Econ 219B
Psychology and Economics: Applications
(Lecture 9)

Stefano DellaVigna

March 18, 2015
Outline

1. Social Pressure II: Charitable Giving
2. Signaling
3. Non-Standard Beliefs
4. Overconfidence
5. Law of Small Numbers
6. Projection Bias
1 Social Pressure II: Charitable Giving

- DellaVigna, Malmendier, and List (2012)
This Paper

• Model of giving with altruism and social pressure
  – Consumer may receive advance notice of fundraiser
  – Consumer can avoid (or seek) fundraiser at a cost
  – Consumer decides whether to give (if at home)

• Field experiment: door-to-door fundraiser
  – Control group: standard fundraiser
  – Flyer Treatment: flyer on doorknob on day before provides advance notice about hour of visit
  – Opt-Out Flyer Treatment: flyer with box “do not disturb”
Flyer Layout with and without Opt-Out

Fundraising Campaign for La Rabida Children’s Hospital

Fundraisers will visit this address tomorrow ( / ) between and to raise funds for La Rabida Children’s Hospital.

☐ Check this box if you Do not want to be disturbed.

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• Model of giving with altruism and social pressure
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  – Control group: standard fundraiser
  – Flyer Treatment: flyer on doorknob on day before provides advance notice about hour of visit
  – Opt-Out Flyer Treatment: flyer with box “do not disturb”
  – Survey Treatments: Administer surveys with varying payment and duration and with or without flyers → to structurally estimate parameters.
Survey Flyers

University of Chicago Study

Researchers will visit this address tomorrow (   ) between   and to conduct a 10 minute survey.

You will be paid $10 for your participation.
• Model

• Giving game with giver and fund-raiser. Timing:
  - Stage 1:
    * No Flyer: Giver at home with probability \( h = h_0 \)
    * Flyer:
      · Giver sees flyer with probability \( r \)
      · Can alter probability of being at home \( h \) from baseline \( h_0 \) at cost \( c(h) \), with \( c(h_0) = 0 \), \( c'(h_0) = 0 \), and \( c''(\cdot) > 0 \)
  - Stage 2:
    * Fund-raiser visits home of giver:
      · If giver at home (w/ prob. \( h \)), in-person donation \( g^* \geq 0 \)
      · If saw flyer (w/ prob. \( r \)), donation via mail \( g_m^* \geq 0 \)
• Utility function of giver:

\[ U(g) = u(W - g - gm) + av(g + \theta gm, G_{-i}) - s(g) \]

• Agent cares about:
  - Private consumption \( u(W - g - gm) \), with \( u'(\cdot) > 0 \) and \( u''(\cdot) \leq 0 \)
  - Giving to charity \( av(\cdot, G_{-i}) \), with \( v'_g(\cdot, \cdot) > 0 \), \( v''_{g,g}(\cdot, \cdot) < 0 \),
    \( \lim_{g \to \infty} v'_g(g, \cdot) = 0 \), and \( v(0, G_{-i}) = 0 \).

• Two special cases for \( v(g, G_{-i}) \):
  - Pure altruism (Charness and Rabin 2002, Fehr and Gächter, 2000):
    \( v(g, G_{-i}) = v(g + \theta gm + G_{-i}) \), \( a \) is altruism parameter
  - Warm glow (Andreoni, 1989 and 1990):
    \( v(g, G_{-i}) = v(g) \), \( a \) is weight on warm glow

• Giving via mail is less attractive (\( \theta < 1 \)): less warm glow, cost of giving,...
- Social Pressure $s(g) = S(g^s - g) \cdot 1_{g < g^s} \geq 0$

  - Social pressure $s = 0$ if not at home or if giving $g \geq g^s$ (socially acceptable amount)

  - Social pressure $s > 0$ for giving $g < g^s$, decreasing in $g$

- Captures identity (Akerlof and Kranton, 2000), social norms, or self-signalling (Bodner and Prelec, 2002; Grossman, 2007)

- Psychology evidence:

  - Tendency to conformity and obedience (Milgram, 1952 and Asch, 1957)

  - Effect stronger for face-to-face interaction
Figure. Social Pressure Cost At Estimated Parameters
• **Second-stage Maximization (Giving)**

• **Lemma 1a. (Conditional Giving In Person).** There is a unique optimal donation \( g^*(a, S) \) (conditional on being at home), which is weakly increasing in \( a \) and takes the form: (i) \( g^*(a, S) = 0 \) for \( a \leq \underline{a} \); (ii) \( 0 < g^*(a, S) < g^S \) for \( \underline{a} < a < \bar{a} \); (iii) \( g^*(a, S) = g^S \) for \( a \leq \bar{a} \); (iv) \( g^*(a, S) > g^S \) for \( a > \bar{a} \).

• No giving via mail when at home

• **Lemma 1b (Conditional Giving Via Mail).** There is a unique optimal donation via mail \( g^*_m(a) \) (conditional on not being at home), which is weakly increasing in \( a \) and takes the form: (i) \( g^*_m(a) = 0 \) for \( a < a_m \); (ii) \( g^*_m(a) > 0 \) for \( a \geq a_m \); (iii) for all levels of \( a \), \( g^*_m(a) \leq g^*(a; S) \).
• First-Stage Maximization (Presence at Home)

• Probability of being at home $h$:
  – **Control (NF) Treatment** $(r = 0)$: Exogenous, $h = h_0$
  – **Flyer (F) Treatment** $(r > 0)$: Choose $h \in [0, 1]$ at cost $c(h)$

• **Lemma 2 (Presence at Home).** There is a unique optimal probability of being at home $h^*(a, S)$
  – For $S = 0$ (no social pressure), $h^*(a, 0) = h_0$ for $a \leq a$ and $h^*(a, 0) > h_0$.
  – For $S > 0$ (social pressure), $h^*(a, S) < h_0$ for $a \leq a$; there is unique $a_0(S) \in (a, \bar{a})$ such that $h^*(a_0(S)) = h_0$.

• Giving due to altruism $\Rightarrow h > h_0$ (Seek being at home)

• Giving due to social pressure $\Rightarrow h < h_0$ (Avoid being at home)
• **Opt-Out (O) Treatment**

  – Flyer + Consumers can tell the charity not to disturb
  
  – Cost of probability of home:

  \[
  C(h) = \begin{cases} 
  0 & \text{if } h = 0 \\
  c(h) & \text{if } h > 0 
  \end{cases}
  \]

  – Still costly to remain at home, but no cost to keep charity out
  
  – (Notice: Never want to set $0 < h < h_0$)

• **Lemma 3 (Opt-Out Decision).** For $S = 0$ (no social pressure), the agent never opts out for any $a$. For $S > 0$ (social pressure), the agent opts out for sufficiently low altruism, $a < a_0(S)$. 
• Allow for heterogeneity in altruism \( a \), with \( a \sim F \)

• Two special cases:
  – *Altruism and No Social Pressure* (A-NoS, \( S = 0 \) and \( F(a) < 1 \))
  – *Social Pressure and Limited Altruism* (S-NoA, \( S > 0 \) and \( F(a) = 1 \))

• **Proposition 1.** The probability \( P(H) \) of home presence is
  – A-NoS: \( P(H)_F = P(H)_{OO} > P(H)_{NF} \)
  – S-NoA: \( P(H)_{NF} > P(H)_F > P(H)_{OO} \)

• **Proposition 2.** The unconditional probability \( P(G) \) of giving is
  – A-NoS: \( P(G)_F = P(G)_{OO} > P(G)_{NF} \)
  – S-NoA: \( P(G)_{NF} > P(G)_F > P(G)_{OO} \)
Experimental Design

• Recruitment and Training: 48 solicitors and surveyors
  – undergraduate students at the University of Chicago, UIC, and Chicago State University
  – Interviewed, trained at UoC
  – aware of different charities but not of treatment

• Time and Place:
  – Saturdays and Sundays between April, 2008 and October, 2008
  – Hours between 10am and 5pm
  – Towns around Chicago: Burr Ridge, Flossmoor, Kenilworth, Lemont, Libertyville, Oak Brook, Orland Park, Rolling Meadows, and Roselle

• Randomization
  – within a solicitor-day observations (4h/6h shifts per day) and
  – at the street level within a town

• Different treatments in different periods ➔ randomization is conditional on solicitor and day fixed effects
Figure 4a. Frequency of Answering the Door

- Baseline (N=946/2,220)
- Flyer (N=1,173/2,370)
- Flyer with Opt Out (N=588/482)

Legend:
- Center for Natural Hazards Mitigation Research (ECU)
- La Rabida Children's Hospital

Opting out
Figure 4b. Frequency of (Unconditional) Giving

Baseline (N=946/2,220) Flyer (N=1,173/2,370) Flyer with Opt Out (N=588/482)
Table 2. Results for Fund-Raising Treatments

<table>
<thead>
<tr>
<th>Specification:</th>
<th>OLS Regressions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dep. Var.</td>
<td>Indicator for Answering the Door</td>
</tr>
<tr>
<td>Flyer Treatment</td>
<td>-0.0388 (0.0137)***</td>
</tr>
<tr>
<td>Flyer with opt out Treatment</td>
<td>-0.0966 (0.0193)***</td>
</tr>
</tbody>
</table>

Flyer Treatment
* ECU Charity
Flyer with opt out Treatment
* ECU Charity
Flyer Treatment
* La Rabida Charity
Flyer with opt out Treatment
* La Rabida Charity
Indicator ECU Charity

Omitted Treatment
Mean of Dep. Var. for Omitted Treatment
0.4151
0.413
0.0629
0.0717

Fixed Effects for Solicitor, Date-Location, Hour, and Area Rating
N
N = 7668
N = 7668
N = 7668
N = 7668
• Evidence by Donation Size:
Social pressure more likely to yield small donations
Use median donation size ($10) as cut-off point

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**Figure 5a. Frequency of Giving: Small versus Large (pooled)**

