

Econ 219B  
Psychology and Economics: Applications  
(Lecture 11)

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## Outline

1. Methodology: Clustering Standard Errors II
2. Menu Effects: Choice Avoidance
3. Menu Effects: Preference for Familiar
4. Menu Effects: Preference for Salient
5. Menu Effects: Confusion
6. Persuasion
7. Social Pressure

# 1 Methodology: Clustering Standard Errors II

- White-heteroskedastic:

$$Var(\hat{\beta})_{Het} = \frac{1}{\sum_{it} x_{it}^2} \sum_{it} \frac{(x_{it}\hat{\varepsilon}_{it})^2}{\sum x_{it}^2}$$

- Notice: Second sum is weighted average of  $\hat{\varepsilon}_{it}^2$ , with more weight given to observations with higher  $x_{it}^2$
- If high  $x_{it}^2$  is associated with high  $\hat{\varepsilon}_{it}^2$ ,  $Var(\hat{\beta})_{Het} > Var(\hat{\beta})_{OLS}$

- Standard Errors Clustered by  $I$  (allow for autocorrelation):

$$Var(\hat{\beta})_{Clust} = \frac{1}{\sum_{it} x_{it}^2} \sum_i \frac{(\sum_t x_{it}\hat{\varepsilon}_{it})^2}{\sum x_{it}^2}$$

- First sum all the covariances  $x_{it}\hat{\varepsilon}_{it}$  within a cluster
- Then square up and add across the clusters
- Notice: This is as if one cluster (one  $i$ ) was one observation

- That is, this form of clustering allows

$$E(u_{it}u_{it'}|X_{it}X_{it'}) \neq 0$$

- Correlation within cluster  $i$

- Requires

$$E(u_{it}u_{i't'}|X_{it}X_{i't'}) = 0$$

for  $i \neq i'$

- No correlation across clusters

- When is  $Var(\hat{\beta})_{Clust} > Var(\hat{\beta})_{Het}$ ?

- Example: Assume  $I = 2, T = 2$

$$Var(\hat{\beta})_{Het} = \frac{1}{\sum_{it} x_{it}^2} \frac{(x_{11}\hat{\varepsilon}_{11})^2 + (x_{12}\hat{\varepsilon}_{12})^2 + (x_{21}\hat{\varepsilon}_{21})^2 + (x_{22}\hat{\varepsilon}_{22})^2}{\sum x_{it}^2}$$

- Compare to

$$\begin{aligned} Var(\hat{\beta})_{Clust} &= \frac{1}{\sum_{it} x_{it}^2} \frac{(x_{11}\hat{\varepsilon}_{11} + x_{12}\hat{\varepsilon}_{12})^2 + (x_{21}\hat{\varepsilon}_{21} + x_{22}\hat{\varepsilon}_{22})^2}{\sum x_{it}^2} = \\ &= Var(\hat{\beta})_{Het} + \frac{1}{\sum_{it} x_{it}^2} \frac{2x_{11}\hat{\varepsilon}_{11}\hat{\varepsilon}_{12}x_{12} + 2x_{21}\hat{\varepsilon}_{21}\hat{\varepsilon}_{22}x_{22}}{\sum x_{it}^2} \end{aligned}$$

- Hence,  $Var(\hat{\beta})_{Clust} > Var(\hat{\beta})_{Het}$  if  $Ex_{i1}x_{i2} > 0$  and  $E\hat{\varepsilon}_{i1}\hat{\varepsilon}_{i2} > 0$  → Positive correlation within cluster (that is, over time) among  $x$  variables and  $\varepsilon$

– Positive correlation  $\rightarrow$  Standard errors understated if no clustering

- Notice that instead this does not capture correlation across clusters, that is,  $E\hat{\varepsilon}_{1t}\hat{\varepsilon}_{2t} = 0$  and  $Ex_{1t}x_{2t} > 0$

- Assume now that we cluster by  $T$  instead (allow for cross-sectional correlation):

$$Var(\hat{\beta})_{Clust} = Var(\hat{\beta})_{Het} + \frac{1}{\sum_{it} x_{it}^2} \frac{2x_{11}\hat{\varepsilon}_{11}\hat{\varepsilon}_{21}x_{21} + 2x_{12}\hat{\varepsilon}_{12}\hat{\varepsilon}_{22}x_{22}}{\sum x_{it}^2}$$

- Hence,  $Var(\hat{\beta})_{Clust} > Var(\hat{\beta})_{Het}$  if  $Ex_{1t}x_{2t} > 0$  and  $E\hat{\varepsilon}_{1t}\hat{\varepsilon}_{2t} > 0$   
 $\rightarrow$  Positive correlation within a time period across the observations among  $x$  variables and  $\varepsilon$

- Calculation of Adjustment of Standard Errors due to Clustering

- $T$  observations within cluster
- Within-cluster correlation of  $x_s$ :  $\rho_x$
- Within-cluster correlation of  $\varepsilon$ :  $\rho_\varepsilon$

- Compare  $Var(\hat{\beta})_{Clust}$  and  $Var(\hat{\beta})_{OLS}$ :

$$Var(\hat{\beta})_{Clust} = Var(\hat{\beta})_{OLS} * (1 + (T - 1) \rho_x \rho_\varepsilon)$$

- Standard errors downward biased with  $OLS$  if  $\rho_x \rho_\varepsilon > 0$ , or positive correlations (as above)
- No bias if no correlation in *either*  $x$  or  $\varepsilon$
- Bias larger the larger is  $T$
- Illustrative case: Suppose all observations within cluster identical ( $\rho_x = \rho_\varepsilon = 1$ )  $\rightarrow$  Bias =  $T$

- Issues with clustering:
- Issue 1. **Number of clusters**
  - Convergence with speed  $I \rightarrow$  Need a large number of clusters  $I$  to apply LLN
  - Beware of papers that apply clustering with  $<20$  clusters
  - **Cameron-Gelbach-Miller (2008)**: Test with good finite sample properties even for  $I \approx 10$
- Issue 2. **Cluster in only one dimension**
  - Clustering by  $I$  controls for autocorrelation
  - Clustering by  $T$  controls for cross-sectional correlation
  - How can control for both? **Cameron-Gelbach-Miller (2006)**: Two-way clustering, can do so



- **Cameron-Gelbach-Miller (2006)**. Double-clustered standard errors with respect to  $I$  and  $T$

- Procedure:

1. Compute standard errors clustering by  $I \rightarrow$  Compute  $V(\hat{\beta})_{Cl-I}$
2. Compute standard errors clustering by  $T \rightarrow$  Compute  $V(\hat{\beta})_{Cl-T}$
3. Compute standard errors clustering by  $T * I$  (this typically means s.e.s not clustered, just robust)  $\rightarrow$  Compute  $V(\hat{\beta})_{Cl-T*I}$
4. Final variance and covariance matrix is

$$V(\hat{\beta})_{DoubleCl} = V(\hat{\beta})_{Cl-I} + V(\hat{\beta})_{Cl-T} - V(\hat{\beta})_{Cl-T*I}$$

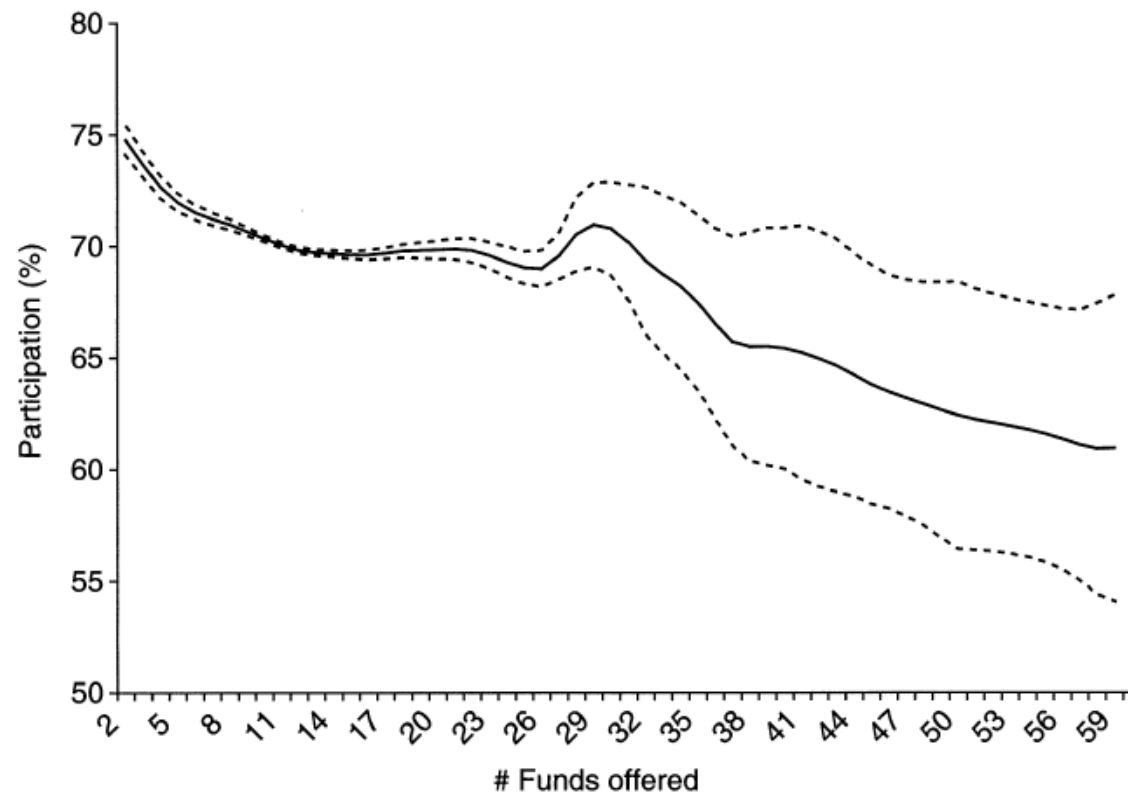
- Intuition: It's variance obtained clustering along one dimension (say,  $I$ ), plus the additional piece of variance along the other dimension that goes beyond the robust s.e.s

- Readings on clustered standard errors:
  - **Stata Manual** → basic, intuitive
  - **Bertrand-Duflo-Mullainathan (QJE, 2004)** → Excellent discussion of practical issues with autocorrelation in diff-in-diff papers, good intuition
  - **Peterson (2007)** → Fairly intuitive, applied to finance
  - **Cameron-Trivedi (2006) and Wooldridge (2003)** → More serious treatment
  - **Colin Cameron (Davis)'s website** → Updates

## 2 Menu Effects: Choice Avoidance

- Second heuristic: Refusal to choose with choice overload
- **Choice Avoidance.** Classical Experiment (**Yiengar-Lepper, JPSP 2000**)
  - Up-scale grocery store in Palo Alto
  - Randomization across time of day of number of jams displayed for taste
    - \* Small number: 6 jams
    - \* Large number: 24 jams
  - Results:
    - \* More consumers sample with Large no. of jams (145 vs. 104 customers)
    - \* *Fewer* consumers buy with Large no. of jams (4 vs. 31 customers)

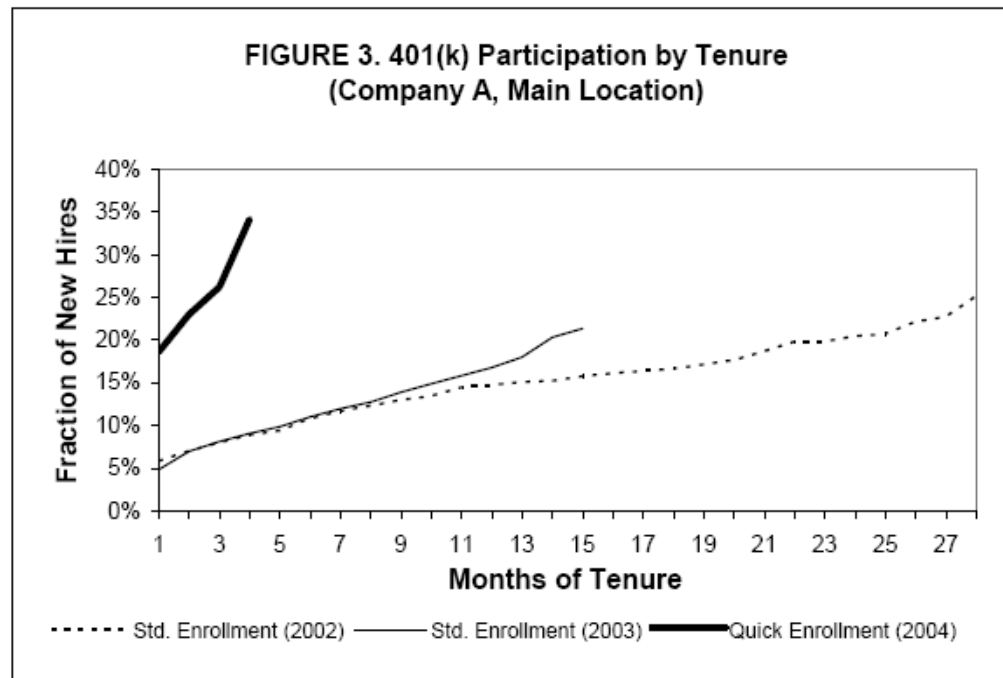
- Field Evidence 1: **Iyengar-Huberman-Lepper (2006)**
- Data set from Fidelity on choice of 401(k) plans
- (Same as for Huberman-Jiang on 1/N)
- Comparison of plans with few options and plans with many options
- Focus on participation rate – Fractions of employees that invest



