Econ 219B
Psychology and Economics: Applications
(Lecture 10)

Stefano DellaVigna

April 18, 2005
Outline

1. Market Reaction to Biases: Introduction

2. Market Reaction to Biases: Pricing

3. Market Reaction to Biases: Corporate decisions
1 Market Reaction to Biases: Introduction

- So far, we focused on consumer deviations from standard model:

  1. Self-control and naivete'
  2. Reference dependence
  3. Narrow Framing
• Who exhibits these deviations?

1. **Self-control and naivete**. Consumers (health clubs, food, credit cards, smoking), workers (retirement saving, benefit take-up)

2. **Reference dependence**. Workers (labor supply, increasing wages), (inexperienced) traders (sport cards), financial investors, house owners

3. **Narrow Framing**. Consumers (environmental goods, coherent arbitrariness, housing choice, insurance choice)
• What is missing from picture?

• Experienced agents!

• Firms!

• In a market, interaction between different groups

• Everyone ‘born’ with biases

• Effect of biases lower if:
  – learning
  – advice
  – consulting
– specialization

• For which agents are these conditions likely to be satisfied?

• Firms

• In particular, firms are likely to be aware of biases.
• Implications?

• Study biases in the market

• Four major instances:
  – Interaction between experienced and inexperienced agents (noise traders – see Lecture 9)
  – Interaction between firms and consumers (contract design, price choice)
  – Interaction between managers and investors (corporate finance)
  – Interaction between employers and employees (labor economics)
  – Interaction between politicians and voters (political economy)
2 Market Reaction to Biases: Pricing

2.1 Self-Control

MARKET (I). INVESTMENT GOODS

Firm

• 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
CONSUMER BEHAVIOR.

• Long-run plans at $t = 0$:

\[
\text{Consume} \iff \beta \delta (-p - c + \delta b) > 0 \\
\iff c < \delta b - p
\]

• Actual consumption decision at $t = 1$:

\[
\text{Consume} \iff c < \beta \delta b - p \quad \text{(Time Inconsistency)}
\]

• Forecast at $t = 0$ of consumption at $t = 1$:

\[
\text{Consume} \iff c < \hat{\beta} \delta b - p \quad \text{(Naiveté)}
\]

FIRM BEHAVIOR. Profit-maximization

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

s.t. \[
\beta \delta \left\{ -L + \int_{-\infty}^{\hat{\beta} \delta b - p} (\delta b - p - c) dF (c) \right\} \geq \beta \delta \bar{u}
\]
Solution for the per-unit price $p^*$:

\[
p^* = a \quad \text{[exponentials]}
\]

\[
- \left(1 - \hat{\beta}\right) \delta b \frac{f \left(\hat{\beta} \delta b - p^*\right)}{f \left(\beta \delta b - p^*\right)} \quad \text{[sophisticates]}
\]

\[
- \frac{F \left(\hat{\beta} \delta b - p^*\right) - F \left(\beta \delta b - p^*\right)}{f \left(\beta \delta b - p^*\right)} \quad \text{[naives]}
\]

Features of the equilibrium

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

2. **Hyperbolic agents**. Time inconsistency
   
   $\implies$ 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

$\implies$ 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. $\implies$
   
   Above-marginal cost pricing: $p^* > a$.
   
   Initial bonus $L^* < K$ (PC).
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
  - ...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 naïveté ⇒ Real effect of time inconsistency

- \( p^* = a - \frac{F(\delta b - p^*) - F(\beta \delta b - p^*)}{f(\beta \delta b - p^*)} \)

- 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 naïveté' \( \hat{\beta} \) (monopoly)

- \( \text{Welfare}_{\text{naive}} \leq \text{Welfare}_{\text{soph}} \).