<table>
<thead>
<tr>
<th></th>
<th>Small Donations</th>
<th>Large Donations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline (N=3,166)</td>
<td>4.0%</td>
<td>2.0%</td>
</tr>
<tr>
<td>Flyer (N=3,433)</td>
<td>3.5%</td>
<td>1.5%</td>
</tr>
<tr>
<td>Flyer with Opt Out (N=1,070)</td>
<td>2.5%</td>
<td>1.0%</td>
</tr>
</tbody>
</table>
Survey Treatments

• Results of fundraiser do not easily allow the estimation of altruism and social pressure parameters
  – Unobserved cost of adjustment $c(h)$
• Solution: estimate elasticity with respect to monetary incentives
• Survey treatments with varying compensation and duration
• Treatments run in 2008 and 2009
Figure 2b. Summary of Door-to-Door Experimental Treatments Run in 2009

Survey Treatments

Baseline
- 5-Minute Survey
  - $0
  - $5

Flyer
- 5-Minute Survey
  - $0
- 10-Minute Survey
  - $0

Opt-out
- 5-Minute Survey
  - $0
  - $5
Survey Results (2009, N = 10,032)
Higher payment (lower duration) increases proportion at home monotonically increases survey completion monotonically (except in NF)
Structural estimates (Minimum-distance estimator)

Minimize distance between predicted moments $m(\vartheta)$ and observed ones $\hat{m}$:

$$\min_{\vartheta} (m(\vartheta) - \hat{m})' W (m(\vartheta) - \hat{m})$$

Moments $m(\vartheta)$:
1. Probability of opening the door ($P(H)_j^c$, $j = F, NF, OO$, $c = LaR, Ecu$)
2. Probability of checking opt-out box ($P(OO)_j^c$, $c = LaR, Ecu$)
3. Probability of giving at all, and giving an amount range ($P(G)_j^c$, $j = F, NF, OO$, $c = LaR, Ecu$)
4. Probability of opening door in survey ($P(H)_j^S$)
5. Probability of filling survey ($P(S)_j^S$)
• Weighting matrix $W$ diagonal of inverse of variance-covariance matrix

• Parametric assumption to estimate the model:
  1. Consumption utility linear: $u(W - g) = W - g$
  2. Altruism function $av(g, G_{-i}) = a \log(G + g)$
  3. Altruism $a$ is distributed $N(\mu, \sigma)$
  4. Acceptable donation $g^S = $10 (median)
  5. Cost function $c(h) = (h - h_0)^2 / 2\eta$
  6. No mail giving ($\theta = 0$)

• Marginal utility of giving: $a/ (G + g) - 1$
• Parameters $\vartheta$:
  1. $h_0^{2008}$ and $h_0^{2009}$—probability of being at home in no-flyer conditions
  2. $r$—probability of observing and remembering the flyer
  3. $\eta$—responsiveness of the probability of being at home to the utility of being at home
  4. $\mu_c^c (c = LaR, Ecu)$—mean of the distribution $F$ of the altruism $\alpha$
  5. $\sigma_c^c (c = LaR, Ecu)$—standard deviation of $F(\alpha)$
  6. $G$—curvature of altruism/warm glow function
  7. $S_c^c (c = LaR, Ecu)$—social pressure associated with not giving
  8. $\mu^S$—mean of the distribution $F^S$ from which the utility of the survey is drawn
  9. $\sigma^S$—standard deviation of $F^S$
  10. $S^S$—social pressure associated with saying no
  11. $v^S$—value of an hour of time completing a survey
• Identification:
  
  – Prob. being at home $h_0 \leftarrow$ Control group
  
  – Prob. seeing flyer $r \leftarrow$ Share opting out
  
  – Utility of doing survey $\mu^S$ and $\sigma^S \leftarrow$ Share completing survey
  
  – Value of time $v^S \leftarrow$ Comparison of effect of $10$ payment and $5$ minute duration
  
  – Elasticity of home presence $\eta \leftarrow$ Share opening door in survey for different payments + Giving in charity
  
  – Altruism parameters $\mu^c, \sigma^c, G \leftarrow$ Given $\eta$, share giving different amounts
  
  – Social pressure parameters $S^i$ and $S^S \leftarrow$ Share opening door and giving
### Appendix Table 1. Empirical Moments and Estimated Moments

<table>
<thead>
<tr>
<th>Specification: Charity</th>
<th>Minimum-Distance Estimates</th>
<th>La Rabida Charity</th>
<th>ECU Charity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Empirical Moments</td>
<td>Estimated Moments</td>
<td>Empirical Moments</td>
</tr>
<tr>
<td>Moments for Charity</td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>P(Home) No Flyer</td>
<td>0.4130</td>
<td>0.4142</td>
<td>0.4171</td>
</tr>
<tr>
<td>P(Home) Flyer</td>
<td>0.3733</td>
<td>0.3735</td>
<td>0.3806</td>
</tr>
<tr>
<td>P(Home) Opt-Out</td>
<td>0.3070</td>
<td>0.2989</td>
<td>0.3281</td>
</tr>
<tr>
<td>P(Opt Out) Opt-Out</td>
<td>0.1202</td>
<td>0.1142</td>
<td>0.0988</td>
</tr>
<tr>
<td>P(Giving) No Flyer</td>
<td>0.0717</td>
<td>0.0666</td>
<td>0.0455</td>
</tr>
<tr>
<td>P(Giving) Flyer</td>
<td>0.0699</td>
<td>0.0710</td>
<td>0.0461</td>
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<tr>
<td>P(Giving) Opt-Out</td>
<td>0.0515</td>
<td>0.0633</td>
<td>0.0272</td>
</tr>
<tr>
<td>Additional Moments (not shown)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P(0&lt;Giving&lt;10), P(Giving=10), P(10&lt;Giving&lt;=20), P(20&lt;Giving&lt;=50), P(Giving&gt;50) in Treatments NF, F, OO</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>N</td>
<td>N = 4962</td>
<td>N = 4962</td>
<td>N = 2707</td>
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<tr>
<td><strong>Common Parameters</strong></td>
<td><strong>Benchmark Estimates</strong></td>
<td><strong>Estimates with Identity Weighting Matrix</strong></td>
<td></td>
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<td>--------------------------------------------</td>
<td></td>
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<tr>
<td><strong>(1)</strong></td>
<td><strong>(2)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prob. Answering Door (h) - Year 2008</td>
<td>0.414</td>
<td>0.414</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.006)</td>
<td></td>
</tr>
<tr>
<td>Prob. Answering Door (h) - Year 2009</td>
<td>0.449</td>
<td>0.445</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.007)</td>
<td>(0.008)</td>
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<tr>
<td>Prob. Observing Flyer (r)</td>
<td>0.322</td>
<td>0.302</td>
<td></td>
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<tr>
<td></td>
<td>(0.011)</td>
<td>(0.012)</td>
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<tr>
<td>Elasticity of Home Presence (eta)</td>
<td>0.047</td>
<td>0.060</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.014)</td>
<td>(0.031)</td>
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<tr>
<td>Implied Cost of Altering Prob. Home by 10 pp.</td>
<td>0.106</td>
<td>0.083</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Survey Parameters</strong></th>
<th><strong>(1)</strong></th>
<th><strong>(2)</strong></th>
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</thead>
<tbody>
<tr>
<td>Mean Utility (in $) of Doing 10-Minute Survey</td>
<td>-26.865</td>
<td>-26.936</td>
</tr>
<tr>
<td></td>
<td>(4.233)</td>
<td>(5.509)</td>
</tr>
<tr>
<td>Std. Dev. of Utility of Doing Survey</td>
<td>30.285</td>
<td>30.332</td>
</tr>
<tr>
<td></td>
<td>(5.208)</td>
<td>(6.303)</td>
</tr>
<tr>
<td>Value of Time of One-Hour Survey</td>
<td>74.580</td>
<td>76.761</td>
</tr>
<tr>
<td></td>
<td>(22.901)</td>
<td>(26.130)</td>
</tr>
<tr>
<td>Social Pressure Cost of Saying No to Survey</td>
<td>4.784</td>
<td>3.869</td>
</tr>
<tr>
<td></td>
<td>(1.285)</td>
<td>(1.918)</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th><strong>Charity Parameters</strong></th>
<th><strong>La Rabida</strong></th>
<th><strong>ECU</strong></th>
<th><strong>La Rabida</strong></th>
<th><strong>ECU</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(1)</strong></td>
<td><strong>(2)</strong></td>
<td></td>
<td><strong>(1)</strong></td>
<td><strong>(2)</strong></td>
</tr>
<tr>
<td></td>
<td>(3.250)</td>
<td>(4.273)</td>
<td>(9.481)</td>
<td>(10.919)</td>
</tr>
<tr>
<td></td>
<td>(1.335)</td>
<td>(1.832)</td>
<td>(3.885)</td>
<td>(3.998)</td>
</tr>
<tr>
<td>Curvature of Altruism Function (G)</td>
<td>12.133</td>
<td>12.224</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(5.147)</td>
<td>(15.518)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Pressure Cost of Giving 0 in Person</td>
<td>3.550</td>
<td>1.364</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.615)</td>
<td>(0.744)</td>
<td>(1.674)</td>
<td>(1.475)</td>
</tr>
</tbody>
</table>
Implied distribution of altruism

Marginal utility of giving (for $S = 0$) is $a/(G+g)-1$

Hence, give $g > 0$ if $a > G=12.13$
Welfare: Does a fund-raiser increase utility for the giver?