- Suggestive evidence: Participation rate is decreasing in number of funds

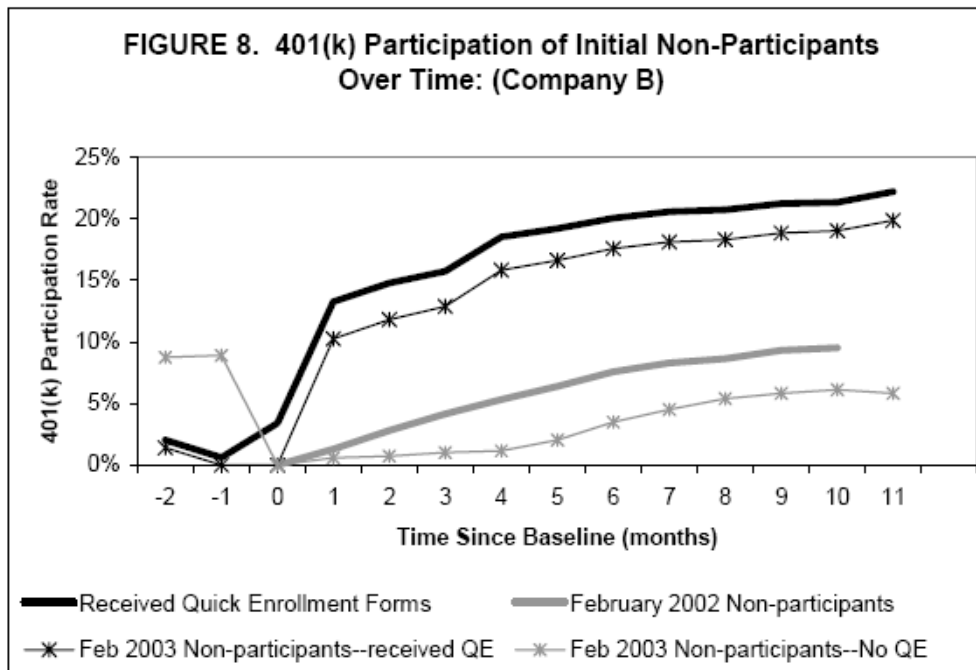
- However, number of funds offered is endogenous: perhaps higher where people are close to indifference → Lower participation
- Field evidence 2: **Choi-Laibson-Madrian (2006)**: Natural experiment
- Introduce in company A of Quick Enrollment
  - Previously: Default no savings
  - 7/2003: Quick Enrollment Card:
    - \* Simplified investment choice: 1 Savings Plan
    - \* Deadline of 2 weeks
  - In practice: Examine from 2/2004

- Company B:
  - Previously: Default no savings
  - 1/2003: Quick Enrollment Card
- Notice: This affects
  - Simplicity of choice
  - But also cost of investing + deadline (self-control)



- 15 to 20 percentage point increase in participation – Large effect
- Increase in participation all on opt-in plan





- Very similar effect for Company B

- What is the effect due to?
- Increase may be due to a reminder effect of the card
- However, in other settings, reminders are not very powerful.
- Example: Choi-Laibson-Madrian (2005):
  - Sent a survey including 5 questions on the benefits of employer match
  - Treatment group: 345 employees that were not taking advantage of the match
  - Control group: 344 employees received the same survey except for the 5 specific questions.
  - Treatment had no significant effect on the savings rate.

- Field Evidence 3: **Bertrand, Karlan, Mullainathan, Zinman (2006)**
- Field Experiment in South Africa
  - South African lender sends 50,000 letters with offers of credit
  - Randomization of interest rate (economic variable)
  - Randomization of psychological variables
  - Crossed Randomization: Randomize independently on each of the  $n$  dimensions
    - \* Plus: Use most efficiently data
    - \* Minus: Can easily lose control of randomization

**Table 2**  
**Summary of Randomized Interventions<sup>a</sup>**

	(1)	(2)	(3)	(4)	(5)
Sample:	All	Customers who did not take up	Customers who took up	“High attention” customer	“Low attention” customer
September wave	0.395 (0.49)	0.394 (0.49)	0.401 (0.49)	0.398 (0.49)	0.393 (0.49)
October wave	0.605 (0.49)	0.606 (0.49)	0.599 (0.49)	0.602 (0.49)	0.607 (0.49)
Offer Interest Rate	7.929 (2.42)	7.985 (2.42)	7.233 (2.31)	6.970 (2.11)	8.384 (2.43)
Small option table	0.432 (0.50)	0.438 (0.50)	0.349 (0.48)	0.250 (0.43)	0.518 (0.50)
No comparison to competitor	0.200 (0.40)	0.200 (0.40)	0.200 (0.40)	0.202 (0.40)	0.199 (0.40)
comparison expressed as a gain	0.401 (0.49)	0.400 (0.49)	0.408 (0.49)	0.397 (0.49)	0.403 (0.49)
No photo on mailing	0.202 (0.40)	0.202 (0.40)	0.206 (0.40)	0.198 (0.40)	0.204 (0.40)
Black photo	0.477 (0.50)	0.477 (0.50)	0.476 (0.50)	0.488 (0.50)	0.472 (0.50)
Coloured photo	0.071 (0.26)	0.071 (0.26)	0.071 (0.26)	0.072 (0.26)	0.071 (0.26)
Indian photo	0.125 (0.33)	0.125 (0.33)	0.122 (0.33)	0.123 (0.33)	0.126 (0.33)
White photo	0.124 (0.33)	0.124 (0.33)	0.125 (0.33)	0.120 (0.32)	0.127 (0.33)
Female photo	0.399 (0.49)	0.398 (0.49)	0.411 (0.49)	0.398 (0.49)	0.399 (0.49)
Male photo	0.399 (0.49)	0.400 (0.49)	0.383 (0.49)	0.404 (0.49)	0.397 (0.49)
Photo matches customer’s race?	0.534 (0.50)	0.535 (0.50)	0.531 (0.50)	0.537 (0.50)	0.533 (0.50)
Photo matches customer’s gender?	0.401 (0.49)	0.402 (0.49)	0.388 (0.49)	0.403 (0.49)	0.400 (0.49)
Promotional lottery	0.250 (0.43)	0.251 (0.43)	0.246 (0.43)	0.250 (0.43)	0.251 (0.43)
Suggestion call	0.003 (0.05)	0.003 (0.05)	0.005 (0.07)	0.003 (0.05)	0.003 (0.05)
Sample	53194	49250	3944	17108	36086

- Manipulation of interest here:
  - Vary number of options of repayment presented
    - \* Small Table: Single Repayment option
    - \* Big Table 1: 4 loan sizes, 4 Repayment options, 1 interest rate
    - \* Big Table 2: 4 loan sizes, 4 Repayment options, 3 interest rates
    - \* Explicit statement that “other loan sizes and terms were available”
  - Compare Small Table to other Table sizes
  - Small Table increases Take-Up Rate by .603 percent
  - One additional point of (monthly) interest rate decreases take-up by .258

**Table 3 Effect of Simplicity  
of Offer Description on Take-Up<sup>a</sup>**

Dependent Variable: Take-Up Dummy			
Sample:	All	High attention	Low attention
	(1)	(2)	(3)
Small option table	0.603 (0.239)	1.146 (0.674)	0.407 (0.219)
$\Delta$ interest rate equivalent	[2.337]	[3.570]	[1.887]
Interest rate	-0.258 (0.049)	-0.321 (0.145)	-0.215 (0.044)
Risk category F.E.?	yes	yes	yes
Experimental wave F.E.?	yes	yes	yes
Sample size	53194	17108	36086

- Small-option Table increases take-up by equivalent of 2.33 pct. interest

- Strong effect of behavioral factor, compared with effect of interest rate
- Effect larger for 'High-Attention' group (borrow at least twice in the past, once within 8 months)
- Authors also consider effect of a number of other psychological variables:
  - Content of photo (large effect of female photo on male take-up)
  - Promotional lottery (no effect)
  - Deadline for loan (reduces take-up)

### 3 Menu Effects: Preference for Familiar

- Third Heuristic: Preference for items that are more familiar
- Choice of stocks by individual investors (**French-Poterba, AER 1991**)
  - Allocation in domestic equity: Investors in the USA: 94%
  - Explanation 1: US equity market is reasonably close to world equity market
  - BUT: Japan allocation: 98%
  - BUT: UK allocation: 82%
- Explanation 2: Preference for own-country equity may be due to costs of investments in foreign assets



- Test: Examine within-country investment: **Huberman (RFS, 2001)**
  - Geographical distribution of shareholders of Regional Bell companies
  - Companies formed by separating the Bell monopoly
  - Fraction invested in the own-state Regional Bell is 82 percent higher than the fraction invested in the next Regional Bell company

- Third, extreme case: Preference for own-company stock
  - On average, employees invest 20-30 percent of their discretionary funds in employer stocks (**Benartzi JF, 2001**)

Panel C: Company Stock Allocation as a Percentage of the Employee Contributions			
Number of plans	78	58	136
Mean: equally weighted	18	29	23
Mean: weighted by employee contributions	21	33	24
Mean: weighted by the number of active participants	21	31	24

- – Notice: This occurs despite the fact that the employees' human capital is already invested in their company
- Also: This choice does not reflect private information about future performance

- Companies where a higher proportion of employees invest in employer stock have lower subsequent one-year returns, compared to companies with a lower proportion of employee investment

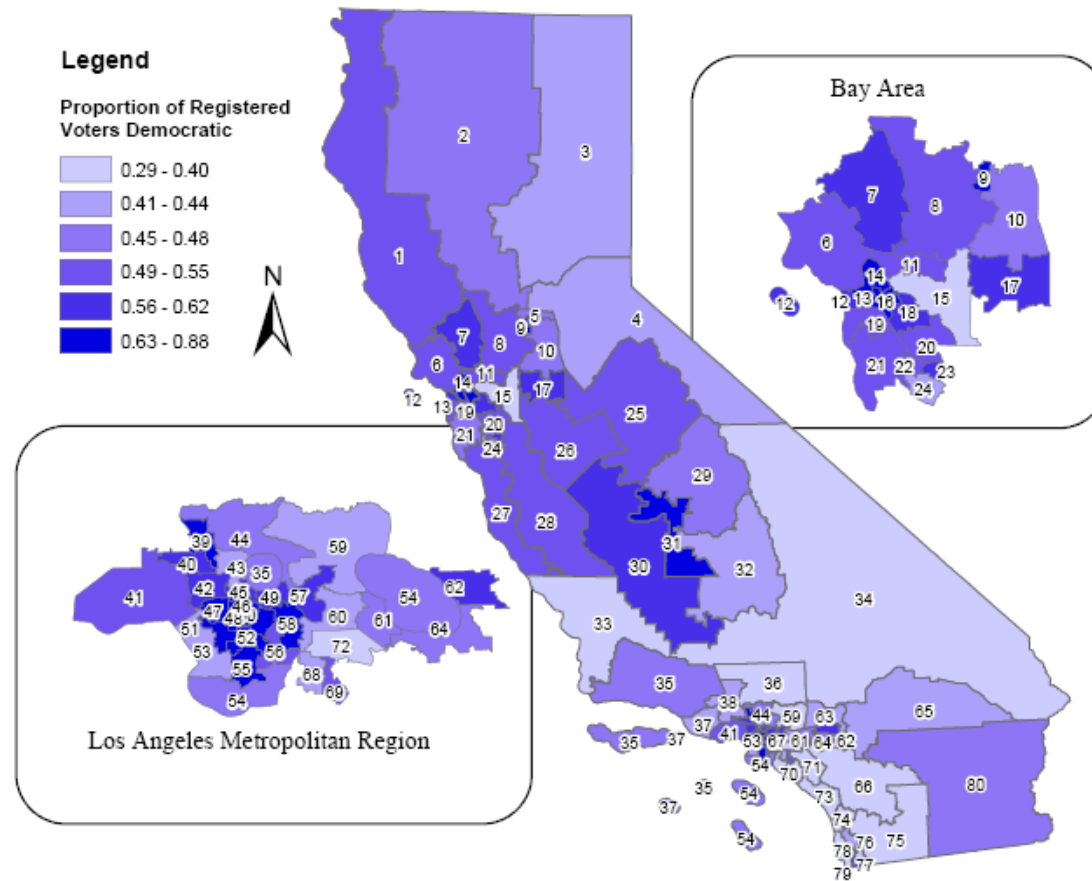
	Allocation to Company Stock					Observed Difference (5 – 1)
	(Low) 1	2	3	4	5 (High)	
Allocation to company stock as a percentage of discretionary contributions	4.59%	12.19%	19.34%	31.85%	53.90%	49.41%
One-year returns	6.64	6.55	1.27	-1.03	0.13	-6.77
Two-year returns	43.69	40.78	38.24	43.33	31.92	-11.77

- Possible Explanation? Ambiguity aversion
  - **Ellsberg (1961)** paradox:
  - Investors that are ambiguity-averse prefer:
    - \* Investment with known distribution of returns
    - \* To investment with unknown distribution
  - This occurs even if the average returns are the same for the two investments, and despite the benefits of diversification.