- Large welfare effects of non-rational expectations
2.2 Self-Control 2


- 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 $u$ with probability $\theta$
   - Utility is $v$ with probability $1 - \theta$
   - Heterogeneity: Distribution of types $\theta$

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

- Time inconsistency ($\beta < 1$) $\rightarrow$ Difference between $u$ and $v$

- Naiveté ($\hat{\beta} > \beta$) $\rightarrow$ $\theta > 0$

- 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 ($\theta < \theta$)

2. Exploitative contracts for sufficiently naive agents ($\theta > \theta$)

• Commitment device contract:

  – Implement $a_\theta = \max_a u(a)$

  – Transfer:

    * $t(a_\theta) = \max_a u(a)$

    * $t(a) = \infty$ for other actions

  – Result here is like in DM: Implement first best
• Exploitative contract:
  
  – Agent has negative utility:
    \[ u(a_\theta) - t(a_\theta) < 0 \]
  
  – Maximize overestimation of agents:
    \[ a_{\theta}^u = \text{arg max} \ (u(a) - v(a)) \]
2.3 Self-Control 3

- Oster&Scott-Morton, Pricing of Magazine Subscriptions, 2004

- Two types of magazines:
  - People
  - Astronomy

- Individuals with self-control problems want to commit to read Astronomy more

- Higher demand of subscriptions for Astronomy than for People

- Magazines offers deeper discount on subscription on People
• Data on 300 US magazines (ABC, MRI)

• Three measures of *Astronomy* (*vs.* *People*):

  1. Expert (0/1). RA rating of whether sources mentioned

  2. Genre: Non-business trade, Religion, Intellectual

  3. Pride-Future Gain. RA rating of "would you be proud" and "pleasure of the moment". (English PhD not representative)

• Various control variables
• Table 3. OLS regression of relative subscription price \((S/12p)\):
  
  – All ‘Astronomy magazine’ predictors associated with higher relative subscription prices
  
  – Magnitudes consistent: 1 SD increase \(\rightarrow\) .02-.03 higher \(S/12p\)

• BUT:
  
  1. Model makes predictions on quantities, not prices
  
  2. Hard to control for important confounding factors
### Table 1: A Sample of Magazine Ratings

<table>
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<th>Pride=6</th>
<th>FutureGain=3</th>
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<td>Art and Antiques</td>
<td>Penthouse</td>
<td>Forbes</td>
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<tr>
<td>Playboy</td>
<td>Art and Auction</td>
<td>Playboy</td>
<td>Fortune</td>
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<td>Easy riders</td>
<td>Barron’s</td>
<td>The Rolling Stone</td>
<td>HBR</td>
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<td>Movieline</td>
<td>Business Week</td>
<td>Spin</td>
<td>Kiplingers</td>
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<td>Forbes</td>
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<td>Fortune</td>
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Table 3: Regression Results

Dependent Variable: One year subscription rate/(newsstand price*number of annual issues)

<table>
<thead>
<tr>
<th>Variable</th>
<th>(1) Expert</th>
<th>(2) Genre</th>
<th>(3) Pride</th>
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** significant at the .05 level or better
Standard errors in parentheses
3 Market Reaction to Biases: Corporate Decisions

3.1 Accounting 1

- Degeorge, Patel, and Zeckhauser (1999)
- Constanca
Earnings Management to Exceed Thresholds by Degeorge et al.

Presentation by Constança Esteves

April 18, 2005
PRESENTATION STRUCTURE

Paper's major findings

Why thresholds are important

Identification strategy

Critique of the paper

Suggestions for future research
Managers of companies manipulate earnings in response to three types of thresholds

- Positive profits
- Maintenance of recent performance
- Meet analyst expectations

Positive profits threshold proves predominant

Future performance of firms that seem to have boosted earnings to meet threshold is poorer than that of its control group
WHY MANAGERS, FIRM STAKEHOLDERS AND THE MARKET CARE ABOUT THRESHOLDS?

Because thresholds are salient

- There is a mental dividing line between meeting or failing to meet the norm
- Thresholds create a reference points, inducing a loss if not met (prospect theory)
- Thresholds as a heuristic or rule of thumb for the health of a company

And managers have some discretion over how and when earnings are reported

- Have some flexibility in the choice of inventory methods, estimation of pension liabilities etc.
- Can transfer income from one year to the next, by deferring expenses, artificially increasing sales by “stuffing the pipeline” etc.
This threshold effect is identified by discontinuity close to the threshold

Theoretical model setup

2 period model: t=1,2

$L_t$ = true earnings, $L_t$ is a random variable

$R_t$ = reported earnings, $R_t \in \mathbb{R}$

$M_t$ = amount added to earnings, $M_t \in \mathbb{R}$

$k()$ = cost of manipulation (convex function)

