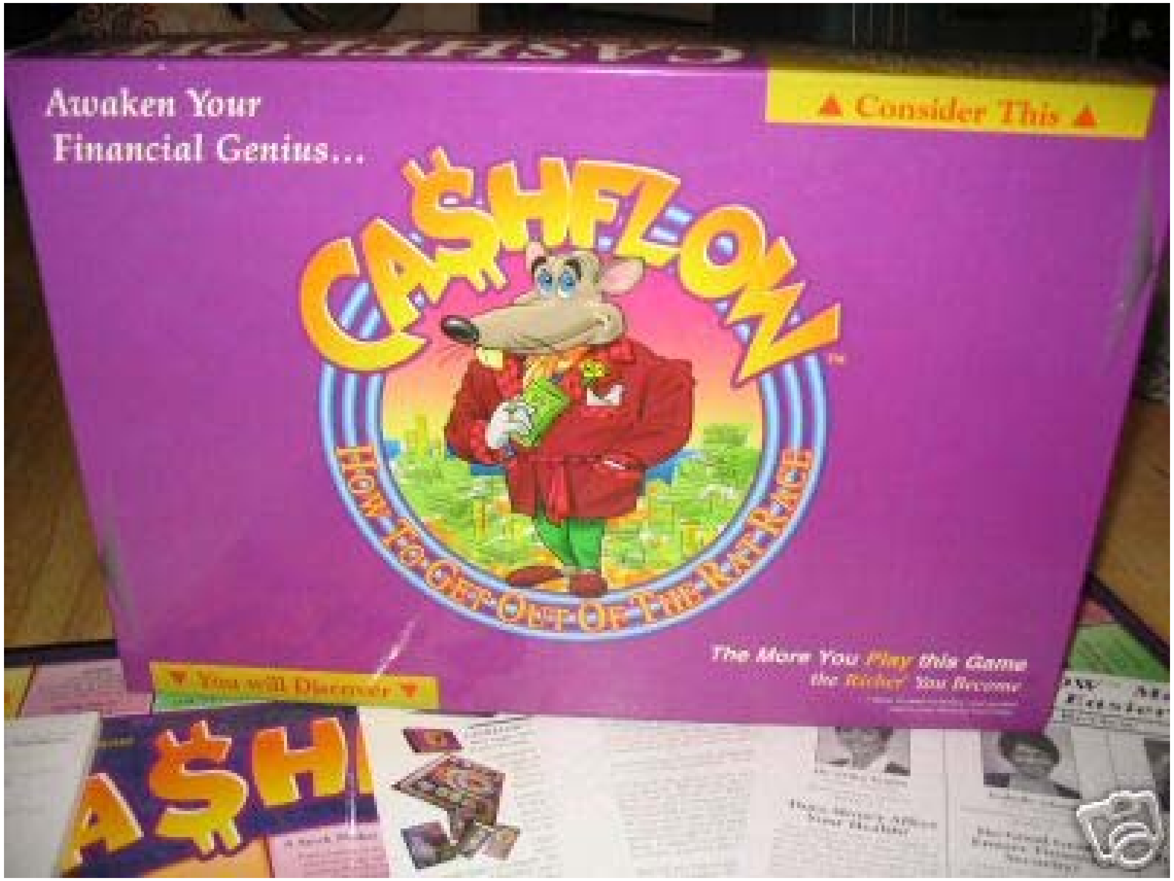
Identification of Overbidding

Overbidding = bidding more than value of auction object to bidder or alternative purchase price ← more than alternative price

1. Hard to measure: Where does *over*-bidding exactly start?
2. Hard to evaluate cause.

- **Incentive misalignment**
  - Private benefits from having the top pick/desired target (prestige)
  - Empire building
  - Career concerns
- **Winner's curse**
- **Other non-standard bidding behavior**
  - Utility from bidding
  - Bidding fever (emotions)
  - Sunk cost (having submitted a bid)
  - Limited attention to lower outside prices / too much attention to advertising

The Object


Awaken Your
Financial Genius...
Consider This
CASHFLOW
HOW TO GET OUT OF THE RAT RACE
The More You Play this Game
the Richer You Become

The Data

- Hand-collected data of all auctions and Buy-it-now transactions of Cashflow 101 on eBay from 2/19/2004 to 9/6/2004.
- 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