## 4 Menu Effects: Preference for Salient

- What happens with large set of options if decision-maker uninformed?
- Possibly use of irrelevant, but salient, information to choose
- **Ho-Imai (2004)**. Order of candidates on a ballot
  - Exploit randomization of ballot order in California
  - Years: 1978-2002, Data: 80 Assembly Districts
- Notice: Similar studies go back to **Bain-Hecock (1957)**

- Areas of randomization



- Use of randomized alphabet to determine first candidate on ballot

Year Election	Randomized Alphabet
1982 Primary	S C X D Q G W R V Y U A N H L P B K J I E T O M F Z
General	L S N D X A M W V T O F I B K Y U P E Q C J Z H R G
1983 Consolidated	L C P K I A U G Z O N B X D W H E M F V R S T Y Q J
1984 Primary	W M F B Q Y T D J U O V I K R H S N P C A E L Z G X
General	V W I H R Q G J O M T S Y C A F U X K B P E Z N D L
1986 General	Q N H U B J E G M V L W X C K O F D Z R Y I T S P A
1988 Primary	W O K N Q A V T H J F Z L B U D Y M I R G C E S X P
General	S W F M K J U Y A T V G O N Q B D E P L Z C I X R H
1990 Primary	E J B Y Q F K M O V X L N Z C W A P R D G T H I S U
General	W F C L D I N J H V K O S A R E Q B T M Y U G Z X P
1992 Primary	U R F A J C D N M K P Z Y X G W O H E B I S V L Q T
General	F Y U A J S B Z G O E Q R L I M H V N T P D K X C W
1994 Primary	K J H G A M I Q U N C Z S W V R P Y B L O T D F E X
General	V I A E M S O K L B G N W Y D P U F Z Q J X C R H T
1996 Primary	G E F C Y P D B Z I V A U S M L H K N T O J Q R X W
General	J Y E P A U S Q B H T R K N L X F D O G M W I Z C V
1998 Primary	L W U J X K C N D O Q A P T Z R Y F E V B H G I M S
General	W K D N V A G P Y C Z I S T L J X Q O F H R B U M E
2000 Primary	O P C Y I H X Z V R S Q E K L G D W J U T M B F A N
General	I T F G J S W R N M K U Y L D C Q A H X O E B V P Z
2002 Primary	W I Z C O M A Q U K X E B Y N P T R L V S J H D F G
General	H M V P E B Q U G N D K X Z J A W Y C O S F I T R L
2003 Recall	R W Q O J M V A H B S G Z X N T C I E K U P D Y F L

Table 1: Randomized Alphabets Used for the California Statewide Elections Since 1982.

- Observe each candidate in different orders in different districts
- Compute absolute vote ( $Y$ ) gain

$$E [Y (i = 1) - Y (i \neq 1)]$$

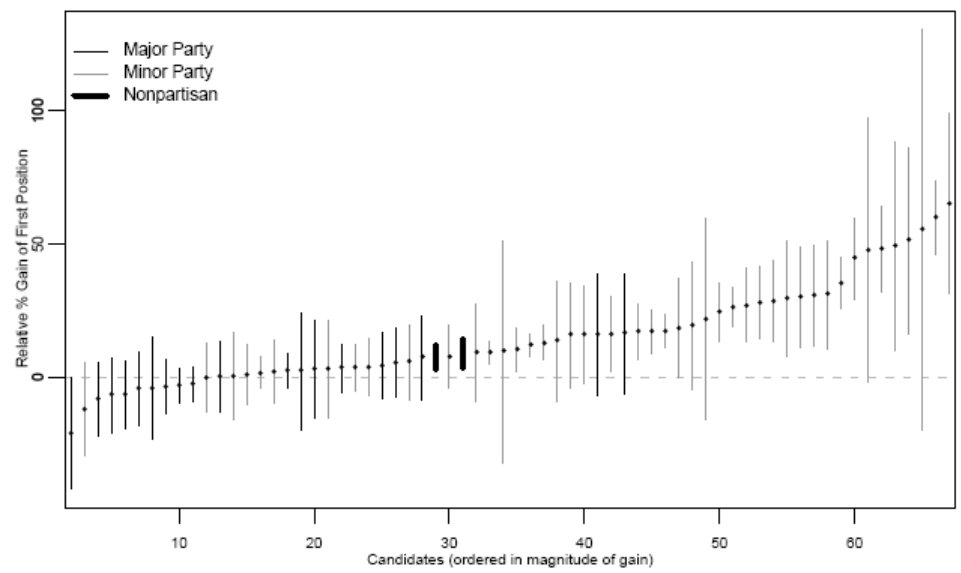
and percentage vote gain

$$E [Y (i = 1) - Y (i \neq 1)] / E [Y (i \neq 1)]$$

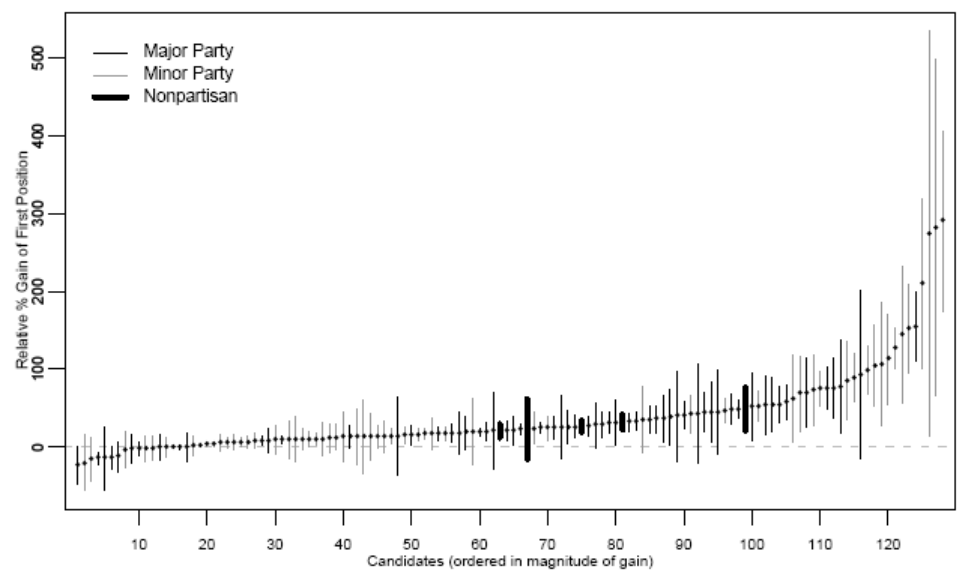
- Result:
  - Small to no effect for major candidates
  - Large effects on minor candidates



General Election 1998 & 2000



Primary Elections, 1998 & 2000



	General				Primary			
	Absolute		Relative		Absolute		Relative	
	ATE	SE	ATE	SE	ATE	SE	ATE	SE
Democratic	0.05	0.46	0.25	0.90	1.89	0.32	43.58	5.53
Republican	-0.06	0.53	-0.43	1.29	2.16	0.46	33.62	5.91
American Independent	0.16	0.02	20.83	1.39	2.33	0.15	26.76	3.55
Green	0.56	0.17	21.18	5.82	3.15	1.16	6.24	3.54
Libertarian	0.23	0.02	14.56	1.03	6.59	1.42	71.92	13.55
Natural Law	0.31	0.06	26.13	2.85	0.40	0.08	44.78	5.45
Peace and Freedom	0.28	0.03	25.49	2.15	6.31	0.53	14.75	1.43
Reform	0.26	0.07	19.57	2.23	4.11	1.56	48.45	9.66
Nonpartisan	1.95	0.30	9.21	3.31	3.44	0.78	19.42	4.05

Table 3: Party-Specific Average Causal Effects of Being Listed in First Position on Ballots Using All Races from 1978 to 2002. ATE and SE represent the average causal effects and their standard errors, respectively. For general and primary elections, the left two columns present the estimates of average absolute gains in terms of the total or party vote, respectively, while the right two columns show those of average relative gains. Each candidate-specific effect is averaged over different races to obtain the overall average effect for each party. In general elections, only minor party and nonpartisan candidates are affected by the ballot order. In primaries, however, the candidates of all parties are affected. The largest effects are found for nonpartisan candidates.

- **Barber-Odean (2004).** Investor with limited attention
  - Stocks in portfolio: Monitor continuously
  - Other stocks: Monitor extreme deviations (*saliience*)
- Which stocks to purchase? High-attention (salient) stocks. On days of high attention, stocks have
  - Demand increase
  - No supply increase
  - Increase in net demand

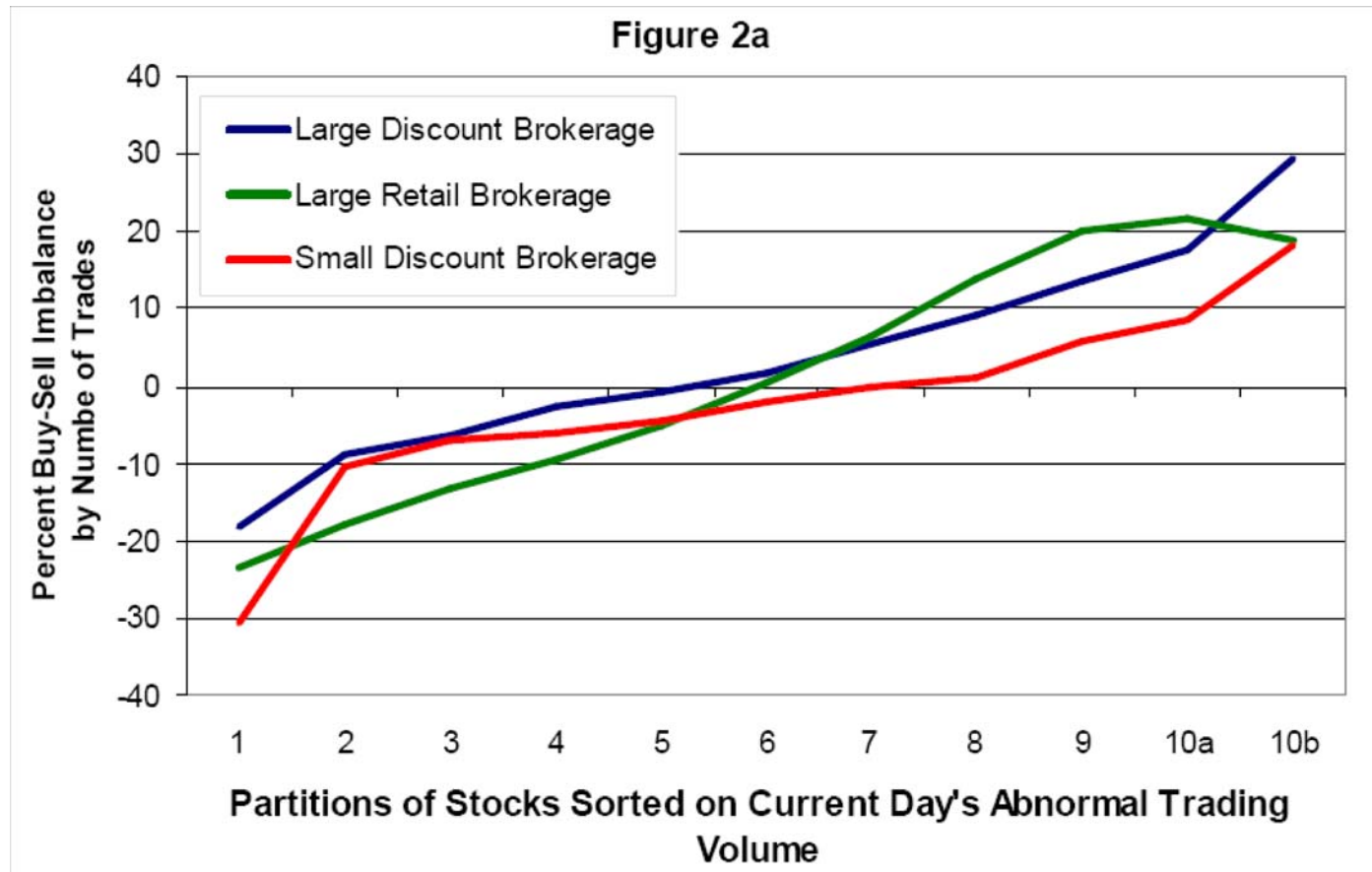
- Heterogeneity:
  - Small investors with limited attention attracted to salient stocks
  - Institutional investors less prone to limited attention
- Market interaction: Small investors are:
  - Net buyers of high-attention stocks
  - Net sellers of low-attention stocks.
- Measure of net buying is Buy-Sell Imbalance:

$$BSI_t = 100 * \frac{\sum_i NetBuy_{i,t} - \sum_i NetSell_{i,t}}{\sum_i NetBuy_{i,t} + \sum_i NetSell_{i,t}}$$