Figure 7b. Overall Utility of Fund-Raiser as function of Altruism
Welfare
1. Low-altruism households pay social pressure cost
2. High-altruism households get benefit
3. Since the former dominate, on net negative welfare for solicitee

<table>
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<tr>
<th>Panel C. Welfare</th>
<th>La Rabida Charity</th>
<th>ECU Charity</th>
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</thead>
<tbody>
<tr>
<td>Welfare in Standard (No-Flyer) Fund-Raiser</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Welfare per Household Contacted (in $)</td>
<td>-1.077 (0.160)</td>
<td>-0.439 (0.286)</td>
</tr>
<tr>
<td>Money Raised per Household Contacted</td>
<td>0.722 (0.036)</td>
<td>0.332 (0.046)</td>
</tr>
<tr>
<td>Money Raised per Household, Net of Salary</td>
<td>0.247 (0.036)</td>
<td>-0.143 (0.046)</td>
</tr>
</tbody>
</table>

- Societal welfare effect can still be positive if money used very well
  But amount of money raised small (negative for ECU)
Flyer and opt-out treatment increase solicitee welfare
Can also raise charity welfare (i.e., net fund-raising)

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</tr>
<tr>
<td><strong>Welfare in Fund-Raiser with Flier</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Welfare per Household Contacted (in $)</td>
<td>-0.924 (0.145)</td>
<td>-0.404 (0.273)</td>
</tr>
<tr>
<td>Money Raised per Household Contacted</td>
<td>0.859 (0.044)</td>
<td>0.333 (0.046)</td>
</tr>
<tr>
<td>Money Raised per Household, Net of Salary</td>
<td>0.248 (0.044)</td>
<td>-0.278 (0.046)</td>
</tr>
<tr>
<td><strong>Welfare in Fund-Raiser with Opt-out</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Welfare per Household Contacted (in $)</td>
<td>-0.586 (0.085)</td>
<td>-0.248 (0.196)</td>
</tr>
<tr>
<td>Money Raised per Household Contacted</td>
<td>0.810 (0.045)</td>
<td>0.369 (0.055)</td>
</tr>
<tr>
<td>Money Raised per Household, Net of Salary</td>
<td>0.294 (0.036)</td>
<td>-0.147 (0.046)</td>
</tr>
</tbody>
</table>
2 Signaling

  - Ego utility from thinking of self as generous
  - Individuals are unsure of (forget) their type
  - Infer type from own behavior in Bayesian way
  - Take into account signaling game in their actions
  - (Signaling can be to self or others)

- Idea:
– Individuals may behave pro-socially to signal to self (or others) that they are generous type

– Generates prediction of pro-social behavior (like other models)

– Unique prediction: behave less pro-socially if pro-social behavior is less diagnostic of generosity

– Crow-out of Intrinsic motivation (Deci 1971)

• Nice features:

  – Micro-founded: Bayesian updating, signaling

  – Ego utility very plausible
• Problems:
  – Hard to solve
  – Multiple equilibria possible
  – Hard to separate self-signaling from signaling to others
Consider this in the context of Dube, Luo, and Fang (2015) paper on case-based marketing

- Send 30,000 SMS messages in China offering to buy movie ticket for 3-D version of X-Men: Day of Future Past
  - Standard price: 100 RMB
  - Randomize price discount: 0, 20, 35, 50, 60, 75 RMB
  - Cross-randomize charitable giving bundled with movie ticker purchase: "If you purchase ticket, X RMB will go to charity": 0, 5, 10, 15 RMB
- Follow-up survey on motivation
- Sample sizes

<table>
<thead>
<tr>
<th>discount (RMB)</th>
<th>Donation (RMB)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>700</td>
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<tr>
<td>20</td>
<td>700</td>
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<tr>
<td>35</td>
<td>700</td>
</tr>
<tr>
<td>50</td>
<td>700</td>
</tr>
<tr>
<td>60</td>
<td>700</td>
</tr>
<tr>
<td>75</td>
<td>700</td>
</tr>
</tbody>
</table>
• For low donation, monotonic effect of discount
• For high donation, non-monotonic effect of discount $\Rightarrow$ Crowd-out of motivation
• Striking result: Interpretation?

• Model adapted from Benabou-Tirole

• Part 1: Individual has consumption utility

\[ V + \alpha p + \gamma a \]

- \( V \) is utility from movie,
- \( p \) is price of movie, \( \alpha \ (<0) \) is price elasticity
- \( a \) is donation, \( \gamma \) is (reduced-form) altruism
- So far, standard model with altruism
• Part 2a: Ego utility on altruism:

\[ \lambda_\alpha E (\alpha|a, p, y) \]

– Individual derives utility from thinking of being altruistic (high \( a \))

– Weight on ego utility is \( \lambda_\alpha \): for \( \lambda_\alpha = 0 \), back to pure altruism case

– Individual solves a signaling game to infer \( \alpha \) given price \( p \), discount \( a \), and donation decision \( y \in 0, 1 \)

– Thus, donation \((y = 1)\) has ego utility benefits, raising \( E\alpha \)
• This is not enough: need Part 2b in Ego utility:

\[ \lambda_\gamma E (\gamma|a, p, y) \]

– Individual derives utility from thinking of self as stingy – or not

– Why this term? There needs to be a signal extraction problem: giving can signal high generosity or low price elasticity

– Unattractive part of Benabou and Tirole model
• Decision: Give \((y = 1)\) if

\[
U(1) = V + \alpha p + \gamma a + \lambda_\alpha E(\alpha | a, p, 1) + \lambda_\gamma E(\gamma | a, p, 1) \geq 0
\]

\[
U(0) = \lambda_\alpha E(\alpha | a, p, 0) + \lambda_\gamma E(\gamma | a, p, 0)
\]

or

\[
V + \alpha p + \gamma a + \Delta(a, p) > 0
\]

where \(\Delta\) is net ego utility

• Updating on \(\gamma\) if purchase \((y = 1)\):

\[
E\left(\gamma | \gamma > -\frac{V + \alpha p + \Delta(a, p)}{a}\right)
\]

• Specify priors on parameters to derive separating equilibrium of signalling game
• Remarkably good fit, but value of some parameters odd

• Relatedly: How much do you need ego utility on price elasticity: not obvious to interpret
  \[ \lambda_\gamma E (\gamma | a, p, y^h) + \lambda_\alpha E (\alpha | a, p, y^h) \]

• Relatedly: Estimation of some parameters appears problematic
  • Value V of good negative on average?
    (What if allow for not all to pay attention)
  • \( \sigma_\alpha \) is at boundary

<table>
<thead>
<tr>
<th></th>
<th>coefficient</th>
<th>st. error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Donation (( \gamma ))</td>
<td>-0.1411</td>
<td>0.1345</td>
</tr>
<tr>
<td>Price, (( \alpha ))</td>
<td>-0.0183</td>
<td>0.0077</td>
</tr>
<tr>
<td>Intercept, (( \bar{V} ))</td>
<td>-0.8526</td>
<td>0.225</td>
</tr>
<tr>
<td>( \sigma_\gamma )</td>
<td>0.1327</td>
<td>0.0632</td>
</tr>
<tr>
<td>( \sigma_\alpha )</td>
<td>0.0001</td>
<td>0.307</td>
</tr>
<tr>
<td>( \lambda_\gamma )</td>
<td>2.1948</td>
<td>0.7931</td>
</tr>
<tr>
<td>( \lambda_\alpha )</td>
<td>-15.9831</td>
<td>3.452</td>
</tr>
</tbody>
</table>
3 Non-Standard Beliefs

• So far, focus on non-standard utility function $U\left(x_i^t|s_t\right)$ as deviations from standard model:

$$\max_{x_i^t \in X_i} \sum_{t=0}^{\infty} \delta^t \sum_{s_t \in S_t} p(s_t) U\left(x_i^t|s_t\right)$$

• Non-standard preferences
  
  – Self-Control Problems $(\beta, \delta)$
  
  – Reference Dependence $(U\left(x_i^t|s_i, r\right))$
  
  – Social Preferences $(U\left(x_i, x_{-i}|s\right))$
• Today: Non-Standard Beliefs:

\[
\max_{x_i^t \in X_i} \sum_{t=0}^{\infty} \delta^t \sum_{s_t \in S_t} p(s_t) U(x_i^t | s_t)
\]

where \( p(s_t) \) is the subjective distribution of states \( S_i \) for agent.

• Distribution for agent differs from actual distribution: \( p(s_t) \neq p(s_t) \)

• Three main examples:

1. **Overconfidence.** Overestimate one’s own skills (or precision of estimate): \( \tilde{p}(\text{good state}_t) > p(\text{good state}_t) \)

2. **Law of Small Numbers.** Gambler’s Fallacy and Overinference in updating \( \tilde{p}(s_t | s_{t-1}) \)

3. **Projection Bias.** Expect future utility \( \tilde{U}(x_i^t | s_t) \) to be too close to today’s
4 Overconfidence

- Overconfidence is of at least two types:
  - Overestimate one’s ability (also called overoptimism)
  - Overestimate the precision of one’s estimates (also called overprecision)

- Psychology: Evidence on overconfidence/overoptimism
  - Svenson (1981): 93 percent of subjects rated their driving skill as above the median, compared to the other subjects in the experiment
  - Weinstein (1980): Most individuals underestimate the probability of negative events such as hospitalization
  - Buehler-Griffin-Ross (1994): Underestimate time needed to finish a project
• Applications in the field of overconfidence/overoptimism

• Example 1. Overconfidence about self-control by consumers ($\hat{\beta} > \beta$)
  – Evidence on self-control supports idea of naiveté
    * Status-quo bias (Madrian-Shea, 1999)
    * Response to teaser rates (Ausubel, 1999)
    * Health-club behavior (DellaVigna-Malmendier, 2006)
- Prediction markets of Google employees (with raffle tickets for total of $10,000 per quarter in payoffs)
- Data: years 2005-2007, 1,463 employees placed ≥ 1 trade
- Securities not related to Google correctly priced on average
- Securities with implications for Google: Substantial overconfidence for two-outcome security, Less so for five-outcome security