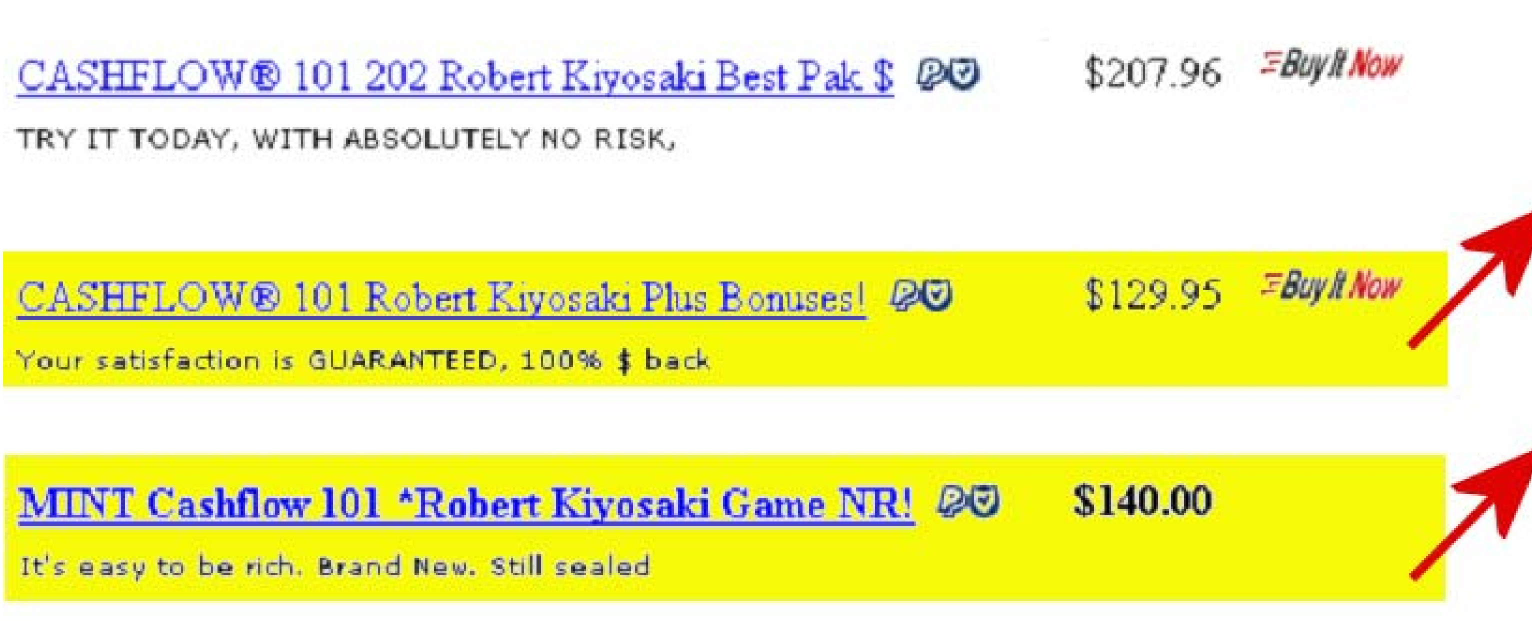
Sample

- Listings (excluding non-US$, bundled offers)
  - 287 by individuals (187 auctions only, 19 auctions with buy-it-now option)
  - 401 by two retailers (only buy-it-now)
- Remove terminated, unsold items, hybrid offers that ended early (buy-it-now) and items without simultaneous *professional* buy-it-now listing. → 2,353 bids, 806 bidders, 166 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 $ TRY IT TODAY, WITH ABSOLUTELY NO RISK,	$207.96	Buy It Now	1d 06h 47m
CASHFLOW® 101 Robert Kiyosaki Plus Bonuses! Your satisfaction is GUARANTEED, 100% $ back	$129.95	Buy It Now	1d 08h 02m
MINT Cashflow 101 *Robert Kiyosaki Game NR! It's easy to be rich. Brand New. Still sealed	**$140.00**	13	1d 08h 04m
cashflow Hard Money Funding 101 real estate	$14.99	Buy It Now	1d 09h 28m
BRANDNEW RICHDAD CASHFLOW FOR KIDS E-GAME	**$20.00**	1	1d 13h 54m
CASHFLOW® 101 Robert Kiyosaki Plus Bonuses! Your satisfaction is GUARANTEED, 100% $ back	$129.95	Buy It Now	1d 14h 17m
CASHFLOW® 101 202 Robert Kiyosaki Best Pak $ TRY IT TODAY, WITH ABSOLUTELY NO RISK,	$207.96	Buy It Now	1d 15h 47m

Listing Example – Magnified



Pricing:

[Buy Now]

$129.95

Pricing:

$140.00

Overbidding

Given the information on the listing website:

- (H0) An auction should never end at a price above the concurrently available purchase price.

Figure 1. Starting Price (*startprice*)