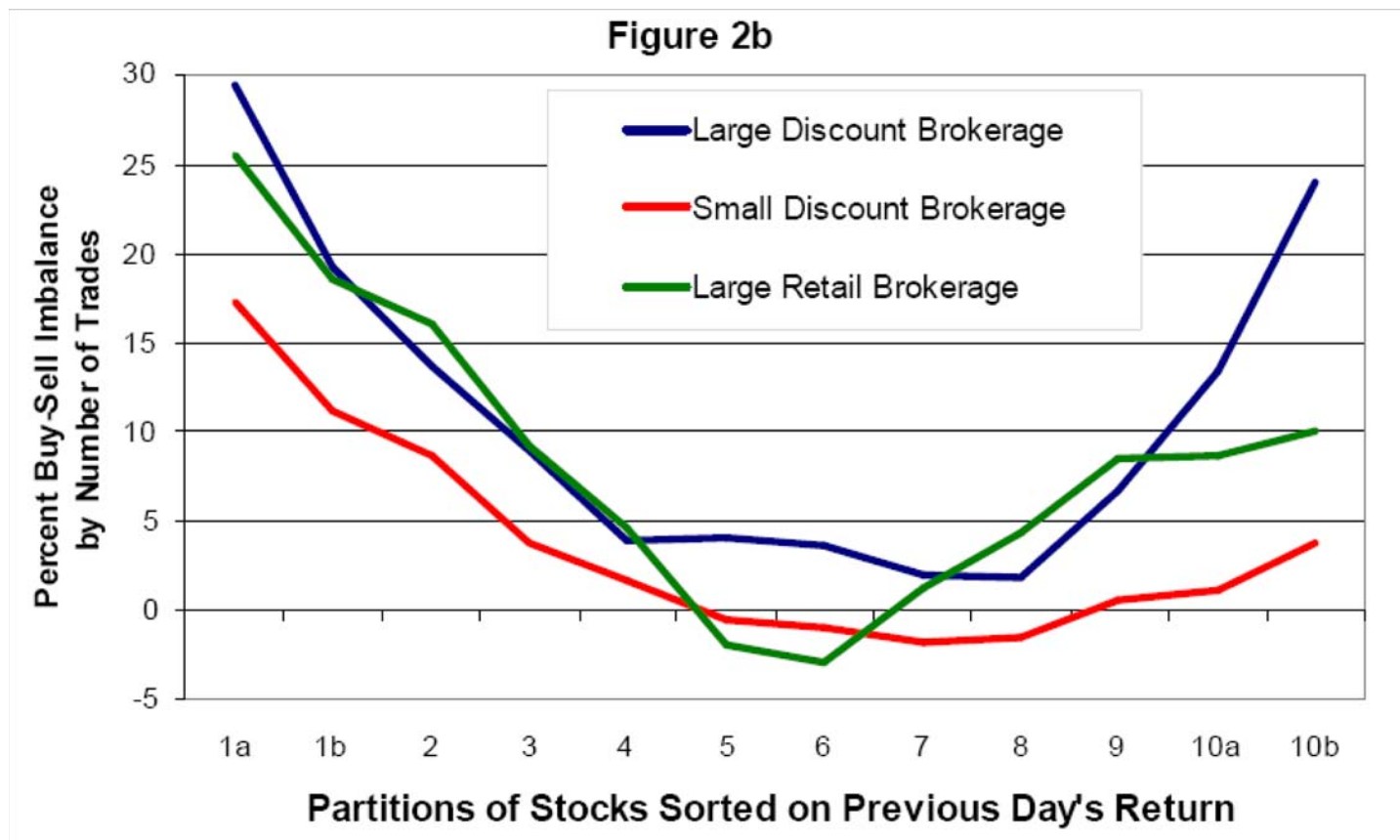
- Notice: Unlike in most financial data sets, here use of individual trading data
- In fact: No obvious prediction on prices
- Measures of attention:
  - same-day (abnormal) volume  $V_t$
  - previous-day return  $r_{t-1}$
  - stock in the news (Using Dow Jones news service)

- Use of sorting methodology
  - Sort variable  $(V_t, r_{t-1})$  and separate into equal-sized bins (in this case, deciles)
    - \* Example:  $V_t^1, V_t^2, V_t^3, \dots, V_t^{10a}, V_t^{10b}$
    - \* (Finer sorting at the top to capture top 5 percent)
  - Classical approach in finance
  - Benefit: Measures variables in a non-parametric way
  - Cost: Loses some information and magnitude of variable

- Effect of same-day (abnormal) volume  $V_t$  monotonic (Volume captures 'attention')

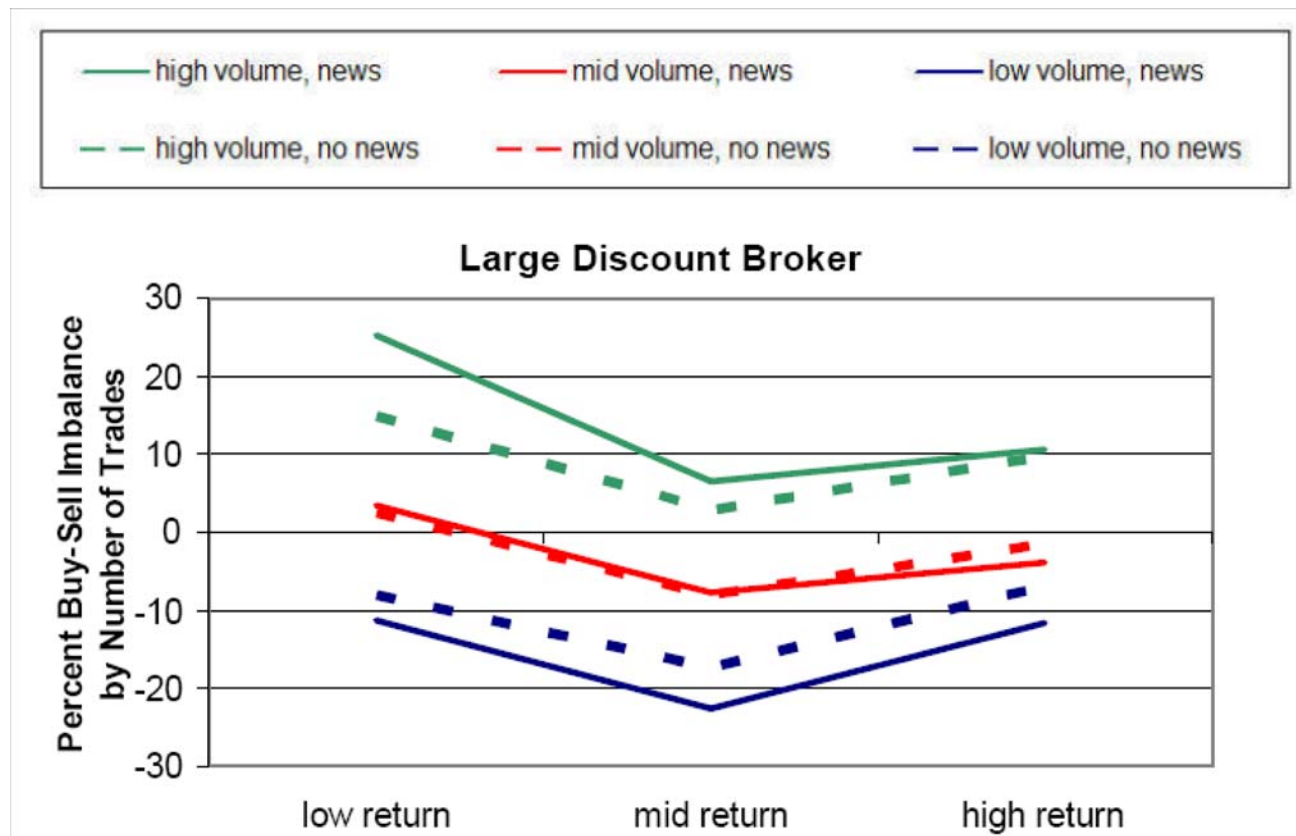


- Effect of previous-day return  $r_{t-1}$  U-shaped  
(Large returns—positive or negative—attract attention)

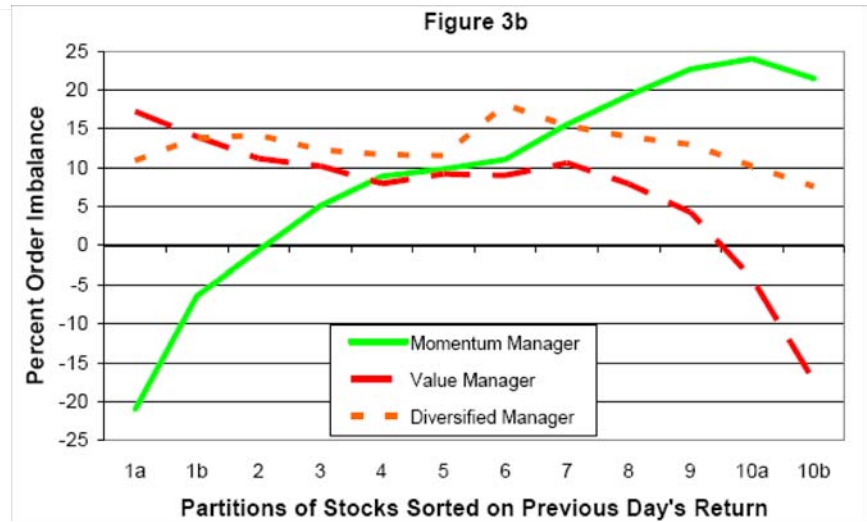
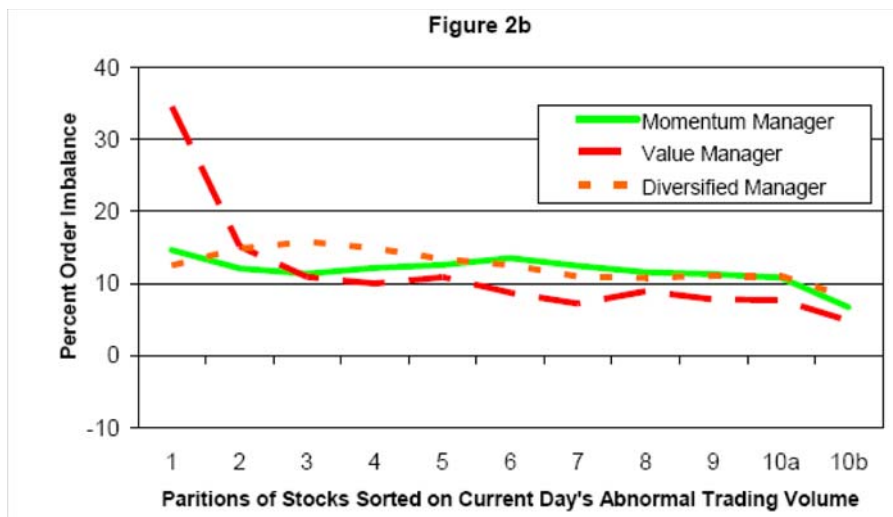




- Notice: Pattern is consistent across different data sets of investor trading
- Figures 2a and 2b are 'univariate' — Figure 3 is 'multivariate'



- Patterns are the opposite for institutional investors (Fund managers)



- Alternative interpretations of results:
- Small investors own few stocks, face short-selling constraints
- (To sell a stock you do not own you need to borrow it first, then you sell it, and then you need to buy it back at end of lending period)
- If new information about the stock:
  - buy if positive news
  - do nothing otherwise
- If no new information about the stock:
  - no trade
- Large investors are not constrained