Table 5. Optimistic bias in the Google markets

<table>
<thead>
<tr>
<th></th>
<th>Obs.</th>
<th>Avg price</th>
<th>Avg payoff</th>
<th>Return (SE)</th>
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<tbody>
<tr>
<td>All markets</td>
<td>70,706</td>
<td>0.357</td>
<td>0.342</td>
<td>-0.015***</td>
</tr>
<tr>
<td>Markets with implication for Google</td>
<td>37,910</td>
<td>0.310</td>
<td>0.293</td>
<td>-0.017***</td>
</tr>
<tr>
<td>Two-outcome markets with implication for Google</td>
<td>9,023</td>
<td>0.509</td>
<td>0.492</td>
<td>-0.017***</td>
</tr>
<tr>
<td>Best outcome for Google</td>
<td>4,556</td>
<td>0.456</td>
<td>0.199</td>
<td>-0.256***</td>
</tr>
<tr>
<td>Worst</td>
<td>4,467</td>
<td>0.563</td>
<td>0.790</td>
<td>0.227***</td>
</tr>
<tr>
<td>Five-outcome markets with implication for Google</td>
<td>26,511</td>
<td>0.239</td>
<td>0.222</td>
<td>-0.017***</td>
</tr>
<tr>
<td>Best outcome for Google</td>
<td>5,592</td>
<td>0.244</td>
<td>0.270</td>
<td>0.027</td>
</tr>
<tr>
<td>2nd</td>
<td>5,638</td>
<td>0.271</td>
<td>0.246</td>
<td>-0.025</td>
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<td>3rd</td>
<td>5,539</td>
<td>0.296</td>
<td>0.179</td>
<td>-0.118**</td>
</tr>
<tr>
<td>4th</td>
<td>5,199</td>
<td>0.206</td>
<td>0.178</td>
<td>-0.028</td>
</tr>
<tr>
<td>Worst</td>
<td>4,543</td>
<td>0.162</td>
<td>0.236</td>
<td>0.074</td>
</tr>
</tbody>
</table>
• Survey evidence suggests phenomenon general

• Oyer and Schaefer, 2005; Bergman and Jenter, 2007
  – Overconfidence of employees about own-company performance is leading explanation for provision of stock options to rank-and-file employees
  – Stock options common form of compensation: (Black and Scholes) value of options granted yearly to employees in public companies over $400 (about one percent of compensation) in 1999 (Oyer and Schaefer, 2005)
  – Incentive effects unlikely to explain the issuance: contribution of individual employee to firm value very limited
  – Overconfidence about own-company performance can make stock options an attractive compensation format for employers
– Overconfidence needs to be larger for employees than for top managers (problem set 2)
– Sorting contributes: Overconfidence plausible since workers overconfident about a company sort into it

• However, Bergman and Jenter (2007): employees can also purchase shares on open market, do not need to rely on the company providing them
  – Under what conditions company will still offer options to overconfident employees?
  – Also, why options and not shares in company?
  – Bergman and Jenter (2007): option compensation is used most intensively by company when employees more likely to be overconfident based on proxy (past returns)
Example 3. Overconfidence about ability by CEOs

Malmendier-Tate (JF 2005 and JFE 2008)

Assume that CEOs overestimate their capacity to create value

Implications for:
- Investment decisions (MT 2005)
- Mergers (MT 2008)
- Equity issuance (MT 2010)

Focus on merger implications

Slides courtesy of Ulrike
Model

Assumptions

1. CEO acts in interest of current shareholders.  
   *(No agency problem.)*

2. Efficient capital market.  
   *(No asymmetric information.)*

Notation

\[ V_A = \text{market value of the acquiring firm} \]
\[ V_T = \text{market value of the target firm} \]
\[ V = \text{market value of the combined firm} \]
\[ \hat{V}_A = \text{acquiring CEO’s valuation of his firm} \]
\[ \hat{V} = \text{acquiring CEO’s valuation of the combined firm} \]
\[ c = \text{cash used to finance the merger} \]
Rational CEO

- Target shareholders demand share $s$ of firm such that:
  \[ sV = V_T - c. \]

- CEO decides to merge if $V - (V_T - c) > V_A$ (levels).
  \[ \Rightarrow \text{Merge if } e > 0 \text{ (differences), where } e \text{ is “synergies.”} \]
  \[ \Rightarrow \text{First-best takeover decision.} \]

- Post-acquisition value to current shareholders:
  \[ \bar{V} = V - (V_T - c) = (V_A + V_T + e - c) - (V_T - c) = V_A + e \]
  \[ \Rightarrow \frac{\partial \bar{V}}{\partial c} = 0 \text{ (No financing prediction.)} \]
Overconfident CEO (I)

- CEO overestimates future returns to own firm:
  \[ \hat{V}_A > V_A \]

  CEO overestimates returns to merger:
  \[ \hat{V} - V > \hat{V}_A - V_A \]

- Target shareholders demand share \( s \) of firm such that:
  \[ sV = V_T - c \]

  CEO believes he should have to sell \( s \) such that:
  \[ s\hat{V} = V_T - c \]
Overconfident CEO (II)

- CEO decides to merge if

\[ \hat{V} - (V_T - c) - \left[ \frac{(\hat{V} - V)(V_T - c)}{V} \right] > \hat{V}_A \] (levels),

i.e. merges if

\[ e + \hat{e} > \left[ \frac{(\hat{V}_A - V_A + \hat{e})(V_T - c)}{V} \right] \] (differences),

where \( \hat{e} \) are perceived “synergies.”
Propositions

Compare

\[ V(c) - (V_T - c) > V_A. \]
and

\[ \hat{V}(c) - (V_T - c) - \frac{[\hat{V}(c)-V(c)](V_T-c)}{V(c)} > \hat{V}_A. \]

1. Overconfident managers do some value-destroying mergers. (Rational CEOs do not.)

2. An overconfident manager does more mergers than a rational manager when internal resources are readily available.

3. An overconfident manager may forgo some value-creating mergers. (Rational managers do not.)
Empirical Predictions

1. On average?
2. Overconfident CEOs do more mergers that are likely to destroy value
3. Overconfident CEOs do more mergers when they have abundant internal resources
4. The announcement effect after overconfident CEOs make bids is lower than for rational CEOs
Data

Data on private accounts

   Yermack (1995)

   Key: Panel data on stock and option holdings of CEOs of Forbes 500 companies 1980-1994

2. Personal information about these CEOs from
   - Dun & Bradstreet
   - Who’s who in finance

Data on corporate accounts

1. CRSP/COMPUSTAT

   Cash flow, Q, stock price…

2. CRSP/SDC-merger databases

   Acquisitions
Primary Measure of Overconfidence
“Longholder”
(Malmendier and Tate 2003)

CEO holds an option until the year of expiration.
CEO displays this behavior at least once during sample period.
→ minimizes impact of CEO wealth, risk aversion, diversification

Robustness Checks:
1. Require option to be at least $x\%$ in the money at the beginning of final year
2. Require CEO to *always* hold options to expiration
3. Compare “late exercisers” to “early exercisers”
Identification Strategy (I)

Case 1:
Wayne Huizenga (Cook Data Services/Blockbuster)
• CEO for all 14 years of sample
• Longholder

J Willard Marriott (Marriott International)
• CEO for all 15 years of sample
• Not a Longholder

AND

Case 2:
Colgate Palmolive
• Keith Crane CEO from 1980-1983 (Not a Longholder)
• Reuben Mark CEO from 1984-1994 (Longholder)
Table 4. Do Overconfident CEOs Complete More Mergers?

<table>
<thead>
<tr>
<th>Variable</th>
<th>logit with controls</th>
<th>random effects</th>
<th>logit with fixed effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>0.8733</td>
<td>0.8600</td>
<td>0.6234</td>
</tr>
<tr>
<td>Qt-1</td>
<td>0.7296</td>
<td>0.7316</td>
<td>0.8291</td>
</tr>
<tr>
<td>Cash Flow</td>
<td>2.0534</td>
<td>2.1816</td>
<td>2.6724</td>
</tr>
<tr>
<td>Ownership</td>
<td>1.2905</td>
<td>1.3482</td>
<td>0.8208</td>
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<tr>
<td>Vested Options</td>
<td>1.5059</td>
<td>0.9217</td>
<td>0.2802</td>
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<tr>
<td>Governance</td>
<td>0.6556</td>
<td>0.7192</td>
<td>1.0428</td>
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<tr>
<td>Longholder</td>
<td>1.5557</td>
<td>1.7006</td>
<td>2.5303</td>
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<tr>
<td>Year Fixed Effects</td>
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<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Observations</td>
<td>3690</td>
<td>3690</td>
<td>2261</td>
</tr>
<tr>
<td>Firms</td>
<td>327</td>
<td>184</td>
<td></td>
</tr>
</tbody>
</table>

Longholder = holds options until last year before expiration (at least once)

Distribution: Logistic. Constant included.