$f(R_t, R_{t-1}) = \text{Payoff for manager in period } t$

$v(R_t, R_{t-1}) = \text{Bonus if manager meets or surpasses benchmark}$

\[ R_1 = L_1 + M_1. \]
\[ R_2 = L_2 - k(M_1) \]
\[ f(R_t, R_{t-1}) = \beta R_t + \nu(R_t, R_{t-1}). \]
\[ v(R_t, R_{t-1}) = \gamma \text{ if } R_t \geq R_{t-1} \]
\[ = 0 \text{ otherwise.} \]

Where managers pick $M_1$ to maximize

\[ f(R_1, R_0) + \delta E[f(R_2, R_1)] \]
A SPECIFIC CASE OF MODEL YIELDS A DISCONTINUITY AT Z

Z = Point at which choosing \( M_1 = -L_1 \) equals payoff from saving for next year

**Assumptions**

- \( R_o = 0, \beta = 1, \gamma = 10, \delta = 1 \)
  \[
  \max f(R_o, R_1) = R_1 + v(R_1, 0)
  \]
- \( L_1 \sim N(0, 10), k(M_1) = e^M - 1 \)
- Initial threshold achieved when \( L_1 + M_1 = 0 \)

**Findings**

- Just below zero, optimal strategy is to set \( M_1 = -L_1 \)
- Left of Z, depress earnings now for a better future
- Right of Z, “borrowing” \( M_1 \) maximizes \( f(R_o, R_1) = R_1 + v(R_1, 0) \)
- \( L_1 \) small and positive, reign in earnings

---

Fig. 2.—Optimal amount of period 1 manipulation, \( M_1 \), as a function of latent period 1 earnings \( L_1 \). Latent earnings \( L_1 \) are normally distributed with mean zero and standard deviation 10. If reported earnings \( R_1 = L_1 + M_1 \) reach at least \( R_o = 0 \), the executive reaps a bonus of 10. The period 2 cost of manipulation is \( k(M_1) = e^M - 1 \). The executive knows \( L_1 \) exactly when choosing the manipulation level \( M_1 \).
EMPIRICALLY, THE EFFECT IS IDENTIFIED USING THE AUTHORS’ $\tau$ STATISTIC AND FIRM QUARTERLY DATA

Identify discontinuities close to thresholds using the authors’ statistic

- $\tau$ statistic indicates if should reject the null hypothesis that distribution at the threshold is continuous and smooth

- $\tau$ statistic extrapolates from neighborhood densities to compute expected density at the threshold assuming no unusual behavior at that point

Theoretical constructs of thresholds are as follows

- Positive profits: $\text{EPS} \geq 0$
- Maintenance of recent performance: $\text{EPS}_t - \text{EPS}_{t-4} \geq 0$
- Meet analyst expectations: $\text{FERR} = \text{EPS} - \text{E}[\text{analyst forecasts}] \geq 0$

Data

- Quarterly data on 5,837 firms over 1974-1996
- Mostly mid-cap or larger firms; not have random sample of firms
FIRST, THE AUTHORS CHECK IF THERE ARE SYSTEMATIC VARIATIONS IN THE DATA THAT MAY BIAS THE RESULTS

Findings

- Problem: median EPS and EPS IQR (interquartile range) increase systematically with share price
- No problem: median FERR and FERR IQR do not vary systematically with share price between 10th and 90th centile
- No problem: median ∆EPS and IQR ∆EPS also not vary systematically with share price between 10th and 90th centile
THEN, THE AUTHOR’S LOOK FOR DISCONTINUITIES CLOSE TO THE “POSITIVE EARNINGS” THRESHOLD

Findings

• Shaved distribution in the negative region

• EPS distribution with a considerable jump between 0 and 1 cents
  - managers seem to prefer to report strictly positive EPS
  - Confirmed by high τ statistic of 4.36

• EPS distribution with another jump between -1 and 0 cents
  - Confirmed by high τ statistic of 3.84

Fig. 7.—Histogram of EPS: exploring the threshold of “positive/zero profits”
... AND LOOK FOR DISCONTINUITIES CLOSE TO "SUSTAIN RECENT PERFORMANCE" THRESHOLD

Findings

- Observe a large jump of the distribution at zero
- $\tau$ statistic high - reject the null that the distribution at zero is continuous and smooth
- Consistent with hypothesis that executives manage earnings to report comparable or higher EPS than 4 quarters ago