- Study pattern for stocks that investors already own

**Panel A: Buy-sell imbalance for Stocks Already Owned Sorted on Current Day's Abnormal Trading Volume.**

Decile	Large Discount Brokerage		Large Retail Brokerage		Small Discount Brokerage	
	Number Imbalance	Value Imbalance	Number Imbalance	Value Imbalance	Number Imbalance	Value Imbalance
1 (lowest volume)	-54.22 (1.43)	-55.64 (1.89)	-28.74 (1.42)	-33.99 (1.84)	-24.25 (6.28)	-33.22 (7.58)
2	-51.13 (0.78)	-53.20 (1.07)	-29.46 (1.09)	-34.09 (1.36)	-33.80 (3.18)	-29.67 (4.47)
3	-48.27 (0.64)	-49.69 (0.95)	-29.54 (1.04)	-31.25 (1.31)	-31.76 (1.71)	-30.05 (2.44)
4	-47.19 (0.56)	-49.51 (0.88)	-28.69 (0.94)	-32.96 (1.11)	-35.65 (1.26)	-33.93 (1.96)
5	-45.95 (0.53)	-47.59 (0.81)	-26.71 (0.90)	-31.04 (1.07)	-32.34 (1.12)	-30.01 (1.63)
6	-45.01 (0.49)	-48.65 (0.71)	-24.32 (0.90)	-29.71 (1.04)	-30.00 (0.97)	-26.50 (1.42)
7	-42.36 (0.50)	-45.85 (0.71)	-21.83 (0.84)	-30.29 (0.89)	-29.85 (0.95)	-26.21 (1.33)
8	-39.43 (0.51)	-43.75 (0.71)	-18.72 (0.81)	-27.21 (0.87)	-28.20 (0.87)	-26.23 (1.22)
9	-35.64 (0.52)	-40.68 (0.70)	-15.45 (0.78)	-21.79 (0.91)	-27.07 (0.85)	-24.99 (1.21)
10a	-33.03 (0.63)	-39.31 (0.85)	-12.27 (0.97)	-19.97 (1.12)	-26.81 (1.06)	-27.99 (1.42)
10b (highest volume)	-24.97 (0.69)	-32.82 (0.92)	-15.01 (1.04)	-20.04 (1.19)	-17.32 (0.98)	-19.38 (1.42)

## 5 Menu Effects: Confusion

- Previous heuristics reflect preference to avoid difficult choices or for salient options
- Confusion is simply an error in the implementation of the preferences
- Different from most behavioral phenomena which are directional biases
- How common is it?
- Application 1. **Shue-Luttmer (2007)**
  - Choice of a political candidate among those in a ballot
  - California voters in the 2003 recall elections

- Do people vote for the candidate they did not mean to vote for?

**Candidates to succeed GRAY DAVIS as Governor if he is recalled:  
Vote for One**

<input type="checkbox"/> NATHAN WHITECLOUD WALTON Student Independent	<input type="checkbox"/> JOEL BRITTON Retired Meat Packer Independent	<input type="checkbox"/> S. ISSA Engineer Republican
<input type="checkbox"/> MAURICE WALKER Real Estate Appraiser Green	<input type="checkbox"/> AUDIE BOCK Educator/Small Businesswoman Democratic	<input type="checkbox"/> BOB LYNN EDWARDS Attorney Democratic
<input type="checkbox"/> CHUCK WALKER Business Intelligence Analyst Republican	<input type="checkbox"/> VIK S. BAJWA Businessman/Father/Entrepreneur Democratic	<input type="checkbox"/> ERIC KOREVAAR Scientist/Businessman Democratic
<input type="checkbox"/> LINGEL H. WINTERS Consumer Business Attorney Democratic	<input type="checkbox"/> BADI BADIOZAMANJ Entrepreneur/Author/Executive Independent	<input type="checkbox"/> STEPHEN L. KNAPP Engineer Republican
<input type="checkbox"/> C.T. WEBER Labor Official/Analyst Peace and Freedom	<input type="checkbox"/> VIP BHOLA Attorney/Businessowner Republican	<input type="checkbox"/> KELLY P. KIMBALL Business Executive Democratic
<input type="checkbox"/> JIM WEIR Community College Teacher Democratic	<input type="checkbox"/> JOHN W. BEARD Businessman Republican	<input type="checkbox"/> D.E. KESSINGER Paralegal/Property Manager Democratic
<input type="checkbox"/> BRYAN QUINN Businessman Republican	<input type="checkbox"/> ED BEYER Chief Operations Officer Republican	<input type="checkbox"/> EDWARD 'ED' KENNEDY Businessman/Educator Democratic
<input type="checkbox"/> MICHAEL JACKSON Satellite Project Manager Republican	<input type="checkbox"/> JOHN CHRISTOPHER BURTON Civil Rights Lawyer Independent	<input type="checkbox"/> TREK THUNDER KELLY Business Executive/Artist Independent
<input type="checkbox"/> JOHN 'JACK' MORTENSEN Contractor/Businessman Democratic	<input type="checkbox"/> CRUZ M. BUSTAMANTE Lieutenant Governor Democratic	<input type="checkbox"/> JERRY KUNZMAN Chief Executive Officer Independent
<input type="checkbox"/> DARRYL L. MOBLEY Businessman/Entrepreneur Independent	<input type="checkbox"/> CHERYL BLY-CHESTER Businesswoman/Environmental Engineer Republican	<input type="checkbox"/> PETER V. UEBERROTH Businessman/Olympics Advisor Republican
<input type="checkbox"/> JEFFREY L. MOCK Business Owner Republican	<input type="checkbox"/> B.E. SMITH Lecturer Independent	<input type="checkbox"/> BILL PRADY Television Writer/Producer Democratic
<input type="checkbox"/> BRUCE MARGOLIN Marijuana Legalization Attorney Democratic	<input type="checkbox"/> DAVID RONALD SAMS Businessman/Producer/Writer Republican	<input type="checkbox"/> DARIN PRICE University Chemistry Instructor Natural Law
<input type="checkbox"/> GINO MARTORANA Restaurant Owner Republican	<input type="checkbox"/> JAMIE ROSEMARY SAFFORD Business Owner Republican	<input type="checkbox"/> GREGORY J. PAWLIK Realtor/Businessman Republican
<input type="checkbox"/> PAUL MARIANO Attorney Democratic	<input type="checkbox"/> LAWRENCE STEVEN STRAUSS Lawyer/Businessperson/Student Democratic	<input type="checkbox"/> LEONARD PADILLA Law School President Independent
<input type="checkbox"/> ROBERT G. MANNHEIM Retired Businessperson Democratic	<input type="checkbox"/> ARNOLD SCHWARZENEGGER Actor/Businessman Republican	<input type="checkbox"/> RONALD JASON PALMIERI Gay Rights Attorney Democratic
<input type="checkbox"/> FRANK A. MACALUSO, JR. Physician/Medical Doctor Democratic	<input type="checkbox"/> GEORGE B. SCHWARTZMAN Businessman Independent	<input type="checkbox"/> CHARLES 'CHUCK' PINEDA, JR. State Hearing Officer Democratic
<input type="checkbox"/> PAUL 'CHIP' MAILANDER	<input type="checkbox"/> MIKE SCHMIER	<input type="checkbox"/> HEATHER PETERS

County of Sacramento  
Statewide Special Election  
October 7, 2003

Candidates Continued / Candidatos Continúa

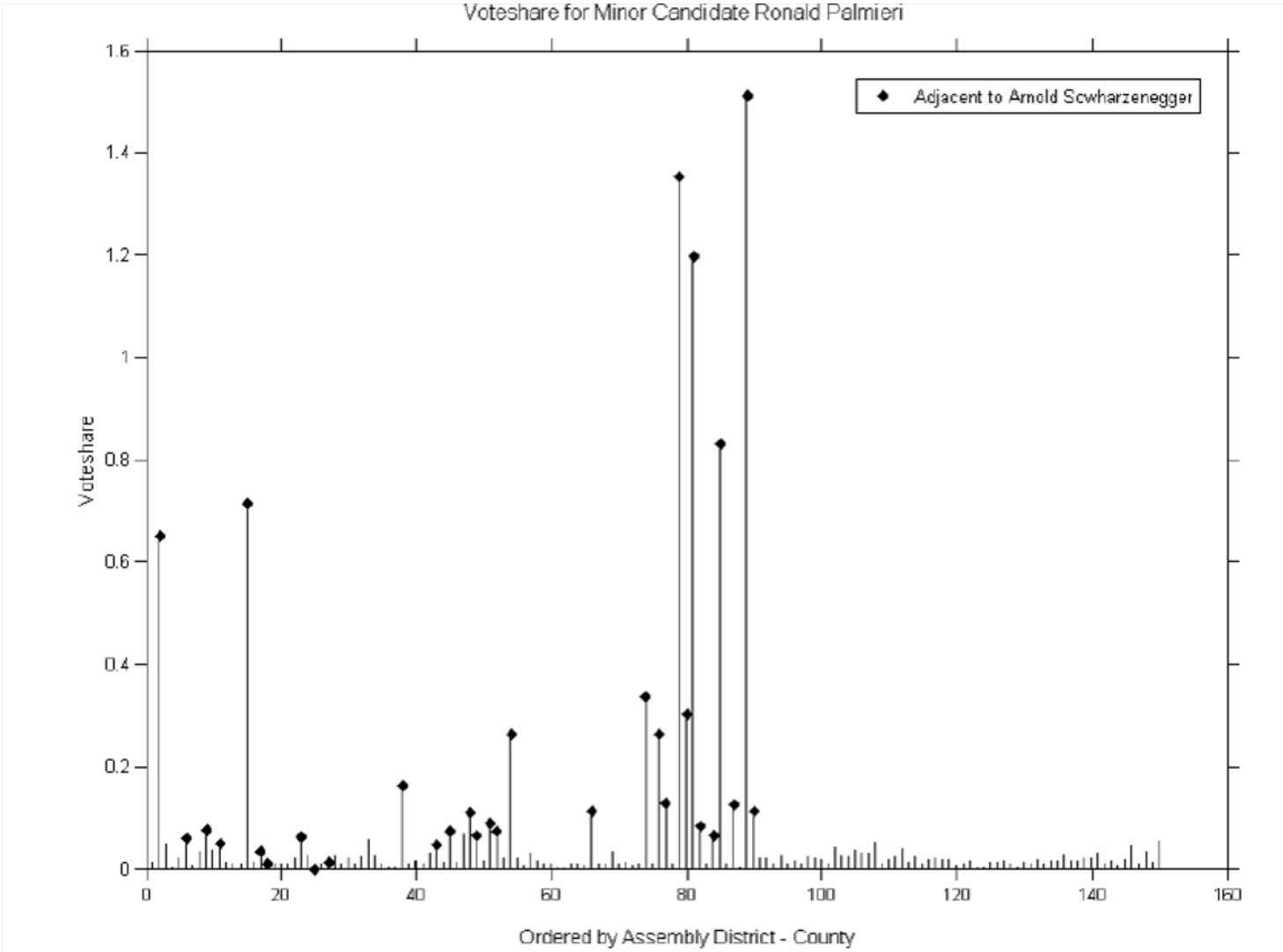
54	ANGELYNE, Independent Entertainer/Artista
55	DOUGLAS ANDERSON, Republican Mortgage Broker/Agente hipotecario
56	IRIS ADAM, Natural Law Business Analyst/Analista empresarial
57	BROOKE ADAMS, Independent Business Executive/Ejecutiva de empresa
58	ALEX-ST. JAMES, Republican Public Policy Strategist/Estratega de política pública
59	JIM HOFFMANN, Republican Teacher/Maestro
60	KEN HAMIDI, Libertarian State Tax Officer/Funcionario impositivo estatal
61	SARA ANN HANLON, Independent Businesswoman/Mujer de negocios
62	IVAN A. HALL, Green Custom Denture Manufacturer/Fabricante de dentaduras postizas a medida
63	JOHN J. "JACK" HICKEY, Libertarian Healthcare District Director/Director de distrito de atención de la salud
64	RALPH A. HERNANDEZ, Democratic District Attorney Inspector/Inspector de fiscalía
65	C. STEPHEN HENDERSON, Independent Teacher/Maestro
66	ARIANNA HUFFINGTON, Independent Author/Columnist/Mother/Escritora/columnista/madre
67	ART BROWN, Democratic Film Writer/Director/Guionista y director de cine
68	JOEL BRITTON, Independent Retired Meat Packer/Empacador de carne jubilado
69	AUDIE BOCK, Democratic Educator/Small Businesswoman/Educadora/propietaria de pequeña empresa
70	VIK S. BA/JWA, Democratic Businessman/Father/Entrepreneur/Hombre de negocios/padre/empresario
71	BADI BADIOZAMANI, Independent Entrepreneur/Author/Executive/Empresario/escritor/ejecutivo
72	VIP BHOLA, Republican Attorney/Businessowner/Abogado/propietario de empresa
73	JOHN W. BEARD, Republican Businessman/Hombre de negocios
74	ED BEYER, Republican Chief Operations Officer/Funcionario principal de operaciones
75	JOHN CHRISTOPHER BURTON, Independent Civil Rights Lawyer/Abogado de derechos civiles
76	CRUZ M. BUSTAMANTE, Democratic Lieutenant Governor/Vicegobernador
77	CHERYL BLY-CHESTER, Republican Businesswoman/Environmental Engineer/Mujer de negocios/ingeniera ambiental
78	B.E. SMITH, Independent Lecturer/Conferencista