Dependent Variable: Acquisition (yes or no); Normalization: Capital.
Table 6. Are Overconfident CEOs Right to Hold Their Options? (I)

Returns from exercising 1 year sooner and investing in the S&P 500 index

<table>
<thead>
<tr>
<th>Percentile</th>
<th>Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>10th</td>
<td>-0.24</td>
</tr>
<tr>
<td>20th</td>
<td>-0.15</td>
</tr>
<tr>
<td>30th</td>
<td>-0.10</td>
</tr>
<tr>
<td>40th</td>
<td>-0.05</td>
</tr>
<tr>
<td>50th</td>
<td>-0.03</td>
</tr>
<tr>
<td>60th</td>
<td>0.03</td>
</tr>
<tr>
<td>70th</td>
<td>0.10</td>
</tr>
<tr>
<td>80th</td>
<td>0.19</td>
</tr>
<tr>
<td>90th</td>
<td>0.39</td>
</tr>
</tbody>
</table>

Mean 0.03

Standard Deviation 0.27

All exercises occur at the maximum stock price during the fiscal year
Alternative Explanations

1. Inside Information or Signalling
   • Mergers should “cluster” in final years of option term
   • Market should react favorably on merger announcement
   • CEOs should “win” by holding

2. Stock Price Bubbles
   • Year effects already removed
   • All cross-sectional firm variation already removed
   • Lagged stock returns should explain merger activity

3. Volatile Equity

4. Finance Training
Empirical Predictions

| Rational CEO | Overconfident CEO |

1. On average?
2. Overconfident CEOs do more mergers that are likely to destroy value
3. Overconfident CEOs do more mergers when they have abundant internal resources
4. The announcement effect after overconfident CEOs make bids is lower than for rational CEOs
### Table 8. Diversifying Mergers

**Longholder** = holds options until last year before expiration (at least once)

**Distribution:** Logistic. Constant included; **Normalization:** Capital.

**Dependent Variable:** Diversifying merger (yes or no).

<table>
<thead>
<tr>
<th></th>
<th>logit</th>
<th>logit with random effects</th>
<th>logit with fixed effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longholder</td>
<td>1.6008</td>
<td>1.7763</td>
<td>3.1494</td>
</tr>
<tr>
<td></td>
<td>(2.40)**</td>
<td>(2.70)***</td>
<td>(2.59)***</td>
</tr>
<tr>
<td>Year Fixed Effects</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Observations</td>
<td>3690</td>
<td>3690</td>
<td>1577</td>
</tr>
<tr>
<td>Firms</td>
<td>327</td>
<td>128</td>
<td></td>
</tr>
</tbody>
</table>

**Dependent Variable:** Intra-industry merger (yes or no).

<table>
<thead>
<tr>
<th></th>
<th>logit</th>
<th>logit with random effects</th>
<th>logit with fixed effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longholder</td>
<td>1.3762</td>
<td>1.4498</td>
<td>1.5067</td>
</tr>
<tr>
<td></td>
<td>(1.36)</td>
<td>(1.47)</td>
<td>(0.75)</td>
</tr>
<tr>
<td>Year Fixed Effects</td>
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<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Observations</td>
<td>3690</td>
<td>3690</td>
<td>1227</td>
</tr>
<tr>
<td>Firms</td>
<td>327</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Regressions include Cash Flow, $Q_{t-1}$, Size, Ownership, Vested Options, and Governance. Industries are Fama French industry groups.
Empirical Predictions

Rational CEO

Overconfident CEO

1. On average?
2. Overconfident CEOs do more mergers that are likely to destroy value
3. Overconfident CEOs do more mergers when they have abundant internal resources
4. The announcement effect after overconfident CEOs make bids is lower than for rational CEOs
Kaplan-Zingales Index

\[ KZ = -1.00 \cdot \frac{\text{CashFlow}}{\text{Capital}} + 0.28 \cdot Q + 3.14 \cdot \text{Leverage} - 39.37 \cdot \frac{\text{Dividends}}{\text{Capital}} - 1.31 \cdot \frac{\text{Cash}}{\text{Capital}} \]

- Coefficients from logit regression (Pr\{financially constrained\})
- High values → Cash constrained
  - Leverage captures debt capacity
  - Deflated cash flow, cash, dividends capture cash on hand
  - Q captures market value of equity (Exclude?)
Table 9. Kaplan-Zingales Quintiles

Longholder = holds options until last year before expiration (at least once)

Distribution: Logistic. Constant included.

Dependent Variable: Acquisition (yes or no); Normalization: Capital.

All regressions are logit with random effects.

<table>
<thead>
<tr>
<th>Quintile 1</th>
<th>Quintile 2</th>
<th>Quintile 3</th>
<th>Quintile 4</th>
<th>Quintile 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longholder</td>
<td></td>
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<tr>
<td></td>
<td>2.2861</td>
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<tr>
<td></td>
<td>(2.46)**</td>
<td>(1.48)</td>
<td>(1.54)</td>
<td>(1.50)</td>
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<tr>
<td>Year Fixed Effects</td>
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<td>yes</td>
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<td>719</td>
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</table>

Diversifying Mergers

<table>
<thead>
<tr>
<th>Quintile 1</th>
<th>Quintile 2</th>
<th>Quintile 3</th>
<th>Quintile 4</th>
<th>Quintile 5</th>
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<tbody>
<tr>
<td>Longholder</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>2.5462</td>
<td>1.8852</td>
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<td></td>
<td>(1.89)*</td>
<td>(1.51)</td>
<td>(1.36)</td>
<td>(0.01)</td>
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<td>Year Fixed Effects</td>
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<td>yes</td>
<td>yes</td>
<td>yes</td>
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<tr>
<td>Observations</td>
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<td>719</td>
<td>719</td>
<td>719</td>
</tr>
<tr>
<td>Firms</td>
<td>125</td>
<td>156</td>
<td>168</td>
<td>165</td>
</tr>
</tbody>
</table>

Regressions include Cash Flow, Qt-1, Size, Ownership, Vested Options, and Governance.
Empirical Predictions

<table>
<thead>
<tr>
<th>Rational CEO</th>
<th>Overconfident CEO</th>
</tr>
</thead>
</table>

1. On average?
2. Overconfident CEOs do more mergers that are likely to destroy value
3. Overconfident CEOs do more mergers when they have abundant internal resources
4. The announcement effect after overconfident CEOs make bids is lower than for rational CEOs
## Table 14. Market Response

**Longholder** = holds options until last year before expiration (at least once)

**Dependent Variable:** Cumulative abnormal returns [-1,+1]

<table>
<thead>
<tr>
<th></th>
<th>OLS (3)</th>
<th>OLS (4)</th>
<th>OLS (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relatedness</td>
<td>0.0048</td>
<td>0.0062</td>
<td>0.0043</td>
</tr>
<tr>
<td></td>
<td>(1.37)</td>
<td>(1.24)</td>
<td>(1.24)</td>
</tr>
<tr>
<td>Corporate Governance</td>
<td>0.0079</td>
<td>0.0036</td>
<td>0.0073</td>
</tr>
<tr>
<td></td>
<td>(2.18)**</td>
<td>(0.64)</td>
<td>(1.98)**</td>
</tr>
<tr>
<td>Cash Financing</td>
<td>0.014</td>
<td>0.0127</td>
<td>0.0145</td>
</tr>
<tr>
<td></td>
<td>(3.91)***</td>
<td>(2.60)***</td>
<td>(3.99)***</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td><strong>-0.0005</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(1.46)</td>
</tr>
<tr>
<td>Boss</td>
<td></td>
<td></td>
<td>0.0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.04)</td>
</tr>
<tr>
<td>Longholder</td>
<td><strong>-0.0067</strong></td>
<td><strong>-0.0099</strong></td>
<td><strong>-0.0079</strong></td>
</tr>
<tr>
<td></td>
<td>(1.81)*</td>
<td>(2.33)**</td>
<td>(2.00)**</td>
</tr>
</tbody>
</table>

Year Fixed Effects: yes, Industry Fixed Effects: no, Industry*Year Fixed Effects: no

Observations: 687

R-squared: 0.10, 0.58, 0.10

Regressions include Ownership and Vested Options.
Do Outsiders Recognize CEO Overconfidence?

Portrayal in Business Press:

1. Articles in
   - New York Times
   - Business Week
   - Financial Times
   - The Economist
   - Wall Street Journal
3. Articles which characterize CEO as
   - Confident or optimistic
   - Not confident or not optimistic
   - Reliable, conservative, cautious, practical, steady or frugal
**Table 13. Press Coverage and Diversifying Mergers**

<table>
<thead>
<tr>
<th></th>
<th>logit</th>
<th>logit with random effects</th>
<th>logit with fixed effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTALconfident</td>
<td>1.6971</td>
<td>1.7826</td>
<td>1.5077</td>
</tr>
<tr>
<td></td>
<td>(2.95)***</td>
<td>(3.21)***</td>
<td>(1.48)</td>
</tr>
<tr>
<td>Year Fixed Effects</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Observations</td>
<td>3647</td>
<td>3647</td>
<td>1559</td>
</tr>
<tr>
<td>Firms</td>
<td>326</td>
<td>326</td>
<td>128</td>
</tr>
</tbody>
</table>

**Dependent Variable:** Diversifying merger (yes or no).

<table>
<thead>
<tr>
<th></th>
<th>logit</th>
<th>logit with random effects</th>
<th>logit with fixed effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTALconfident</td>
<td>1.0424</td>
<td>1.0368</td>
<td>0.8856</td>
</tr>
<tr>
<td></td>
<td>(0.20)</td>
<td>(0.16)</td>
<td>(0.31)</td>
</tr>
<tr>
<td>Year Fixed Effects</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Observations</td>
<td>3647</td>
<td>3647</td>
<td>1226</td>
</tr>
<tr>
<td>Firms</td>
<td>326</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Regressions include Total Coverage, Cash Flow, Q₁, Size, Ownership, Vested Options, and Governance. Industries are Fama French industry groups.
• Overconfidence/Overprecision: Overestimate the precision of one’s estimates

• Alpert-Raiffa (1982). Ask questions such as
  – ‘The number of "Physicians and Surgeons" listed in the 1968 Yellow Pages of the phone directory for Boston and vicinity’
  – ‘The total egg production in millions in the U.S. in 1965.’
  – ‘The toll collections of the Panama Canal in fiscal 1967 in millions of dollars’

• Ask for 99 percent confidence intervals for 1,000 questions

• No. of errors: 426! (Compare to expected 20)

• (Issue: Lack of incentives)
• **Investor Overconfidence: Odean (1999)**

• Investor overconfidence/overprecision predicts excessive trading
  – investor believes signal is too accurate -> Executes trade

• Empirical test using data set from discount brokerage house

• Follow all trades of 10,000 accounts

• January 1987-December 1993

• 162,948 transactions
• Traders that overestimate value of their signal trade too much

• Substantial cost for trading too much:
  – Commission for buying 2.23 percent
  – Commission for selling 2.76 percent
  – Bid-ask spread 0.94 percent
  – Cost for ‘round-trip purchase’: 5.9 percent (!)
• Stock return on purchases must be at least 5.9 percent.

• Compute buy-and-hold returns

• Evidence: Sales outperform purchases by 2-3 percent!