➔ 46% below $20; mean=$46.14; SD=43.81

➔ only 3 auctions above buy-it-now

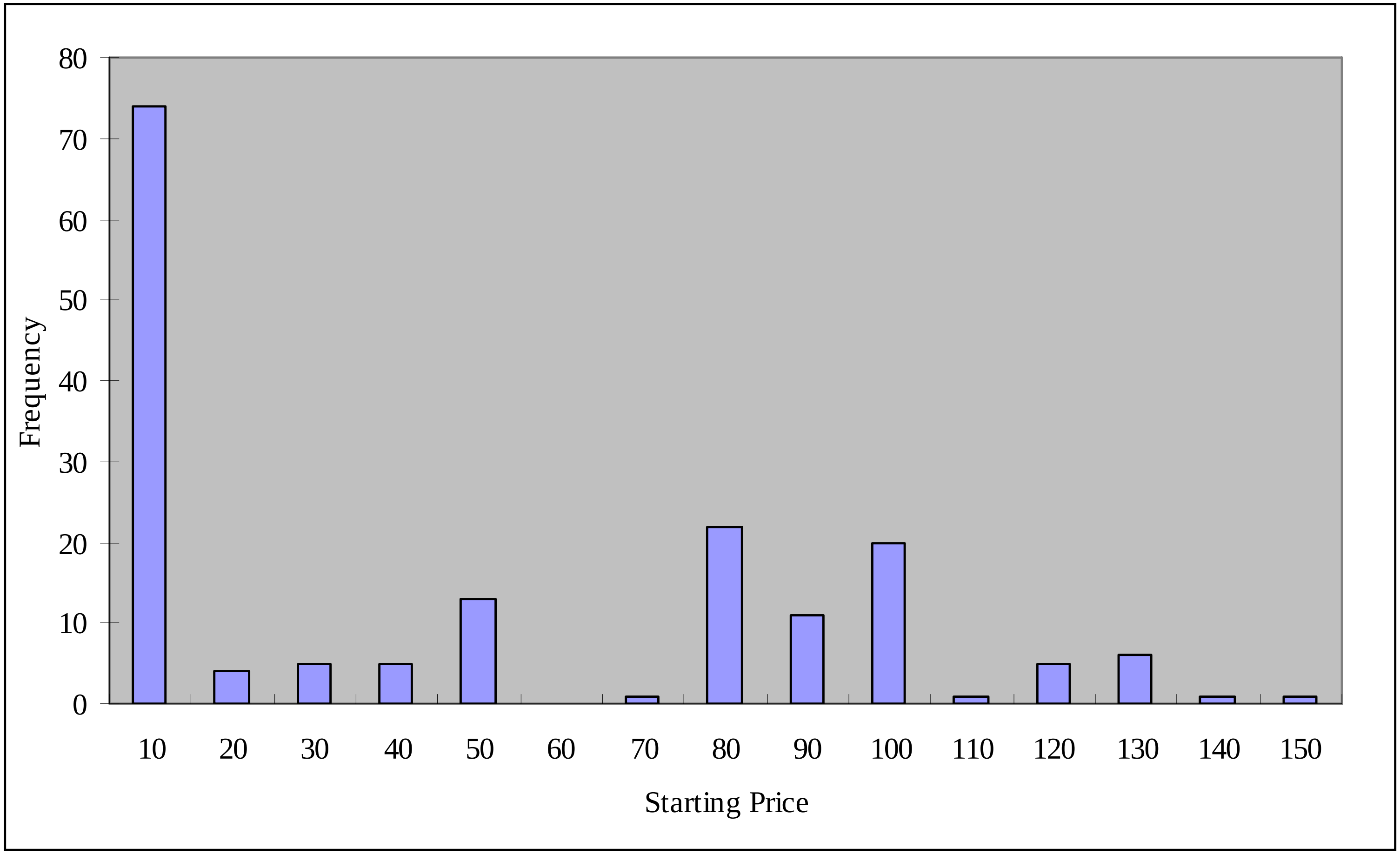


Figure 2. Final Price (*finalprice*)

➔ 43% are above "buy-it-now" (mean $132.55; SD 17.03)

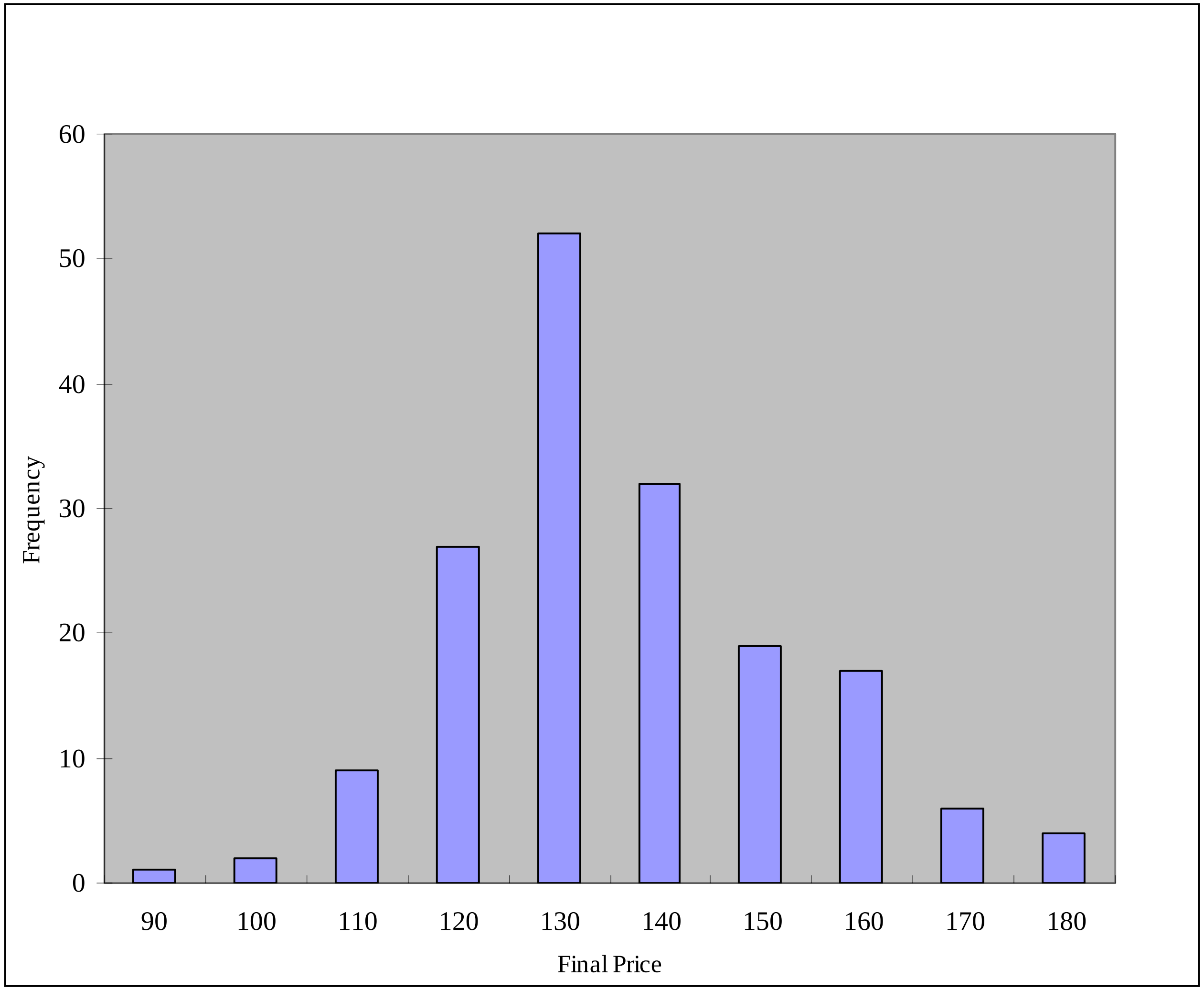
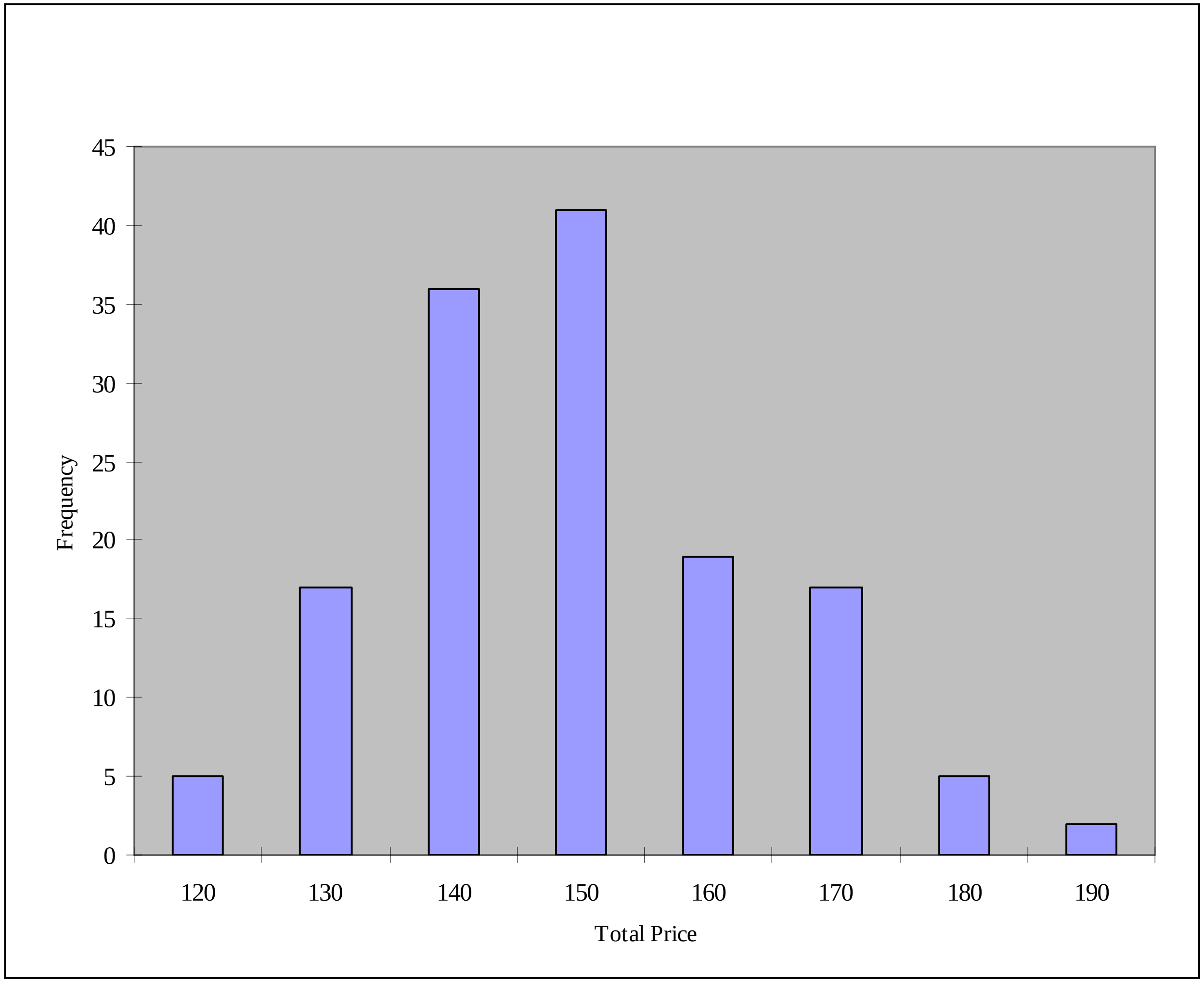