Candidate listing continues on next page /  
La lista de candidatos continúa en la página siguiente →

1	27	53	79	105	131	157	183	209	235	261	287
2	28	54	80	106	132	158	184	210	236	262	288
3	29	55	81	107	133	159	185	211	237	263	289
4	30	56	82	108	134	160	186	212	238	264	290
5	31	57	83	109	135	161	187	213	239	265	291
6	32	58	84	110	136	162	188	214	240	266	292
7	33	59	85	111	137	163	189	215	241	267	293
8	34	60	86	112	138	164	190	216	242	268	294
9	35	61	87	113	139	165	191	217	243	269	295
10	36	62	88	114	140	166	192	218	244	270	296
11	37	63	89	115	141	167	193	219	245	271	297
12	38	64	90	116	142	168	194	220	246	272	298
13	39	65	91	117	143	169	195	221	247	273	299
14	40	66	92	118	144	170	196	222	248	274	300
15	41	67	93	119	145	171	197	223	249	275	301
16	42	68	94	120	146	172	198	224	250	276	302
17	43	69	95	121	147	173	199	225	251	277	303
18	44	70	96	122	148	174	200	226	252	278	304
19	45	71	97	123	149	175	201	227	253	279	305
20	46	72	98	124	150	176	202	228	254	280	306
21	47	73	99	125	151	177	203	229	255	281	307
22	48	74	100	126	152	178	204	230	256	282	308
23	49	75	101	127	153	179	205	231	257	283	309

- Design:
  - Exploit closeness on ballot
  - Exploit specific features of closeness
  - Exploit random variation in placement of candidates on the ballot (as in Ho-Imai)
- First evidence: Can this matter?
- If so, it should affect most minor party candidates





- Model:

- Share  $\beta_1$  of voters meaning to vote for major candidate  $j$  vote for neighboring candidate  $i$
- Estimate  $\beta_1$  by comparing voting for  $i$  when close to  $j$  and when far from  $j$
- Notice: The impact depends on vote share of  $j$
- Specification:

$$VoteShare_i = \beta_0 + \beta_1 * VSAdjacent_j + Controls + \varepsilon$$

- Rich set of fixed effects, so identify off changes in order

**Table 2: Primary Results**

Dependent Variable: <i>Votes</i> share = (votes / total votes)×100	(1)	(2)	(3)
<i>Adjacent</i>	0.104** (0.018)		
<i>Adjacent</i> × <i>Schwarzenegger</i>		0.088** (0.025)	
<i>Adjacent</i> × <i>Bustamante</i>		0.143** (0.025)	
<i>Adjacent</i> × <i>McClintock</i>		0.107* (0.045)	
<i>Adjacent Dummy</i>			0.037** (0.006)
<b>Observations</b>	1,817,904	1,817,904	1,817,904
<b>R-Squared</b>	0.8676	0.8676	0.8676

- Results:

- 1 in 1,000 voters vote for adjacent candidate
- Difference in error rate by candidate (see below)
- Notice: Each candidate has 2.5 adjacent candidates → Total misvoting is 1 in 400 voters

- Interpretations:
  1. Limited Attention: Candidates near major candidate get reminded in my memory
  2. Trembling Hand: Pure error
  
- To distinguish, go back to structure of ballot.
  - Much more likely to fill-in the bubble on right side than on left side if (2)
  - No difference if (1)

**Table 3: Robustness Checks**

Dependent Variable: <i>Votes</i> share = (votes / total votes)×100	(1)	(2)	(3)	(4)	(5)	(6)
<i>Adjacent</i>	0.082** (0.027)			0.104** (0.018)	0.113** (0.018)	
<i>Adjacent Dummy</i>	0.010 (0.007)					
<i>Adjacent Dummy</i> × <i>CA Votes</i> share		0.112** (0.019)				
<i>North Adjacent</i>			0.082** (0.022)			0.082** (0.022)
<i>South Adjacent</i>			0.111** (0.033)			0.111** (0.033)
<i>East Adjacent</i>			0.143** (0.035)			
<i>West Adjacent</i>			0.038** (0.011)			
<i>Diagonally Adjacent</i>				0.002 (0.003)		
<i>Punchcard Adjacent</i>					0.030+ (0.018)	
<i>Horizontally Adjacent</i>						0.031** (0.008)
<i>Horizontally Adjacent</i> × <i>Confusing Side</i>						0.123** (0.038)
<b>Observations</b>	1,817,904	1,817,904	1,817,904	1,817,904	1,817,904	1,817,904
<b>R-Squared</b>	0.8676	0.8676	0.8677	0.8676	0.8677	0.8677

- Effect is mostly due to Trembling hand / Confusion
- Additional results:
  - Spill-over of votes larger for more confusing voting methods (such as punch-cards)

**Table 7: Interactions with Voting Technology**

Dependent Variable: <i>Voteshare</i> = (votes / total votes)×100	(1)	(2)	(3)	(4)
<i>Adjacent</i> × <i>punch card</i>	0.197** (0.020)	0.200** (0.019)		
<i>Adjacent</i> × <i>optical scan</i>	0.100** (0.020)	0.108** (0.019)		
<i>Adjacent</i> × <i>touch screen</i>	0.065** (0.016)	0.067** (0.015)		

- – Spill-over of votes larger for precincts with a larger share of lower-education demographics → more likely to make errors when faced with large number of option

**Table 4: Overall Effect of Precinct Demographic Ch**

Dependent Variable: <i>Votes</i> share = (votes / total votes)×100	(1)	(2)	(3)
<i>Adjacent</i>	0.6368** (0.1012)	0.0544** (0.0162)	0.3353** (0.0467)
<i>Adjacent</i> × % <i>HS Graduates</i>	-0.0062** (0.0013)		
<i>Adjacent</i> × % <i>College Graduates</i>	-0.0056** (0.0010)		

- This implies (small) aggregate effect: confusion has a different prevalence among the voters of different major candidates

- **Rashes (JF, 2001)** Similar issue of confusion for investor choice
- Two companies:
  - Major telephone company MCI (Ticker MCIC)
  - Small investment company (ticker MCI)
  - Investors may confuse them
  - MCIC is much bigger → this affects trading of company MCI

#### Summary Statistics

Daily return and volume information is shown for Massmutual Corporate Investors fund (MCI), MCI Communications (MCIC), and AT&T (T) for the sample period 11/21/94–11/13/97. The return for security  $j$  is expressed in percentages and defined as  $\text{Log}[(P_{j,t+1} + D_{j,t+1})/P_{j,t}]$ , where  $P_{j,t}$  and  $D_{j,t}$  are the price and dividend, respectively, for security  $j$  on day  $t$ .

	Mean (Return)	SD (Return)	Mean (Volume)	SD (Volume)	Mean (Price)
MCI	0.078	0.7136	4,155	4,497	36.14
MCIC	0.087	2.3645	$4.154 \times 10^6$	$4.713 \times 10^6$	28.07
T	0.055	1.6440	$4.810 \times 10^6$	$2.837 \times 10^6$	38.64



- Check correlation of volume (Table III)
  - High correlation
  - What if two stocks have similar underlying fundamentals?
  - No correlation of MCI with another telephone company (AT&T)

**Table III**  
**Daily Volume Correlation Coefficient Matrices**

This table presents the correlation of daily volumes between Massmutual Corporate Investors fund (MCI), MCI Communications (MCIC), AT&T (T) and the New York Stock Exchange Composite Index (NYSE). The pairwise Pearson product-moment correlations are shown with the standard error of these coefficients in parentheses.

	MCI	MCIC	T	NYSE
Panel A: Sample Period 11/21/94–11/13/97				
MCI	1			
MCIC	0.5592 (0.0302)	1		
T	0.0291 (0.0364)	0.1566 (0.0360)	1	
NYSE	0.1162 (0.0362)	0.2817 (0.0350)	0.3397 (0.0343)	1

- Predict returns of smaller company with bigger company (Table IV)
- Returns Regression:

$$r_{MCI,t} = \alpha_0 + \alpha_1 r_{MCIC,t} + \beta X_t + \varepsilon_t$$

Constant	MCIC Return	(MCIC Return) * dummy (MCIC return <0)	T Return	S&P 500 Return	S&P Smallcap Return Residual	Lehman Long Bond Index Return	$R^2$
Panel A: Sample Period 11/22/94–11/13/97							
0.0956 (2.6223)				0.0372 (0.9370)	0.1011 (1.9233)	0.0932 (2.3438)	0.0286 0.0247
0.0954 (2.6243)	0.0862 (2.2779)			0.0128 (0.3128)	0.1068 (2.0356)	0.0905 (2.2818)	0.0353 0.0301
0.0957 (2.6306)	0.0851 (2.2430)		0.0171 (0.4190)	0.0052 (0.1166)	0.1077 (2.0501)	0.0907 (2.2862)	0.0355 0.0290
0.0721 (1.5202)	0.1205 (2.0557)	-0.0722 (-0.7664)		0.0149 (0.3630)	0.1070 (2.0375)	0.0913 (2.3015)	0.0360 0.0296

- Results:

- Positive correlation  $\alpha_1 \rightarrow$  The swings in volume have some impact on prices.

- Difference between reaction to positive and negative news:

$$r_{MCI,t} = \alpha_0 + \alpha_1 r_{MCIC,t} + \alpha_2 r_{MCIC,t} * \mathbf{1}(r_{MCIC,t} < 0) + \beta X_t + \varepsilon_t$$

- Negative  $\alpha_2$ . Effect of arbitrage  $\rightarrow$  It is much easier to buy by mistake than to short a stock by mistake

- Size of confusion? Use relation in volume.

- We would like to know the result (as in Luttmer-Shue) of

$$V_{MCI,t} = \alpha + \beta V_{MCIC,t} + \varepsilon_t$$

– Remember:  $\beta = Cov(V_{MCI,t}, V_{MCIC,t}) / Var(V_{MCIC,t})$

– We know (Table I)

$$\begin{aligned} .5595 &= \rho_{MCI,MCIC} = \frac{Cov(V_{MCI,t}, V_{MCIC,t})}{\sqrt{Var(V_{MCI,t})Var(V_{MCIC,t})}} = \\ &= \beta * \frac{\sqrt{Var(V_{MCIC,t})}}{\sqrt{Var(V_{MCI,t})}} \end{aligned}$$

– Hence,  $\beta = .5595 * \sqrt{Var(V_{MCI,t})} / \sqrt{Var(V_{MCIC,t})} = .5595 * 10^{-3} = 5 * 10^{-4}$

– Hence, the error rate is approximately  $5 * 10^{-4}$ , that is, 1 in 2000

- Conclusion

- Deviation from standard model: confusion.
- Can have an aggregate impact, albeit a small one
- Can be moderately large for error from common choice to rare choice
- Other applications: eBay bidding on misspelled names (find cheaper items when looking for 'shavre' [shaver] or 'tyo' [toy])

## 6 Persuasion

- Persuasion and Social Pressure: Change in opinion/action beyond prediction of Bayesian model
- **Persuasion:** Sender attempts to convince Receiver with words/images to take an action
  - Rational persuasion through Bayesian updating
  - Non-rational persuasion, i.e.: neglect of incentives of person presenting information
  - Effect of persuasion directly on utility function (advertising/emotions)
- **Social Pressure:** Presence of Sender exerts pressure to take an action

- **DellaVigna and Gentzkow (2010):** Overview on Persuasion:
  - Persuading consumers: Marketing
  - Persuading voters: Political Communication
  - Persuading donors: Fund-raising
  - Persuading investors: Financial releases

- First problem: How to measure when persuasion occurs?