<table>
<thead>
<tr>
<th></th>
<th>Panel A: All Transactions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
</tr>
<tr>
<td>Purchases</td>
<td>49,948</td>
</tr>
<tr>
<td>Sales</td>
<td>47,535</td>
</tr>
<tr>
<td>Difference</td>
<td></td>
</tr>
<tr>
<td>N1</td>
<td></td>
</tr>
<tr>
<td>N2</td>
<td></td>
</tr>
</tbody>
</table>
• Is the result weaker for individuals that trade the most? No

<table>
<thead>
<tr>
<th></th>
<th>84 trading days later</th>
<th>252 trading days later</th>
<th>504 trading days later</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchases</td>
<td>29,078</td>
<td>2.13</td>
<td>7.07</td>
</tr>
<tr>
<td>Sales</td>
<td>26,732</td>
<td>3.04</td>
<td>9.76</td>
</tr>
<tr>
<td>Difference</td>
<td>-0.91</td>
<td>-2.69</td>
<td>-3.50</td>
</tr>
<tr>
<td>N1</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>N2</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.010)</td>
</tr>
</tbody>
</table>

• Huge cost to trading for individuals:
  – Transaction costs
  – Pick wrong stocks
• Barber and Odean, 2001: Gender difference
  – Psychology: Men more overconfident than women about financial decisions
  – Trading data: men trade 45 percent more than women ⇒ pay a larger returns cost

• This is correlational evidence:
  – gender correlates with overconfidence + gender correlates with trading
    ⇒ Overconfidence explanations
  – However: Gender may proxy for unobservables of investors that correlate with trading activity

• General issue with correlations design (Michigan and NYU schools + Heckman proponents of this)
• How to get around this?

• **D’Acunto (2013):** Use priming
  
  – Run experiments on lottery choices resembling investment decisions (on MTurk)
  
  – Control group just reads a neutral short reading
  
  – Treated group reads a text priming strong gender identity
  
  – Male priming should affect overconfidence
  
  – Male priming could affect overconfidence too in compensatory fashion
  
  – Effect on lottery choices $\rightarrow$ More risk taking
• Overconfidence/overprecision can explain other puzzles in asset pricing:
  – short-term positive correlation of returns (momentum)
  – long-term negative correlation (long-term reversal)

• **Daniel-Hirshleifer-Subrahmanyam (1998)**

• Assume overconfidence + self-attribution bias (discount information that is inconsistent with one’s priors)
  – Overconfidence $\rightarrow$ trade excessively in response to private information
  – Long-term: public information prevails, valuation returns to fundamentals $\rightarrow$ long-term reversal
  – Short-term: additional private information interpreted with self-attribution bias $\rightarrow$ become even more overconfident

• Two other explanations for this: Law of small numbers $\pm$ Limited attention
5 Law of Small Numbers

- Overconfidence is only one form of non-Bayesian beliefs

- Tversky-Kahneman (1974). Individuals follow heuristics to simplify problems:
  - Anchoring. $\rightarrow$ Leads to over-precision (above)
  - Availability. $\rightarrow$ Connected to limited attention (next lecture)
  - Representativeness. $\rightarrow$ Today’s lecture

- Individuals expect random draws to be exceedingly representative of the distribution they come from
  - HTHHTT judged more representative than HHHTTT
  - But the two are equally likely! (exchangeability)
• Rabin (QJE, 2002). Law of Small Numbers
  
  – I.i.d. signals from urn drawn with replacement
  
  – Subjects instead believe drawn from an urn of size $N < \infty$ without replacement
  
  – $\rightarrow$ Gambler’s Fallacy: After signal, subject expect next draw to be a different signal
  
  – Example: Return to mutual fund is drawn from an urn with 10 balls, 5 Up and 5 Down (with replacement)
  
  – Observe ‘Up, Up’ — Compute probability of another Up
    * Bayesian: .5
    * Law of Small Numbers: $3/8 < .5$
  
  – Example of representativeness: ‘Up, Up, Down’ more representative than ‘Up, Up, Up’
• Evidence on gambler’s fallacy.

• Clotfelter and Cook (MS, 1993)

• Lotteries increasingly common in US ($17bn sales in 1989)

• Maryland daily-numbers lottery → Bet on 3-digit number
  – Probability of correct guess .001
  – Payout: $500 per $1 bet (50 percent payout)

• Gambler’s Fallacy → Betters will stop betting on number just drawn
  – Examine 52 winning numbers in 1988
  – In 52 of 52 cases (!) betting volume decreases 3 days after win, relative to baseline
- Substantial decrease in betting right after number is drawn
- Effect lasts about 3 months
- However: no cost for fallacy → Does effect replicate with cost?
• Terrell (JRU, 1994)

• New Jersey’s pick-three-numbers game (1988-1992)

• Pari-mutuel betting system
  – the fewer individuals bet on a number, the higher is the expected payout
  – Cost of betting on popular numbers
    – Payout ratio .52 $\Rightarrow$ Average win of $260$ for $50c$ bet

• Issue: Do not observe betting on all numbers $\Rightarrow$ Use payout for numbers that repeat
Table 1. Average payouts to winning numbers

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winners repeating within 1 week</td>
<td>8</td>
<td>349.06</td>
<td>91.66</td>
</tr>
<tr>
<td>Winners repeating between 1 and 2 weeks</td>
<td>8</td>
<td>349.44</td>
<td>81.56</td>
</tr>
<tr>
<td>Winners repeating between 2 and 3 weeks</td>
<td>14</td>
<td>307.76</td>
<td>58.33</td>
</tr>
<tr>
<td>Winners repeating between 3 and 8 weeks</td>
<td>59</td>
<td>301.03</td>
<td>70.55</td>
</tr>
<tr>
<td>Winners not repeating within 8 weeks</td>
<td>1622</td>
<td>260.11</td>
<td>57.98</td>
</tr>
<tr>
<td>All Winners</td>
<td>1714</td>
<td>262.79</td>
<td>57.99</td>
</tr>
</tbody>
</table>

- Strong gambler's fallacy:
  - Right after win, 34 percent decrease in betting
  - 34 percent payout increase
  - Effect dissipates over time
• Comparison with Maryland lottery:
  
  – Smaller effect (34 percent vs. 45 percent)

  – $\rightarrow$ Incentives temper phenomenon, but only partially

• Other applications:

  – Probabilities are known, but subjects misconstrue the i.i.d. nature of the draws.

  – Example: Forecast of the gender of a third child following two boys (or two girls)
• Back to **Rabin (QJE, 2002).**
  
  - Probabilities known $\rightarrow$ Gambler’s Fallacy
  - Probabilities not known $\rightarrow$ Overinference: After signals of one type, expect next signal of *same* type

• Example:
  
  - Mutual fund with a manager of uncertain ability.
  - Return drawn with replacement from urn with 10 balls
    * Probability .5: fund is well managed (7 balls Up and 3 Down)
    * Probability .5: fund is poorly managed (3 Up and 7 Down)
  - Observe sequence ‘Up, Up, Up’ $\rightarrow$ What is $P(Well|UUU)$?
    * Bayesian: $P(Well|UUU) = .5P(UUU|Well)/[.5P(UUU|Well) + .5P(UUU|Poor)] = .7^3 / (.7^3 + .3^3) \approx .927$. 
* Law-of-Small-Number: $P(\text{Well}|UUU) = \frac{7/10 \times 6/9 \times 5/8}{[(7/10 \times 6/9 \times 5/8) + (3/10 \times 2/9 \times 1/8)]} \approx .972.$

* Over-inference about the ability of the mutual-fund manager

- Also assume:
  * Law-of-Small-Number investor believes that urn replenished after 3 periods
  * Need re-start or

- What is Forecast of $P(U|UUU)$?
  * Bayesian: $P(U|UUU) = .927 \times .7 + (1 - .927) \times .3 \approx .671$
  * Law-of-Small-Number: $P(U|UUU) = .972 \times .7 + (1 - .972) \times .3 \approx .689$

• Over-inference despite the gambler’s fallacy beliefs
• Substantial evidence of over-inference (also called extrapolation)

• Notice: Case with unknown probabilities is much more common than lottery case

• Excellent review: Fuster, Laibson, and Mendel (JEP 2010)

• Benartzi (JF, 2001)
  – Examine investment of employees in employer stock
  – Does it depend on the past performance of the stock?

• Sample:
  – S&P 500 companies with retirement program
  – Data from 11-k filing
  – 2.5 million participants, $102bn assets
Buy-and-Hold Raw Returns and Subsequent Allocations to Company Stock as a Percentage of Discretionary Contributions

This table displays equally weighted mean allocations to company stock (as a percentage of discretionary contributions) by quintile of past buy-and-hold raw returns. Company stock allocations are measured at the end of 1993. Portfolio 1 (5) includes retirement savings plans with the lowest (highest) past buy-and-hold raw returns. The table also provides the difference between the allocations of the extreme portfolios (i.e., portfolio 5 minus portfolio 1) and t-statistics. N = 142.