Figure 4. Total Price (incl. shipping cost)

➔ 72% are above "buy-it-now" plus its shipping cost (mean=$144.68; SD=15.29)



Alternative Explanations

1. “Noise”: are these penny-difference
2. Quality differences (I): quality of item
3. Quality differences (II): quality of seller
4. Concerns about unobserved wording differences between auctions and buy-it-now posting.
5. Concerns about consumers’ understanding of buy-it-now posting.

Table V. Disproportionate Influence of Overbidders

		Observations	(Percent)
Auction-level sample			
Does the auction end up overbid?	No	78	56.52%
	Yes	60	**43.48%**
Total		138	100.00%
Bidder-level sample			
Does the bidder ever overbid?	No	670	83.02%
	Yes	137	**16.98%**
Total		807	100.00%
Bid-level sample			
Is the bid an over-bid?	No	2,101	89.29%
	Yes	252	**10.71%**
Total		2,353	100.00%

Overbidding is defined using the final price.

- Bidders with bias have *disproportionate* impact
- Opposite of Chicago intuition

3 Market Reaction to Biases: Behavioral Finance

- Who do 'smart' investors respond to investors with biases?
- First, brief overview of anomalies in Asset Pricing (from Barberis and Thaler, 2004)
  1. **Underdiversification.**
     (a) Too few companies.
        - Investors hold an average of 4-6 stocks in portfolio.
        - Improvement with mutual funds

     (b) Too few countries.
        - Investors heavily invested in own country.
        - Own country equity: 94% (US), 98% (Japan), 82% (UK)
        - Own area: own local Bells (Huberman, 2001)

(c) Own company

   – In companies offering own stock in 401(k) plan, substantial investment in employer stock

2. **Naive diversification.**

   – Investors tend to distribute wealth ‘equally’ among alternatives in 401(k) plan (Benartzi and Thaler, 2001; Huberman and Jiang, 2005)

3. **Excessive Trading.**

   – Trade too much given transaction costs (Odean, 2001)

4. **Disposition Effect in selling**
   - Investors more likely to sell winners than losers

5. **Attention Effects in buying**
   - Stocks with extreme price or volume movements attract attention (Odean, 2003)

- Should market forces and arbitrage eliminate these phenomena?

- **Arbitrage**:
  - Individuals attempt to maximize individual wealth
  - They take advantage of opportunities for free lunches
- Implications of arbitrage: ‘Strange’ preferences do not affect pricing
- Implication: For prices of assets, no need to worry about behavioral stories
- Is it true?