- Treatment group  $T$ , control group  $C$ , *Persuasion Rate* is

$$f = 100 * \frac{y_T - y_C}{e_T - e_C} \frac{1}{1 - y_0},$$

- $e_i$  is the share of group  $i$  receiving the message,
- $y_i$  is the share of group  $i$  adopting the behavior of interest,
- $y_0$  is the share that would adopt if there were no message

TABLE 1, PART A  
PERSUASION RATES: SUMMARY OF STUDIES

Paper	Treatment	Control	Variable $t$	Time Horizon	Treatment group $t_T$	Control group $t_C$	Exposure rate $e_T - e_C$	Persuasion rate $f$
	(1)	(2)	(4)	(7)	(9)	(10)	(11)	(12)
<u>Persuading Consumers</u>								
Simester et al. (2007) (NE)	17 clothing catalogs sent	12 catalogs	Share Purchasing $\geq 1$ item	1 year	36.7% 69.1%	33.9% 66.8%	100%* 100%*	4.2% 6.9%
Bertrand, Karlan, Mullainathan, Shafir, and Zinman (2010) (FE)	Mailer with female photo Mailer with 4.5% interest rate	Mailer no photo Mailer 6.5% i.r.	Applied for loan	1 month	9.1% 9.1%	8.5% 8.5%	100%* 100%*	0.7% 0.7%
<u>Persuading Voters</u>								
Gosnell (1926)	Card reminding of registration	No card	Registration	Few days	42.0%	33.0%	100.0%	13.4%
Gerber and Green (2000) (FE)	Door-to-Door GOTV Canvassing GOTV Mailing of 1-3 Cards	No GOTV No GOTV	Turnout	Few days	47.2% 42.8%	44.8% 42.2%	27.9% 100%*	15.6% 1.0%
Green, Gerber, and Nickerson (2003) (FE)	Door-to-Door Canvassing	No GOTV	Turnout	Few days	31.0%	28.6%	29.3%	11.5%
Green and Gerber (2001) (FE)	Phone Calls By Youth Vote Phone Calls 18-30 Year-Olds	No GOTV No GOTV	Turnout Turnout	Few days	71.1% 41.6%	66.0% 40.5%	73.7% 41.4%	20.4% 4.5%
DellaVigna and Kaplan (2007) (NE)	Availab. of Fox News Via Cable	No F.N. via cable	Rep. Vote Share	0-4 years	56.4%	56.0%	3.7%	11.6% <sup>+</sup>
Enikolopov, Petrova, and Zhuravskaya (2010) (NE)	Availability of independent anti-Putin TV station (NTV)	No NTV	Vote Share of anti-Putin parties	3 months	17.0%	10.7%	47.0%	7.7% <sup>+</sup>
Knight and Chiang (2010) (NE)	Unsurprising Dem. Endors. (NYT) Surprising Dem. Endors. (Denver)	No endors. No endors.	Support for Gore	Few weeks	75.5% 55.1%	75.0% 52.0%	100.0% 100.0%	2.0% 6.5%
Gerber, Karlan, and Bergan (2009) (FE)	Free 10-week subscription to Washington Post	No Subscr.	Dem. Vote Share (stated in survey)	2 months	67.2%	56.0%	94.0%	19.5% <sup>+</sup>
Gentzkow (2006) (NE)	Exposure to Television	No Television	Turnout	10 years	54.5%	56.5%	80.0%	4.4%
Gentzkow and Shapiro (2009) (NE)	Read Local Newspaper	No local paper	Turnout	0-4 years	70.0%	69.0%	25.0%	12.9%



TABLE 1, PART B  
PERSUASION RATES: SUMMARY OF STUDIES

Paper	Treatment	Control	Variable $t$	Time Horizon	Treatment group $t_T$	Control group $t_C$	Exposure rate $e_T - e_C$	Persuasion rate $f$
	(1)	(2)	(4)	(7)	(9)	(10)	(11)	(12)
<u>Persuading Donors</u>								
List and Lucking-Reiley (2002) (FE)	Fund-raiser mailer with low seed	No mailer	Share	1-3 weeks	3.7%	0%	100%*	3.7%
	Fund-raiser mailer with high seed	No mailer	Giving Money		8.2%	0%	100%*	8.2%
Landry, Lange, List, Price, and Rupp (2006) (FE)	Door-To-Door Fund-raising Campaign for University Center	No visit	Share Giving Money	immediate	10.8%	0%	36.3%	29.7%
DellaVigna, List, and Malmendier (2009) (FE)	Door-To-Door Fund-raising Campaign for Out-of-State Charity	No visit	Share Giving Money	immediate	4.6%	0%	41.7%	11.0%
Falk (2007) (FE)	Fund-raiser mailer with no gift	No mailer	Share	1-3 weeks	12.2%	0%	100%*	12.2%
	Mailer with gift (4 post-cards)	No mailer	Giving Money		20.6%	0%	100%*	20.6%
<u>Persuading Investors</u>								
Engelberg and Parsons (2009) (NE)	Coverage of Earnings News in Local Paper	No coverage	Trading of Shares of Stock in News	3 days	0.023%	0.017%	60.0%	0.010%

**Notes:** Calculations of persuasion rates by the authors. The list of papers indicates whether the study is a natural experiment ("NE") or a field experiment ("FE"). Columns (9) and (10) report the value of the behavior studied (Column (4)) for the Treatment and Control group. Column (11) reports the Exposure Rate, that is, the difference between the Treatment and the Control group in the share of people exposed to the Treatment. Column (12) computes the estimated persuasion rate  $f = 100 * (t_T - t_C) / ((e_T - e_C) * (1 - t_C))$ . The persuasion rate denotes the share of the audience that was not previously convinced and that is convinced by the message. The studies where the exposure rate (Column (11)) is denoted by "100%\*" are cases in which the data on the differential exposure rate between treatment and control is not available. In these case, we assume  $e_T - e_C = 100\%$ , which implies that the persuasion rate is a lower bound for the actual persuasion rate. In the studies on "Persuading Donors", even in cases in which an explicit control group with no mailer or no visit was not run, we assume that such a control would have yielded  $t_C = 0\%$ , since these behaviors are very rare in absence of a fund-raiser. For studies

- Persuasion rate helps reconcile seemingly very different results, e.g. persuading voters

- More in detail: **DellaVigna-Kaplan (QJE, 2007)**, Fox News natural experiment
  1. Fast expansion of Fox News in cable markets
    - October 1996: Launch of 24-hour cable channel
    - June 2000: 17 percent of US population listens regularly to Fox News (Scarborough Research, 2000)
  2. Geographical differentiation in expansion
    - Cable markets: Town-level variation in exposure to Fox News
    - 9,256 towns with variation even within a county
  3. Conservative content
    - Unique right-wing TV channel (Groseclose and Milyo, 2004)

- Empirical Results

- **Selection.** In which towns does Fox News select? (Table 3):

$$d_{k,2000}^{FOX} = \alpha + \beta v_{k,1996}^{R,Pres} + \beta Contr_{k,1996}^R + \Gamma_{2000} X_{k,2000} + \Gamma_{00-90} X_{k,00-90} + \Gamma_{CC} C_{k,2000} + \varepsilon_k.$$

- Controls  $X$

- Cable controls (Number of channels and potential subscribers)
- US House district or county fixed effects

- Conditional on  $X$ , Fox News availability is orthogonal to

- political variables
- demographic variables

TABLE III  
DETERMINANTS OF FOX NEWS AVAILABILITY, LINEAR PROBABILITY MODEL

Dep. var.	Availability of Fox News via cable in 2000				
	(1)	(2)	(3)	(4)	(5)
Pres. republican vote share in 1996	0.1436 (0.1549)	0.6363 (0.2101)***	0.3902 (0.1566)**	-0.0343 (0.0937)	-0.0442 (0.1024)
Pres. log turnout in 1996	0.1101 (0.0557)**	0.0909 (0.0348)***	0.0656 (0.0278)**	0.0139 (0.0124)	-0.0053 (0.0173)
Pres. Rep. vote share change 1998-1992					
Control variables					
Census controls: 1990 and 2000	—	X	X	X	X
Cable system controls	—	—	X	X	X
U. S. House district fixed effects	—	—	—	X	—
County fixed effects	—	—	—	—	X
<i>F</i> -test: Census controls = 0		<i>F</i> = 3.54***	<i>F</i> = 2.73***	<i>F</i> = 1.11	<i>F</i> = 1.28
<i>F</i> -test: Cable controls = 0			<i>F</i> = 18.08***	<i>F</i> = 21.09***	<i>F</i> = 18.61***
<i>R</i> <sup>2</sup>	0.0281	0.0902	0.4093	0.6698	0.7683
<i>N</i>	<i>N</i> = 9,256	<i>N</i> = 9,256	<i>N</i> = 9,256	<i>N</i> = 9,256	<i>N</i> = 9,256

- **Baseline effect – Presidential races**

- *Effect on Presidential Republican vote share (Table 4):*

$$v_{k,2000}^{R,Pres} - v_{k,1996}^{R,Pres} = \alpha + \beta_F d_{k,2000}^{FOX} + \Gamma_{2000} X_{k,2000} + \Gamma_{00-90} X_{k,00-90} + \Gamma_C C_{k,2000} + \varepsilon_k.$$

- **Results:**

- Significant effect of Fox News with district (Column 3) and county fixed effects (Column 4)
- .4-.7 percentage point effect on Republican vote share in Pres. elections
- Similar effect on Senate elections → Effect is on ideology, not person-specific
- Effect on turnout

TABLE IV  
THE EFFECT OF FOX NEWS ON THE 2000–1996 PRESIDENTIAL VOTE SHARE CHANGE

Dep. var.	Republican two-party vote share change between 2000 and 1996				
	(1)	(2)	(3)	(4)	(5)
Availability of Fox News via cable in 2000	-0.0025 (0.0037)	0.0027 (0.0024)	0.008 (0.0026)***	0.0042 (0.0015)***	0.0069 (0.0014)***
Pres. Rep. vote share change 1988–1992					
Constant	0.0347 (0.0017)***	-0.028 (0.0245)	-0.0255 (0.0236)	0.0116 (0.0154)	0.0253 (0.0185)
Control variables					
Census controls: 1990 and 2000	—	X	X	X	X
Cable system controls	—	—	X	X	X
U. S. House district fixed effects	—	—	—	X	—
County fixed effects	—	—	—	—	X
$R^2$	0.0007	0.5207	0.5573	0.7533	0.8119
$N$	$N = 9,256$	$N = 9,256$	$N = 9,256$	$N = 9,256$	$N = 9,256$

- Magnitude of effect: How do we generalize beyond Fox News?
- Estimate audience of Fox News in towns that have Fox News via cable (First stage)
  - Use Scarborough micro data on audience with Zip code of respondent
  - Fox News exposure via cable increases regular audience by 6 to 10 percentage points
  - How many people did Fox News convince?
  - Heuristic answer: Divide effect on voting (.4-.6 percentage point) by audience measure (.6 to .10)
- Result: Fox News convinced 3 to 8 percent of audience (Recall measure) or 11 to 28 percent (Diary measure)

- How do we interpret the results?
- Benchmark model:
  1. **New media source** with unknown bias  $\beta$ , with  $\beta \sim N\left(\beta_0, \frac{1}{\gamma_\beta}\right)$
  2. Media observes (differential) quality of Republican politician,  $\theta_t \sim N\left(0, \frac{1}{\gamma_\theta}\right)$ , i.i.d., in periods  $1, 2, \dots, T$
  3. **Media broadcast:**  $\psi_t = \theta_t + \beta$ . Positive  $\beta$  implies pro-Republican media bias
  4. **Voting in period  $T$ .** Voters vote Republican if  $\hat{\theta}_T + \alpha > 0$ , with  $\alpha$  ideological preference



- Signal extraction problem. New media (Fox News) says Republican politician (George W. Bush) is great
  - Is Bush great?
  - Or is Fox News pro-Republican?
- A bit of both, the audience thinks. Updated media bias after  $T$  periods:

$$\hat{\beta}_T = \frac{\gamma_\beta \beta_0 + T\gamma_\theta \bar{\psi}_T}{\gamma_\beta + T\gamma_\theta}.$$

- Estimated quality of Republican politician:

$$\hat{\theta}_T = \frac{\gamma_\theta * 0 + W [\psi_T - \hat{\beta}_T]}{\gamma_\theta + W} = \frac{W [\psi_T - \hat{\beta}_T]}{\gamma_\theta + W}$$

- **Persuasion.** Voter with persuasion  $\lambda$  ( $0 \leq \lambda \leq 1$ ) does not take into account enough media bias:

$$\hat{\theta}_T^\lambda = \frac{W^\lambda[\psi_T - (1 - \lambda)\hat{\beta}_T]}{\gamma_\theta + W^\lambda}$$

- Vote share for Republican candidate.  $P(\alpha + \hat{\theta}_T^\lambda \geq 0) = 1 - F(-\hat{\theta}_T^\lambda)$

- **Proposition 1.** Three results:

1. **Short-Run I:** *Republican media bias increases Republican vote share:*  
 $\partial[1 - F(-\hat{\theta}_T^\lambda)]/\partial\beta > 0$ .
2. **Short-Run II:** *Media bias effect higher if persuasion ( $\lambda > 0$ ).*
3. **Long-run** ( $T \rightarrow \infty$ ). *Media bias effect  $\iff$  persuasion  $\lambda > 0$ .*

- Intuition.
  - Fox News enthusiastic of Bush
  - Audience updates beliefs: “This Bush must be really good” (**Short-Run I**)
  - Believe media more if credulous or persuadable (**Short-Run II**)
  - But: Fox News enthusiastic also of Karl Rove, Rick Lazio, Bill Frist  
—> “They cannot be all good!”
  - Make inference that Fox News is biased, stop believing it
  - Fox News influences only individuals subject to persuasion (**Long-Run**)
- What is the evidence about persuasion bias?