<table>
<thead>
<tr>
<th>Quintiles Formed on the Basis of Buy-and-Hold Raw Returns for:</th>
<th>Quintile of Buy-and-Hold Returns</th>
<th>Observed Difference (5 − 1)</th>
<th>T-Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior year</td>
<td>(Low) 1 2 3 4 5 (High)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior 2 years</td>
<td>21.10% 23.16% 27.85% 25.99% 23.70%</td>
<td>2.60%</td>
<td>0.60</td>
</tr>
<tr>
<td>Prior 3 years</td>
<td>22.61% 22.43% 25.18% 28.74% 22.96%</td>
<td>0.35</td>
<td>0.06</td>
</tr>
<tr>
<td>Prior 4 years</td>
<td>14.14% 25.45% 26.21% 28.84% 27.78%</td>
<td>13.64</td>
<td>3.33</td>
</tr>
<tr>
<td>Prior 5 years</td>
<td>11.74% 22.20% 28.18% 31.10% 30.23%</td>
<td>18.49</td>
<td>4.64</td>
</tr>
<tr>
<td>Prior 6 years</td>
<td>12.64% 18.68% 26.27% 34.66% 31.21%</td>
<td>18.57</td>
<td>4.33</td>
</tr>
<tr>
<td>Prior 7 years</td>
<td>11.99% 18.72% 29.33% 33.45% 29.96%</td>
<td>17.97</td>
<td>4.63</td>
</tr>
<tr>
<td>Prior 8 years</td>
<td>11.36% 18.98% 24.11% 34.79% 33.70%</td>
<td>22.34</td>
<td>5.87</td>
</tr>
<tr>
<td>Prior 9 years</td>
<td>11.46% 20.69% 24.22% 32.96% 33.63%</td>
<td>22.17</td>
<td>5.70</td>
</tr>
<tr>
<td>Prior 10 years</td>
<td>11.08% 20.76% 20.52% 34.04% 36.68%</td>
<td>25.60</td>
<td>6.49</td>
</tr>
<tr>
<td>Prior 10 years</td>
<td>10.37% 19.68% 21.56% 31.51% 39.70%</td>
<td>29.33</td>
<td>8.39</td>
</tr>
</tbody>
</table>

- Very large effect of past returns + Effect depends on long-term performance
- Is the effect due to inside information?

<table>
<thead>
<tr>
<th>Allocation to company stock as a percentage of discretionary contributions</th>
<th>Allocation to Company Stock</th>
<th>Observed Difference (5 - 1)</th>
<th>Threshold for Significant Difference at $\alpha = 10%$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocation to company stock</td>
<td>(Low) 1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>One-year returns</td>
<td>6.64</td>
<td>6.55</td>
<td>1.27</td>
</tr>
<tr>
<td>Two-year returns</td>
<td>43.69</td>
<td>40.78</td>
<td>38.24</td>
</tr>
<tr>
<td>Three-year returns</td>
<td>59.29</td>
<td>70.28</td>
<td>68.64</td>
</tr>
<tr>
<td>Four-year returns</td>
<td>101.08</td>
<td>114.55</td>
<td>109.89</td>
</tr>
</tbody>
</table>

- No evidence of insider information

- Over-inference pattern observed for investors of all types
• Over-inference pattern observed for investors of all types

• **Barber-Odean-Zhou (JFE, forthcoming):** Uses Individual trades data
  – Individual US investors purchase stocks with high past returns
  – Average stock that individual investors purchase outperformed the stock market in the previous three years by over 60 percent

• **Kaustia and Knupfer (JF 2008)**
  – Use Finnish data to be able to track individual investors over time
  – Examine investors that subscribe to an IPO in a 1st period, 1995-Oct. 1999
  – Return is highly idiosyncratic
  – Indeed, Figure 1 shows no predictability on returns in second period: Nov. 1999-Dec. 2000
• What about probability of subscribing to IPOs in second period?
• Strong effect of personally experience returns

Figure 2. Likelihood of further participation by past subscription activity and past initial returns. This figure is based on a logit regression similar to that in Table II column 1, that is, the dependent variable is one if an investor participates in at least one IPO in the second half, zero otherwise (see more description in Table II header). Unlike in Table II, here previous
• This implies effect on pricing:
  – Stocks with high past returns attract individual investors
  – \( \rightarrow \) Get overpriced
  – \( \rightarrow \) Later mean-revert

• DeBondt and Thaler (1985):
  – Form portfolio of winners in the past 3 years
  – Form portfolio of losers in past 3 years.
  – ‘Winners’ underperform the ‘losers’ by 25 percentage points over the next three years
Figure 1. Cumulative Average Residuals for Winner and Loser Portfolios of 35 Stocks (1-36 months into the test period)
• Barberis-Shleifer-Vishny (JFE, 1998)
  – Alternative model of law of small number in financial markets.
  – Draws of dividends are i.i.d.
  – Investors believe that
    * draws come from ‘mean-reverting’ regime or ‘trending’ regime
    * ‘mean-reverting’ regime more likely ex ante
  – Result: If investors observe sequence of identical signals,
    * Short-Run: Expect a mean-reverting regime (the gambler’s fallacy)
      → Returns under-react to information → Short-term positive correlation (momentum)
    * Long-run: Investors over-infer and expect a ‘trending’ regime → Long-term negative correlation of returns
• Extrapolation also in other contexts

• Gallagher (AEJ Applied 2014)
  – Consider idiosyncratic flood events
  – Largely uncorrelated from year to year
  – Statistical information on flood probabilities available
  – What is the effect of a recent flood?
  – Large increase in probability of insurance

• Effect is present also for communities not directly hit

• What explains the effect? Media salience is critical
Figure 2: Flood Insurance Take-up for Communities Hit by a Presidential Disasters Declaration Flood 1990-2007
Figure 3: Flood Insurance Take-up for Hit and Non-Hit Communities within Presidential Disaster Declaration Flooded Counties 1990-2007
Figure 8: Flood Insurance Take-up for Geographic and Media Neighbors

Each panel contains coefficients from a distinct event study regression using a version of Equation (2) and the 1980-2007 panel. Panel A includes event time indicators for communities located in one of the five closest non-flooded counties. Panel B includes event time indicators for non-flooded communities located in the same TV media market as a flooded community. Panel C includes both geographic and media indicators. Panel D includes both geographic and media indicators, and their interaction (not displayed).
6 Projection Bias

- Beliefs systematically biased toward current state

- Read-van Leeuwen (1998):
  - Office workers choose a healthy snack or an unhealthy snack
  - Snack will be delivered a week later (in the late afternoon).
  - Two groups: Workers are asked
    * when plausibly hungry (in the late afternoon) → 78 percent chose an unhealthy snack
    * when plausibly satiated (after lunch).→ 42 percent choose unhealthy snack
• **Gilbert, Pinel, Wilson, Blumberg, and Wheatly (1999):**
  
  – Individuals under-appreciate adaptation to future circumstances \(\rightarrow\) Projection bias about future reference point

  – Subjects forecast happiness for an event

  – Compare predictions to responses after the event has occurred

  – Thirty-three current assistant professors at the University of Texas (1998) forecast that getting tenure would significantly improve their happiness (5.9 versus 3.4 on a 1-7 scale).

  – Difference in rated happiness between 47 assistant professors that were awarded tenure by the same university and 20 that were denied tenure is smaller and not significant (5.2 versus 4.7).

  – Similar results as function of election of a Democratic of Republican president, compared to the realized ex-post differences.
• Projection bias. (Loewenstein, O’Donoghue, and Rabin (2003))
  – Individual is currently in state \( s' \) with utility \( u(c, s') \)
  – Predict future utility in state \( s \)
  – Simple projection bias:
    \[
    \hat{u}(c, s) = (1 - \alpha)u(c, s) + \alpha u(c, s')
    \]
  – Parameter \( \alpha \) is extent of projection bias \( \Rightarrow \alpha = 0 \) implies rational forecast

• Notice: People misforecast utility \( \hat{u} \), not state \( s \); however, same results if the latter applies
• Conlin-O’Donoghue-Vogelsang (2006)
• Purchasing behavior: Cold-weather items
• Main Prediction:
  – Very cold weather
  – $\rightarrow$ Forecast high utility for cold-weather clothes
  – $\rightarrow$ Purchase ‘too much’
  – $\rightarrow$ Higher return probability
• Denote temperature at Order time as $\omega_O$ and temperature at Return time as $\omega_R$
• Predictions:
  1. If $\alpha = 0$ (no proj. bias), $P[R|O]$ is independent of $\omega_O$ and $\omega_R$
  2. If $\alpha > 0$ (proj. bias), $\partial P[R|O]/\partial \omega_O < 0$ and $\partial P[R|O]/\partial \omega_R > 0$
• Purchase data from US Company selling outdoor apparel and gear
  – January 1995-December 1999, 12m items
  – Date of order and date of shipping + Was item returned
  – Shipping address

• Weather data from National Climatic Data Center
  – By 5-digit ZIP code, use of closest weather station

• Items:
  – Parkas/Coats/Jackets Rated Below 0F
  – Winter Boots
  – Drop mail orders, if billing and shipping address differ, >9 items ordered, multiple units same item, low price
  – No. obs. 2,200,073

• Note: Probability of return fairly high, Delay between order and receipt 4-5 days
<table>
<thead>
<tr>
<th></th>
<th>Gloves/ Mittens</th>
<th>Winter Boots</th>
<th>Hats</th>
<th>Sports Equipment</th>
<th>Parkas/ Coats</th>
<th>Vests</th>
<th>Jackets</th>
<th>All Seven Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observations</td>
<td>484,084</td>
<td>262,610</td>
<td>484,086</td>
<td>146,594</td>
<td>524,831</td>
<td>151,958</td>
<td>145,910</td>
<td>2,200,073</td>
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<td>Number of Different Items</td>
<td>106</td>
<td>93</td>
<td>88</td>
<td>233</td>
<td>133</td>
<td>20</td>
<td>37</td>
<td>710</td>
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<tr>
<td>Percent Returned</td>
<td>10.9</td>
<td>15.6</td>
<td>10.8</td>
<td>6.6</td>
<td>22.2</td>
<td>12.8</td>
<td>18.0</td>
<td>14.4</td>
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<tr>
<td>Price of Item (dollars)</td>
<td>29.26</td>
<td>68.33</td>
<td>23.74</td>
<td>74.10</td>
<td>148.58</td>
<td>40.90</td>
<td>106.70</td>
<td>70.10</td>
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<tr>
<td>Percent of Buyer’s Prior Purchases Returned</td>
<td>7.2</td>
<td>6.6</td>
<td>6.9</td>
<td>7.2</td>
<td>7.3</td>
<td>6.8</td>
<td>8.2</td>
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<tr>
<td>Number of Buyer’s Prior Purchases</td>
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<td>22.2</td>
<td>23.9</td>
<td>27.7</td>
<td>20.5</td>
<td>21.71</td>
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<td>23.83</td>
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<td>Buyer has a Prior Purchase</td>
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<td>0.82</td>
<td>0.83</td>
<td>0.86</td>
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<td>Days Between Order and Shipment</td>
<td>0.42</td>
<td>0.97</td>
<td>0.72</td>
<td>0.94</td>
<td>2.17</td>
<td>1.24</td>
<td>1.13</td>
<td>1.11</td>
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<tr>
<td>Days Between Order and Receipt</td>
<td>4.13</td>
<td>4.66</td>
<td>4.46</td>
<td>4.58</td>
<td>5.92</td>
<td>5.04</td>
<td>4.89</td>
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<tr>
<td>Ordered Through Internet</td>
<td>0.04</td>
<td>0.03</td>
<td>0.03</td>
<td>0.02</td>
<td>0.04</td>
<td>0.02</td>
<td>0.05</td>
<td>0.03</td>
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<td>Purchased by a Female</td>
<td>0.71</td>
<td>0.66</td>
<td>0.71</td>
<td>0.70</td>
<td>0.66</td>
<td>0.72</td>
<td>0.66</td>
<td>0.69</td>
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<td>0.98</td>
<td>0.97</td>
<td>0.98</td>
<td>0.98</td>
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<td>Items in Order</td>
<td>3.5</td>
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<td>Temperature Rating</td>
<td>-10.11</td>
<td>-5.64</td>
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<td></td>
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</tbody>
</table>