- Fictitious example:
  - Asset A returns \$1 tomorrow with $p = .5$
  - Asset B returns \$1 tomorrow with $p = .5$

  - Arbitrage –> Price of A has to equal price of B
  - If $p_A > p_B$,
    * sell A and buy B
    * keep selling and buying until $p_A = p_B$
  - Viceversa if $p_A < p_B$

- Problem: Arbitrage is limited (de Long et al., 1991; Shleifer, 2001)
- In Example: can buy/sell A or B and tomorrow get fundamental value
- In Real world: prices can diverge from fundamental value

- Real world example. Royal Dutch and Shell
  - Companies merged financially in 1907
  - Royal Dutch shares: claim to 60% of total cash flow
  - Shell shares: claim to 40% of total cash flow
  - Shares are nothing but claims to cash flow
  - Price of Royal Dutch should be 60/40=3/2 price of Shell

- p_{RD}/p_S differs substantially from 1.5 (Fig. 1)

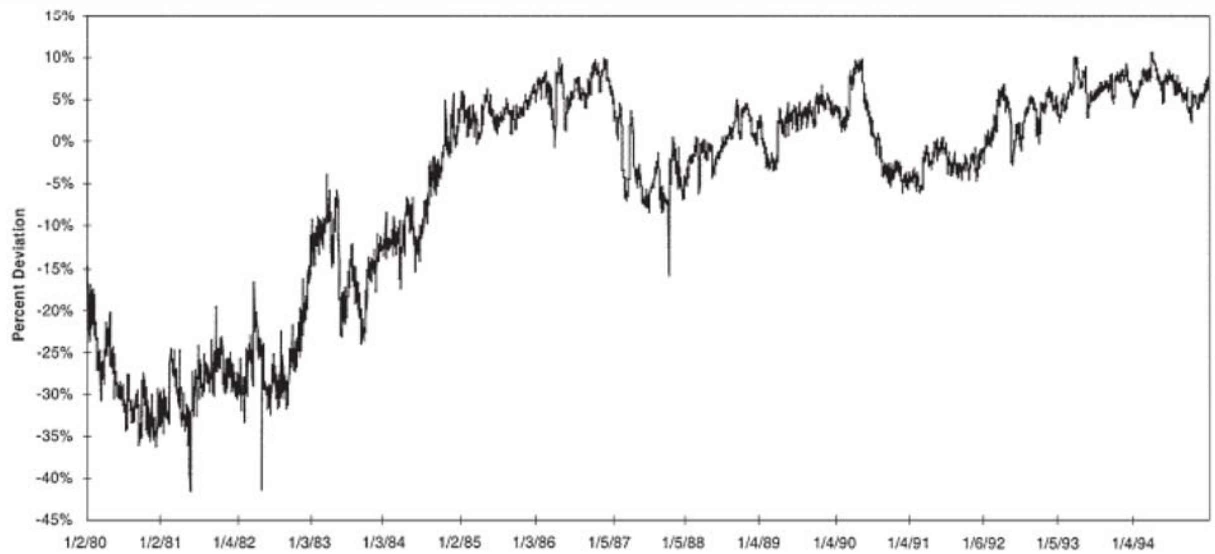


Fig. 1. Log deviations from Royal Dutch/Shell parity. Source: Froot and Dabora (1999).

- Plenty of other example (Palm/3Com)

- What is the problem?
  - Noise trader risk, investors with correlated valuations that diverge from fundamental value
  - (Example: Naive Investors keep persistently bidding down price of Shell)
  - In the long run, convergence to cash-flow value
  - In the short-run, divergence can even increase
  - (Example: Price of Shell may be bid down even more)

- **Noise Traders**
- DeLong, Shleifer, Summers, Waldman (*JPE* 1990)
- Shleifer, *Inefficient Markets*, 2000
- Fundamental question: What happens to prices if:
  - (Limited) arbitrage
  - Some irrational investors with correlated (wrong) beliefs
- First paper on Market Reaction to Biases
- *The* key paper in Behavioral Finance

The model assumptions

A1: arbitrageurs risk averse and short horizon

$\longrightarrow$ Justification?

* Short-selling constraints

(per-period fee if borrowing cash/securities)

* Evaluation of Fund managers.

* Principal-Agent problem for fund managers.

A2: noise traders (Kyle 1985; Black 1986)

misperceive future expected price at t by

$\rho_t \stackrel{i.i.d.}{\sim} \mathcal{N}(\rho^*, \sigma_\rho^2)$

misperception *correlated* across noise traders ($\rho^* \neq 0$)

$\longrightarrow$ Justification?

* fads and bubbles (Internet stocks, biotechs)

* pseudo-signals (advice broker, financial guru)

* behavioral biases / misperception riskiness

What else?

- μ noise traders, $(1-\mu)$ arbitrageurs
- OLG model
  - Period 1: initial endowment, trade
  - Period 2: consumption
- Two assets with identical dividend r
  - safe asset: perfectly elastic supply
    $\Longrightarrow$ price=1 (numeraire)
  - unsafe asset: inelastic supply (1 unit)
    $\Longrightarrow$ price?
- Demand for unsafe asset: λ^a and λ^n, with $\lambda^n\mu + \lambda^a(1-\mu) = 1$.
- CARA: $U(w) = -e^{-2\gamma w}$ (w wealth when old)

$$
\begin{aligned}
E\left[U(w)\right] &= \int_{\infty}^{\infty} - e^{-2\gamma w} \cdot \frac{1}{\sqrt{2\pi\sigma_w^2}} \cdot e^{-\frac{1}{2\sigma^2}(w-\overline{w})^2} dw \\
&= -\int_{\infty}^{\infty} \frac{1}{\sqrt{2\pi\sigma_w^2}} \cdot e^{-\frac{4\gamma w\sigma_w^2 + w^2 + \overline{w}^2 - 2w\overline{w}}{2\sigma_w^2}} dw \\
&= -\int_{\infty}^{\infty} \frac{1}{\sqrt{2\pi\sigma_w^2}} \cdot e^{-\frac{(w-[2\gamma\sigma_w^2+\overline{w}])^2 + \overline{w}^2 - 4\gamma^2\sigma_w^4 - \overline{w}^2 - 2\gamma\sigma_w^2\overline{w}}{2\sigma_w^2}} dw \\
&= -e^{\frac{4\gamma^2\sigma_w^4 + 2\gamma\sigma_w^2\overline{w}}{2\sigma_w^2}} \int_{\infty}^{\infty} \frac{1}{\sqrt{2\pi\sigma_w^2}} \cdot e^{-\frac{(w-[2\gamma\sigma_w^2+\overline{w}])^2}{2\sigma_w^2}} dw \\
&= -e^{4\gamma^2\sigma_w^2 + 2\gamma\overline{w}} = e^{-2\gamma\left(\overline{w} - \gamma\sigma_w^2\right)} \\
&\Downarrow
\end{aligned}
$$

$$
\max E\left[U(w)\right] \quad \underset{\text{pos. mon. transf.}}{\curvearrowright} \quad \max \overline{w} - \gamma\sigma_w^2
$$