Fig. 5.—Histogram of change in EPS ($\Delta$EPS = EPS$_t$ – EPS$_{t-4}$): exploring the threshold of "sustain recent performance."
... AND FINALLY, LOOK FOR DISCONTINUITIES CLOSE TO THE “MEET THE ANALYST EXPECTATIONS” THRESHOLD
Meet analyst expectations threshold

Findings

- Distribution of FERR drops sharply below zero, though hard to see
- Extra pile-up of observations at zero confirmed by the high τ statistic
- High levels of shortfall in density close to zero (versus equidistant bin on the other side of the threshold of zero)
THEY ALSO ANALYSE INTERACTIONS AMONG THE THRESHOLDS
Positive EPS threshold proves predominant

Example

Method

- Condition distribution of EPS on having attained/not attained any of the the other two thresholds
- Conclude that positive EPS threshold is dominant
  - prevails regardless of whether or not the two other thresholds are met
LAST, THEY ANALYSE THE PERFORMANCE OF FIRMS THAT HAVE BARELY MET THE THRESHOLD

Performance in the subsequent year is poorer relative to that of control group

Confirmed for no mean reversion

- Coefficient of $\beta$ not statistically different from zero conditional on observations where $\Delta \text{EPS}_t > 5$

$\Delta \text{EPS}_{t+1} = \alpha + \beta \Delta \text{EPS}_t$

Expect that “meet threshold” group will underperform the groups immediately above “surpass threshold” and below “miss threshold”

Main finding is that mean and median $\Delta \text{EPS}$ in period two is lower for group B than for group A (significant under the Wilcoxon test)
PAPER CRITIQUE
Virtues

Tries to identify the phenomenon of earnings manipulation close to a threshold
  • Widely believed to be the case

Used psychological insights, such as loss aversion, to explain why the market and managers care about thresholds

Creates a new test statistic to try to distinguish whether the pattern of the sample distribution we see close to the threshold is due to a regular continuing trend in the data or due to a discontinuity
PAPER CRITIQUE

Potential flaws

Theoretical model

- Strange to have the optimal amount of borrowing at time 1 ($M_1$) be equal to the total latent earnings ($L_1$) instead of the short-fall between latent and threshold earnings

Identification of the discontinuity

- Could test robustness of the results using
  - another test statistic (but perhaps not many available at the time)
  - sensitivity of results to the size of the bins

Comparison of performance of “Meet threshold firm” with just “Miss the threshold” and “Surpass threshold”

- Robustness check on whether these groups differ in the amount of mean reversion
- Treatment and control groups may vary greatly; therefore results may be explained by other factors other than earnings manipulation
  - Need to show that they are similar in other aspects, e.g. mean reversion, etc.
SUGGESTIONS FOR FUTURE RESEARCH

Investigate how other thresholds can lead to misbehavior

- Any policy that establishes a threshold for receiving rewards or punishment
  - e.g. teachers and pay-for-performance above threshold
  - e.g. electoral fraud - close elections more corrupt

Identify other methods, both parametric and non-parametric, to check for discontinuities at thresholds
• Issues:
  
  – Effect of competition: what if other firms do it? (Shleifer, AEA 2004)
  
  – Uncertainty about ability to meet threshold
  
  – Managers want to insure themselves against risks
3.2 Accounting 2


- On Friday investors appear to be less responsive to earning surprises

- Immediate stock response to F earning surprises 20 percent lower than on non-F

- Do firms respond by timing more negative earnings on Friday?

- Three measures of earning quality:
  1. Non-negative operating profits
  2. Non-negative surprise relative to analyst forecast ($e^1$)
  3. Returns around announcement date (0,1)
Figure 1a: Response To Earnings Surprise From 0 To +1

Mean Cumulative Abnormal Return vs. Earnings Surprise Decile

- Friday
- Other Days
Figure 3a: Non-negative Earnings by Day of the Week

- Monday: 0.84
- Tuesday: 0.83
- Wednesday: 0.82
- Thursday: 0.81
- Friday: 0.77
Figure 3b: Non-negative Earnings Surprise by Day of Week

Day of the Week

Probability of Non-negative Earnings Surprise

1  2  3  4  5
Figure 3c: Abnormal Return from 0 to +1 by Day of Week

Day of the Week

Abnormal Return

1 2 3 4 5

-0.004 -0.003 -0.002 -0.001 0.000 0.001 0.002