**WEATHER CONDITIONS**

<table>
<thead>
<tr>
<th></th>
<th>Order-Date Temperature (°F)</th>
<th>Receiving-Date Temperature (°F)</th>
<th>Snowfall on Day Item Ordered (0.1&quot;)</th>
<th>Snowfall on Day Item Received (0.1&quot;)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>40.60</td>
<td>39.74</td>
<td>1.79</td>
<td>1.58</td>
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<tr>
<td></td>
<td>39.90</td>
<td>38.97</td>
<td>2.69</td>
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<td></td>
<td>41.48</td>
<td>40.72</td>
<td>1.69</td>
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<td>37.81</td>
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<td>2.35</td>
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<td></td>
<td>43.29</td>
<td>42.29</td>
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<td></td>
<td>44.76</td>
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<td>1.43</td>
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<td></td>
<td>46.88</td>
<td>45.70</td>
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<td>0.66</td>
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<tr>
<td></td>
<td>41.85</td>
<td>40.94</td>
<td>1.70</td>
<td>1.57</td>
</tr>
</tbody>
</table>
• Main estimation: Probit

\[ P(R|O) = \Phi (\alpha + \gamma_O \omega_O + \gamma_R \omega_R + BX) \]

### Table 1

<table>
<thead>
<tr>
<th></th>
<th>Gloves &amp; Mittens</th>
<th>Winter Boots</th>
<th>Hats</th>
<th>Sports Equipment</th>
<th>Parkas &amp; Coats</th>
<th>Vests</th>
<th>Jackets</th>
<th>All Seven Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order-Date Temperature</td>
<td>-0.00013**</td>
<td>-0.00026**</td>
<td>-0.00020**</td>
<td>-0.00011*</td>
<td>-0.00009</td>
<td>-0.00048**</td>
<td>-0.00014</td>
<td>-0.00019**</td>
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<tr>
<td></td>
<td>(0.00005)</td>
<td>(0.00009)</td>
<td>(0.00005)</td>
<td>(0.00006)</td>
<td>(0.00007)</td>
<td>(0.00011)</td>
<td>(0.00013)</td>
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<td>Receiving-Date Temperature</td>
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<td>0.00018*</td>
<td>-0.00005</td>
<td>-0.00008</td>
<td>0.00007</td>
<td>-0.00010</td>
<td>0.00010</td>
<td>0.00003</td>
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<tr>
<td></td>
<td>(0.00006)</td>
<td>(0.00009)</td>
<td>(0.00006)</td>
<td>(0.00007)</td>
<td>(0.00008)</td>
<td>(0.00011)</td>
<td>(0.00014)</td>
<td>(0.00003)</td>
</tr>
<tr>
<td>Price of Item</td>
<td>0.00075**</td>
<td>0.00005</td>
<td>0.00145**</td>
<td>0.00033**</td>
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<td>0.00166**</td>
<td>0.00016</td>
<td>0.00023**</td>
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<tr>
<td></td>
<td>(0.00024)</td>
<td>(0.00013)</td>
<td>(0.00025)</td>
<td>(0.00008)</td>
<td>(0.00004)</td>
<td>(0.00024)</td>
<td>(0.00018)</td>
<td>(0.00003)</td>
</tr>
<tr>
<td>Item Purchased with Credit Card</td>
<td>0.02042**</td>
<td>0.04337**</td>
<td>0.02876**</td>
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<td>0.05893**</td>
<td>0.02294**</td>
<td>0.05312**</td>
<td>0.02531**</td>
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<tr>
<td></td>
<td>(0.00250)</td>
<td>(0.00418)</td>
<td>(0.00244)</td>
<td>(0.00191)</td>
<td>(0.00405)</td>
<td>(0.00535)</td>
<td>(0.00568)</td>
<td>(0.00137)</td>
</tr>
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<td>Items in Order</td>
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<td>0.00012</td>
<td>-0.00035</td>
<td>-0.00078**</td>
<td>0.00196**</td>
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<td>0.00141**</td>
<td>-0.00028**</td>
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<td></td>
<td>(0.00022)</td>
<td>(0.00029)</td>
<td>(0.00022)</td>
<td>(0.00028)</td>
<td>(0.00023)</td>
<td>(0.00045)</td>
<td>(0.00058)</td>
<td>(0.00012)</td>
</tr>
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<td>Clothing Type Fixed Effects</td>
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<td>YES</td>
<td>YES</td>
<td>NO*</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
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<tr>
<td>Item Fixed Effects</td>
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<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
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<tr>
<td>Month-Region Fixed Effects</td>
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<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
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<tr>
<td>Year-Region Fixed Effects</td>
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<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Observations</td>
<td>484,067</td>
<td>262,510</td>
<td>484,085</td>
<td>146,403</td>
<td>524,831</td>
<td>151,958</td>
<td>145,910</td>
<td>2,199,950</td>
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<tr>
<td>R-Squared</td>
<td>0.04</td>
<td>0.05</td>
<td>0.07</td>
<td>0.13</td>
<td>0.03</td>
<td>0.03</td>
<td>0.04</td>
<td>0.07</td>
</tr>
</tbody>
</table>

Table presents marginal effects on the probability that an item is returned. Standard errors are in parentheses.

* Statistically significant at the .10 level; ** Statistically significant at the .05 level.

* Clothing Type information was not provided for sports equipment items.
• Main finding: $\gamma_O < 0$.
  – Warmer weather on order date lowers probability of return
  – **Magnitude:**
  – This goes against standard story: If weather is warmer, less likely you will use it $\Rightarrow$ Return it more
  – Projection Bias: Very cold weather $\Rightarrow$ Mispredict future utility $\Rightarrow$ Return the item

• Second finding: $\gamma_R \approx 0$
  – Warmer weather on (predicted) return does not affect return
  – This may be due to the fact that do not observe when return decision is made
• Similar estimates for linear probability model with household fixed effects

| TABLE 3 |
|-------------------|-------------------------------|-------------------------------|
|                  | Household Fixed Effects       | No Household Fixed Effects    |
| Order-Date Temperature | -0.00002** (0.00027)         | -0.000039** (0.00013)        |
| Receiving-Date Temperature | 0.00017 (0.00029)           | 0.00002 (0.00015)           |

|                | YES                           | YES                           |
| Clothing Type Fixed Effects | YES                           | YES                           |
| Item Fixed Effects             | YES                           | YES                           |
| Month-Region Fixed Effects      | YES                           | YES                           |
| Year-Region Fixed Effects       | YES                           | YES                           |
| Household Fixed Effects         | NO                            |                               |
| Observations                   | 162,380                       | 162,380                       |
| R-Squared                      | 0.19                          | 0.10                          |

• Simple structural model: Estimates of projection bias $\alpha$ around .3-.4

| TABLE 6 |
|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
|                  | Winter Boots      | Hats              | Parkas & Coats    | Vests             | Jackets           |
| $\alpha$          | 0.3064** (0.0570) | 0.4598** (0.00001)| 0.3814** (0.0352) | 0.0002 (0.0056)   | 0.4092** (0.0002) |
• **Busse, Pope, Pope, Silva-Risso (2013):** Evidence from car purchases and house purchases

• Projection bias:
  – Convertible looks particularly attractive on a hot day
  – 4-wheel drive attractive on snowy day
  – House with pool higher selling price on hot day

• Strong evidence in the data
Figure 5. Temperature-Convertible Residuals - Chicago. This Figure provides scatter plots for the residuals of convertible percentage of vehicles sold (Panel B of Figure 3) and residuals of mean high temperature (Panel B of Figure 4) separately for each quarter of the year.

Panel A. Quarter 1

Panel C. Quarter 3

Panel B. Quarter 2

Panel D. Quarter 4

Residuals of Convertible Percentage of Vehicles Sold

Residuals of Mean Temperature

t-stat: 5.2

t-stat: 1.5

t-stat: 4.0

t-stat: 4.7
Figure 10. Snowfall and 4-Wheel Drive Sales - Event Study Design. This Figure plots the weighted average and 95% confidence intervals for the residuals of the 4-wheel drive percentage of total vehicles sold for the twelve weeks leading up to and the twelve weeks after a snow storm event (week 0). The events were chosen to be the highest snowfall week of the year for DMAs that have above-median in weather variation.
Figure 11 - Seasonal Value of a Swimming Pool. Panel A shows the average residual values for homes with swimming pools that go under contract during each month of the year. Panel B shows the estimated effect of a swimming pool on a house's residual sales price, conditional on other house characteristics, as estimated by Equation (7). 95% confidence intervals are also presented.

Panel A. Residuals by Month
7 Next Lecture

- Non-Standard Decision-Making
- Limited Attention
  - Financial Markets
  - Consumption