Arbitrageurs:

$$\text{max}(w_t - \lambda_t^a p_t)(1 + r)$$

$$+\lambda_t^a (E_t[p_{t+1}] + r)$$

$$-\gamma\,(\lambda_t^a)^2\,Var_t(p_{t+1})$$

Noise traders:

$$\text{max}(w_t - \lambda_t^n p_t)(1 + r)$$

$$+\lambda_t^n (E_t[p_{t+1}] + \rho_t + r)$$

$$-\gamma\,(\lambda_t^n)^2\,Var_t(p_{t+1})$$

(Note: Noise traders know how to factor the effect of future price volatility into their calculations of values.)

f.o.c.

Arbitrageurs: $\frac{\partial E[U]}{\partial \lambda_t^a} \stackrel{!}{=} 0$

$$\lambda_t^a = \frac{r + E_t[p_{t+1}] - (1+r)p_t}{2\gamma \cdot Var_t(p_{t+1})}$$

Noise traders: $\frac{\partial E[U]}{\partial \lambda_t^n} \stackrel{!}{=} 0$

$$\lambda_t^n = \frac{r + E_t[p_{t+1}] - (1+r)p_t}{2\gamma \cdot Var_t(p_{t+1})} + \frac{\rho_t}{2\gamma \cdot Var_t(p_{t+1})}$$

Interpretation

- Demand for unsafe asset function of:
  - (+) expected return $(r + E_t[p_{t+1}] - (1 + r)p_t)$
  - (-) risk aversion (γ)
  - (-) variance of return $(Var_t(p_{t+1}))$

  - (+) overestimation of return ρ_t (noise traders)

- Notice: noise traders hold more risky asset than arb. if $\rho > 0$ (and viceversa)

- Notice: Variance of prices come from noise trader risk. "Price when old" depends on uncertain belief of next periods' noise traders.

- Impose general equilibrium: $\lambda^n \mu + \lambda^a (1 - \mu) = 1$ to obtain

$$1 = \frac{r + E_t[p_{t+1}] - (1+r)p_t}{2\gamma \cdot Var_t(p_{t+1})} + \mu \frac{\rho_t}{2\gamma \cdot Var_t(p_{t+1})} \text{ or}$$

$$p_t = \frac{1}{1+r}\left[r + E_t[p_{t+1}] - 2\gamma \cdot Var_t(p_{t+1}) + \mu \rho_t\right]$$

- To solve for p_t, we need to solve for $E_t[p_{t+1}] = E[p]$ and $Var_t(p_{t+1})$

$$E[p] = \frac{1}{1+r}\left[r + E_t[p] - 2\gamma \cdot Var_t(p_{t+1}) + \mu E[\rho_t]\right]$$

$$E[p] = 1 + \frac{-2\gamma \cdot Var_t(p_{t+1}) + \mu \rho^*}{r}$$

– Rewrite p_t plugging in

$$
\begin{aligned}
p_t &= 1 - \frac{2\gamma \cdot Var_t(p_{t+1})}{r} + \frac{\mu\rho^*}{r(1+r)} + \frac{\mu\rho_t}{1+r} \\
Var[p_t] &= Var\left[\frac{\mu\rho_t}{1+r}\right] = \frac{\mu^2}{(1+r)^2} Var(\rho_t) = \frac{\mu^2}{(1+r)^2}\sigma_\rho^2
\end{aligned}
$$

– Rewrite p_t

$$p_t = 1 - 2\frac{\gamma\mu^2\sigma_\rho^2}{r(1+r)^2} + \frac{\mu\rho^*}{r} + \frac{\mu(\rho_t - \rho^*)}{1+r}$$

– Noise traders affect prices!

– Term 1: Variation in noise trader (mis-)perception

– Term 2: Average misperception of noise traders

– Term 3: Compensation for noise trader risk

- **Relative returns of noise traders**
  - Compare returns to noise traders R^n to returns for arbitrageurs R_a:

$$
\begin{aligned}
\Delta R &= R^n - R^a = \left(\lambda_t^n - \lambda_t^a\right)\left[r + p_{t+1} - p_t\left(1+r\right)\right] \\
E\left(\Delta R | \rho_t\right) &= \rho_t - \frac{\left(1+r\right)^2 \rho_t^2}{2\gamma\mu\sigma_\rho^2} \\
E\left(\Delta R\right) &= \rho^* - \frac{\left(1+r\right)^2 \left(\rho^*\right)^2 + \left(1+r\right)^2 \sigma_\rho^2}{2\gamma\mu\sigma_\rho^2}
\end{aligned}
$$

  - Noise traders hold more risky asset if $\rho^* > 0$
  - Return of noise traders can be higher if $\rho^* > 0$ (and not too positive)
  - Noise traders therefore may outperform arbitrageurs if optimistic!
  - (Reason is that they are taking more risk)

Welfare

- Sophisticated investors have higher utility
- Noise traders have lower utility than they expect
- Noise traders may have higher returns (if $\rho^* > 0$)
- Noise traders do not necessarily disappear over time

- Three fundamental assumptions

  1. OLG: no last period; short horizon

  2. Fixed supply unsafe asset (a cannot convert safe into unsafe)

  3. Noise trader risk systematic

- Noise trader models imply that biases affect asset prices:

  – Reference Dependence

  – Attention

  – Persuasion

- Here:
  - Biased investors
  - Non-biased investors
- Behavioral corporate finance:
  - Investors (biased)
  - CEOs (smart)
- Behavioral Industrial Organization:
  - Consumers (biased)
  - Firms (smart)

4 Market Reaction to Biases: Political Economy

- Interaction between:
  - (Smart) Politicians:
    * Personal beliefs and party affiliation
    * May pursue voters/consumers welfare maximization
    * BUT also: strong incentives to be reelected
  - Voters (with biases):
    * Low (zero) incentives to vote
    * Limited information through media
    * Likely to display biases
- **Behavioral political economy**

- Examples of voter biases:

  - Effect of candidate order (Ho and Imai)

  - Imperfect signal extraction (Wolfers, 2004) –> Voters more likely to vote an incumbent if the local economy does well even if... it's just due to changes in oil prices

  - Susceptible to persuasion (DellaVigna and Kaplan, 2007)

  - More? Short memory about past performance?

- **Eisensee and Stromberg (2007)**: Limited attention of voters

- Setting:
  - Natural Disasters occurring throughout the World
  - US Ambassadors in country can decide to give Aid
  - Decision to give Aid affected by
    * Gravity of disaster
    * Political returns to Aid decision
- Idea: Returns to aid are lower when American public is distracted by a major news event

- Main Measure of Major News: median amount of Minutes in Evening TV News captured by top-3 news items (Vanderbilt Data Set)

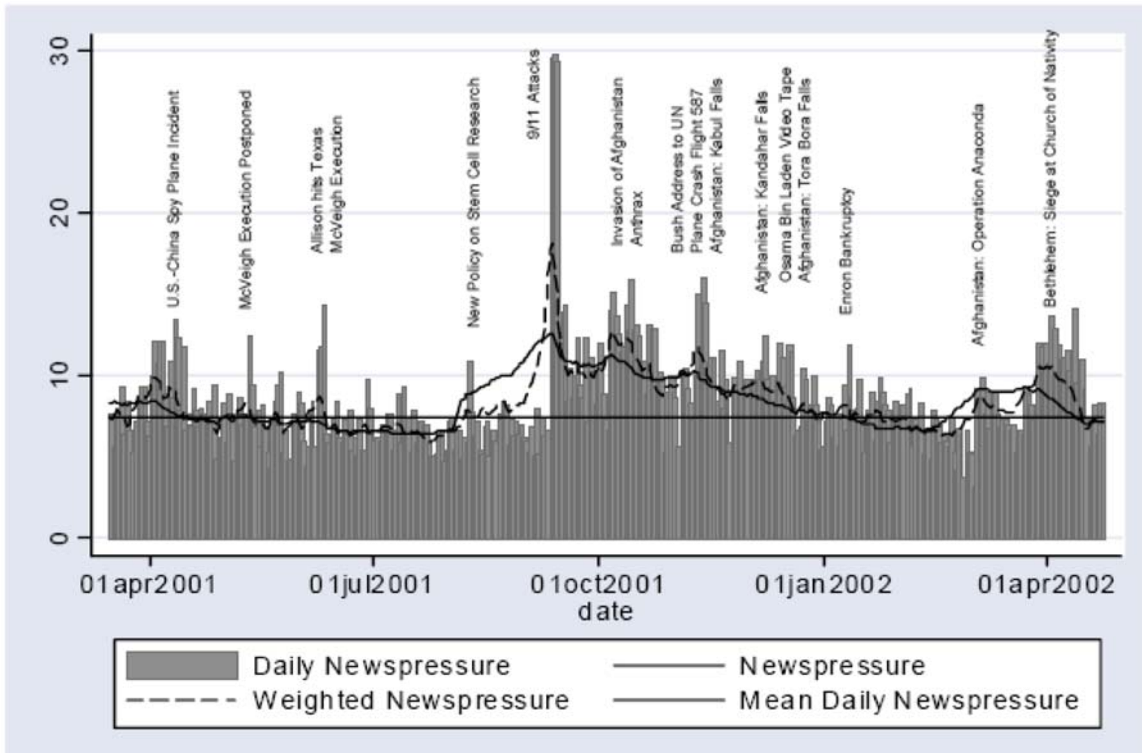


FIGURE IV
News Pressure (Minutes) during 405 Days, 15 March 2001 – 23 Apr 2002, by Day

- – Dates with largest news pressure

TABLE III

DATES OF TWO LARGEST *daily news pressure* AND MAIN STORY, BY YEAR

Year	Date	Main News Story
2003	14 Aug	*New York City Blackout*
	22 Mar	*Invasion of Iraq: Day 3*
2002	11 Sep	*9/11 Commemoration*
	24 Oct	*Sniper Shooting in Washington: Arrest of Suspects*
2001	13 Sep	*9/11 Attack on America: Day 3*
	12 Sep	*9/11 Attack on America: Day 2*
2000	26 Nov	*Gore vs. Bush: Florida Recount - Certification by Katherine Harris*
	8 Dec	*Gore vs. Bush: Florida Recount - Supreme Court Ruling*
1999	1 Apr	*Kosovo Crisis: U.S. Soldiers Captured*
	18 Jul	*Crash of Plane Carrying John F. Kennedy, Junior*
1998	16 Dec	*U.S. Missile Attack on Iraq*
	18 Dec	*Clinton Impeachment*
1997	23 Dec	*Oklahoma City Bombing: Trial*
	31 Aug	*Princess Diana's Death*
1996	18 Jul	*TWA Flight 800 Explosion*
	27 Jul	*Olympic Games Bombing in Atlanta*
1995	3 Oct	*O.J. Simpson Trial: The Verdict*
	22 Apr	*Oklahoma City Bombing*
1994	17 Jan	*California Earthquake*
	18 Jun	*O.J. Simpson Arrested*
1993	17 Jan	*U.S. Missile Attack on Iraq*
	20 Apr	*Waco, Texas: Cult Standoff Ends in Fire*
1992	16 Jul	*Perot Quits 1992 Presidential Campaign*
	1 May	*Los Angeles Riots*

- 5,000 natural Disasters in 143 countries between 1968 and 2002 (CRED)
  - 20 percent receive USAID from Office of Foreign Disaster Assistance (first agency to provide relief)
  - 10 percent covered in major broadcast news
  - OFDA relief given if (and only if) Ambassador (or chief of Mission) in country does Disaster Declaration
  - Ambassador can allocate up to $50,000 immediately
- Estimate

$$\text{Re}\,lief = \alpha News + \beta X + \varepsilon$$

- Below: $News$ about the Disaster is instrumented with:
  - Average News Pressure over 40 days after disaster
  - Olympics

TABLE IV

EFFECT OF THE PRESSURE FOR NEWS TIME ON DISASTER *News* AND *Relief*

	Dependent variable: *News*				Dependent variable: *Relief*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
News Pressure	-0.0162	-0.0163	-0.0177	-0.0142	-0.0117	-0.0119	-0.0094	-0.0078
	(0.0041)***	(0.0041)***	(0.0057)***	(0.0037)***	(0.0045)***	(0.0045)***	(0.0058)	(0.0040)**
Olympics	-0.1078	-0.1079	-0.0871	-0.111	-0.1231	-0.1232	-0.1071	-0.1098
	(0.0470)**	(0.0470)**	(-0.0628)	(0.0413)***	(0.0521)**	(0.0521)**	(0.0763)	(0.0479)**
World Series	-0.1133				-0.1324			
	(-0.1065)				(0.1031)			
log Killed			0.0605				0.0582	
			(0.0040)***				(0.0044)***	
log Affected			0.0123				0.0376	
			(0.0024)***				(0.0024)***	
imputed log Killed				0.0491				0.0442
				(0.0034)***				(0.0037)***
imputed log Affected				0.0151				0.0394
				(0.0020)***				(0.0020)***
Observations	5212	5212	2926	5212	5212	5212	2926	5212
R-squared	0.1799	0.1797	0.3624	0.2875	0.1991	0.1989	0.4115	0.3726

Linear probability OLS regressions. All regressions include year, month, country and disaster type fixed effects. Regressions with imputed values ((4) and (8)) also include fixed effects for the interaction of missing values and disaster type. Robust standard errors in parentheses:* significant at 10%; ** significant at 5%; *** significant at 1%.

- – 1st Stage: 2 s.d increase in News Pressure (2.4 extra minutes) decrease
    - ∗ probability of coverage in news by 4 ptg. points (40 percent)
    - ∗ probability of relief by 3 ptg. points (15 percent)

- Is there a spurious correlation between instruments and type of disaster?
- No correlation with severity of disaster

TABLE V

CORRELATIONS BETWEEN INSTRUMENTS AND THE SEVERITY OF DISASTERS

	Dependent variable	
	News Pressure	*Olympics*
log Killed	-0.0082	0.0003
	(0.0113)	(0.0010)
log *Affected*	0.0005	-0.0006
	(0.0068)	(0.0006)
p-value: F-test of joint insignificance	0.75	0.62
Observations	5212	5212
R-squared	0.3110	0.2035

OLS regressions with the instruments *News Pressure* and *Olympics* as dependent variables, and including year, month, country and disaster type fixed effects. Robust standard errors in parentheses:* significant at 10%; ** significant at 5%; *** significant at 1%. The F-test tests the joint significance of log *Killed* and log *Affected* in the regression.

- OLS and IV Regressions of Reliefs on presence in the News
- (Instrumented) availability in the news at the margin has huge effect: Almost one-on-one effect of being in the news on aid

TABLE VI
DEPENDENT VARIABLE: *Relief*

	OLS					IV		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
News	0.2886	0.158	0.1309	0.2323	0.2611	0.8237	0.6341	0.6769
	(0.0200)***	(0.0232)***	(0.0178)***	(0.0328)***	(0.0569)***	(0.2528)***	(0.3341)*	(0.2554)***
News*abs(Pr(news)-0.5)				-0.4922	-0.302			
				(0.1059)***	(0.0840)***			
abs(Pr(news)-0.5)				0.5374	0.2959			
				(0.0943)***	(0.0831)***			
log Killed		0.0486					0.0198	
		(0.0046)***					-0.0208	
log Affected		0.0358					0.0299	
		(0.0024)***					(0.0048)***	
imputed log Killed			0.0378	0.0546	0.0307			0.0109
			(0.0038)***	(0.0049)***	(0.0046)***			-0.0132
imputed log Affected			0.0375	0.0445	0.0345			0.0292
			(0.0020)***	(0.0023)***	(0.0026)***			(0.0045)***
F-stat, instruments, 1st stage						11.0	6.1	11.1
Over-id restrictions, χ^2_{df} (p-value)						0.51_1(0.47)		0.64_1 (0.42)
Observations	5212	2926	5212	5212	5027	5212	2926	5212
R-squared	0.2443	0.4225	0.3800	0.3860				

All regressions include year, month, country, and disaster type fixed effects. Regressions with imputed values ((3), (4) and (5)) also include fixed effects for the interaction of missing values and disaster type. Robust standard errors in parentheses: * significant at 10%; ** significant at 5%; *** significant at 1%.

- Second example: Theory/History paper, **Glaeser (2005)** on Political Economy of Hatred
- Idea: Hatred has demand side and supply side
  - Demand side:
    - Voters are susceptible to hatred (experiments: ultimatum game)
    - Media can mediate hatred
  - Supply side:
    - Politicians maximize chances of reelection
    - Set up a hatred media campaign toward a group for electoral gain
    - In particular, may target non-median voter

- Idea:
  - Group hatred can occur, but does not tend to occur naturally
  - Group hatred can be due to political incentives
  - Example 1: *African Americans in South, 1865-1970*
    - No hatred before Civil War
    - Conservative politicians foment it to lower demand for redistribution
    - Diffuse stories of violence by Blacks
  - Example 2: *Hatred of Jews in Europe, 1930s*
    - No hatred before 1920
    - Jews disproportionately left-wing
    - Right-wing Hitler made up Protocol of Elders of Zion

5 Next Lecture

- More Market Response to Biases
  - Managers: Corporate Decisions
  - Welfare Response to Biases
- Methodology of Field Psychology and Economics
- Concluding Remarks