- **Cain-Loewenstein-Moore (JLegalStudies, 2005).** Psychology Experiment
  - Pay subjects for precision of estimates of number of coins in a jar
  - Have to rely on the advice of second group of subjects: advisors
  - (Advisors inspect jar from close)
  - Two experimental treatments:
    - \* *Aligned incentives.* Advisors paid for closeness of subjects' guess
    - \* *Mis-Aligned incentives, Common knowledge.* Advisors paid for how high the subjects' guess is. Incentive common-knowledge
    - \* *(Mis-Aligned incentives, Not Common knowledge.)*

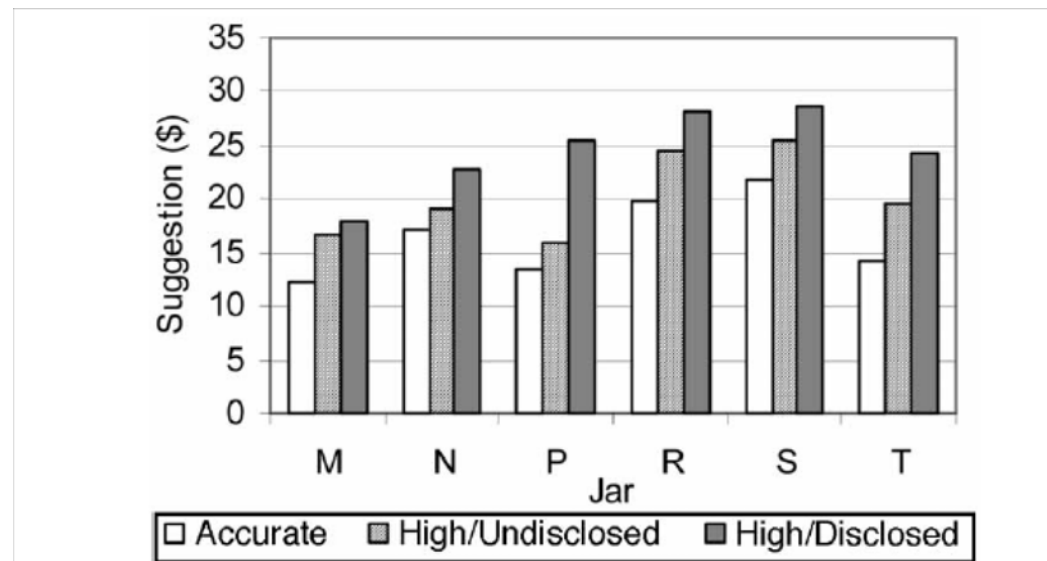
**Table 1.** Payoff Function for Advisors in Accurate Condition and for All Estimators

Range of Estimator's Estimate from True Value (\$)	Payoff (\$)
.00-.50	5.00
.51-1.00	4.50
1.01-1.50	4.00
1.51-2.00	3.50
2.01-2.50	3.00
2.51-3.00	2.50
3.01-3.50	2.00
3.51-4.00	1.50
4.01-4.50	1.00
4.51-5.00	.50

**Table 2.** Advisors' Payoff Function in Conflict-of-Interest Conditions

Range of Estimator's Estimate above True Value (\$)	Payoff (\$)
.50-1.00	1.00
1.01-1.50	1.90
1.51-2.00	2.70
2.01-2.50	3.40
2.51-3.00	4.00
3.01-3.50	4.50
3.51-4.00	4.90
4.01-4.50	5.20
4.51-5.00	5.40
5.01 +	5.50

- Result 1: Advisors increase estimate in *Mis-Aligned incentives* treatment — Even more so when common knowledge



- Result 2. Estimate of subjects is higher in Treatment with *Mis-Aligned incentives*

**Table 6.** Estimator Estimates of Jar Values

	Accurate (N = 27)	High/Undisclosed (N = 26)	High/Disclosed (N = 27)	Significance of Advisor Incentives ( <i>p</i> ) (Accurate versus High Conditions)	Significance of Disclosure ( <i>p</i> ) (Conflict-of-Interest Conditions)
Estimator estimate	14.21 (2.20)	16.81 (3.56)	18.14 (5.00)	<.001	.19
Estimator absolute error	5.25 (1.58)	5.14 (1.31)	6.69 (2.44)	<.363	<.01

- Subjects do not take sufficiently into account incentives of information provider
- Effect even stronger when incentives are known → Advisors feel free(er) to increase estimate
- Applications to many settings

- Application 1: **Malmendier-Shantikumar (JFE, 2007)**.
  - Field evidence that small investors suffer from similar bias
  - Examine recommendations by analysts to investors
  - Substantial upward distortion in recommendations (Buy=Sell, Hold=Sell, etc)

Panel A: Entire Sample	Sample size	Percentage within category				
		Strong Sell	Sell	Hold	Buy	Strong Buy
All	121,130	1.72	2.86	36.84	32.90	25.67
Unaffiliated	112,664	1.79	2.96	37.68	32.40	25.17

- Higher distortion for analysis working in Inv. Bank affiliated with company they cover (through IPO/SEO)



- Question: Do investors discount this bias?
  - Analyze Trade Imbalance (essentially, whether trade is initiated by Buyer)
  - Assume that
    - \* large investors do large trades
    - \* small investors do small trades
  - See how small and large investors respond to recommendations
- Examine separately for affiliated and unaffiliated analysts

All Recommendations

	Large Trade	Small Trade	Difference S-L
Strong Sell	-0.103 (0.040)	-0.105 (0.050)	-0.002 (0.064)
Sell	-0.118 (0.034)	-0.139 (0.046)	-0.021 (0.057)
Hold	-0.091 (0.011)	0.007 (0.014)	0.099 (0.018)
Buy	0.011 (0.012)	0.134 (0.013)	0.123 (0.017)
Strong Buy	0.112 (0.013)	0.243 (0.014)	0.131 (0.019)
(Strong Sell)*Affiliation	-0.196 (0.255)	-0.838 (0.331)	-0.643 (0.418)
(Sell)*Affiliation	0.094 (0.254)	-0.087 (0.272)	-0.180 (0.372)
(Hold)*Affiliation	-0.001 (0.044)	0.005 (0.056)	0.006 (0.072)
(Buy)*Affiliation	-0.068 (0.034)	0.013 (0.039)	0.081 (0.052)
(Strong Buy)*Affiliation	-0.129 (0.036)	-0.023 (0.041)	0.106 (0.055)
Sample size	86,961	86,961	
R <sup>2</sup>	0.0034	0.0085	

- Results:
  - Small investor takes analyst recommendations literally (buy Buys, sell Sells)
  - Large investors discount for bias (hold Buys, sell Holds)
  - Difference is particularly large for affiliated analysts
  - Small investors do not respond to affiliation information
- Strong evidence of distortion induced by incentives

# 7 Social Pressure

- Clear example of social pressure without social learning
- *Milgram experiment*: post-WWII
- Motivation: Do Germans yield to pressure more than others?
  - Subjects: Adult males in US
  - Recruitment: experiment on punishment and memory
  - Roles:
    - \* teacher (subjects)
    - \* learner (accomplice)

- Teacher asks questions
- Teacher administers shock for each wrong answer
- Initial shock: 15V
- Increase amount up to 450V (not deadly, but very painful)
- Learner visible through glass (or audible)
- Learner visibly suffers and complains
  
- Results:
  - 62% subjects reach 450V
  - Subjects regret what they did ex post
  - When people asked to predict behavior, almost no one predicts escalation to 450V

- It's not the Germans (or Italians)! Most people yield to social pressure
- Furthermore, naivete' — Do not anticipate giving in to social pressure
- Social Pressure likely to be important in organization and public events

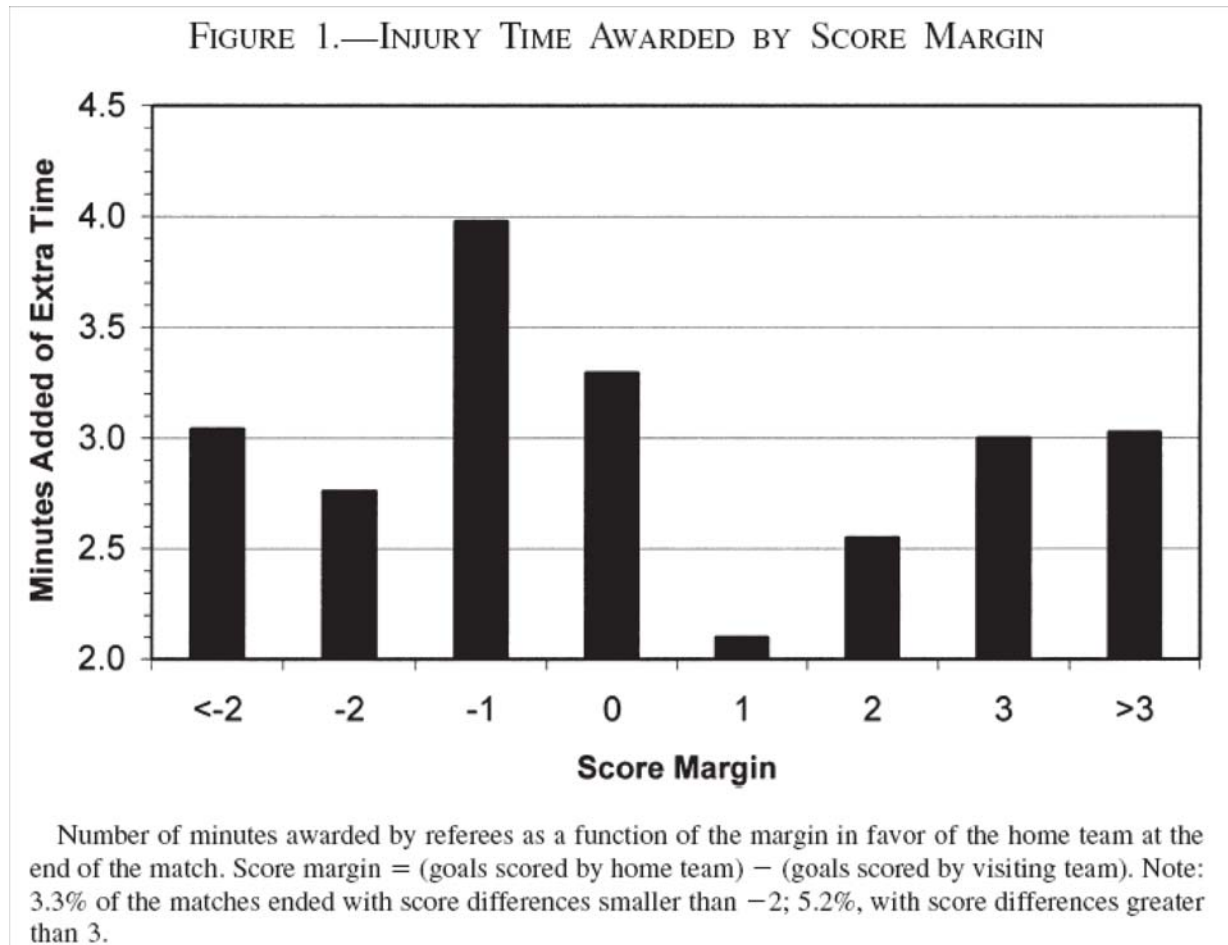
- Second classical psychology experiment: Asch (1951)
  - Subjects are shown two large white cards with lines drawn on them
    - \* First card has three lines of substantially differing length on them
    - \* Second card has only one line.
  - Subjects are asked which of the lines in the second card is closest in length to the line in the first card
- Control treatment: subjects perform the task in isolation → 98 percent accuracy
- High social-pressure treatment: subjects choose after 4 to 8 subjects (confederates) unanimously choose the wrong answer → Over a third of subjects give wrong answer

- Social Pressure Interpretation:
  - Avoid disagreeing with unanimous judgment of the other participants
  - Result disappears if confederates are not unanimous
- Alternative interpretation: Social learning about the rules of the experiment
- Limitation: subjects not paid for accuracy



- An example of social pressure in a public event
- **Garicano, Palacios-Huerta, and Prendergast (REStat, 2006)**
  - Soccer games in Spanish league
  - Injury time at end of each game (0 to 5 min.)
  - Make up for interruptions of game
  - Injury time: last chance to change results for teams
- Social Pressure Hypothesis: Do referees provide more injury time when it benefits more the home team?
  - Yielding to social pressure of public
  - No social learning plausible
  - Note: referees professionals, are paid to be independent

- Results: Figure 1 – Clear pattern, very large effects



- Table 5. Response to incentives → After 1994, 3 points for winning (1 for drawing, 0 for losing).

TABLE 5.—MARGINAL EFFECT OF INCENTIVES ON INJURY TIME

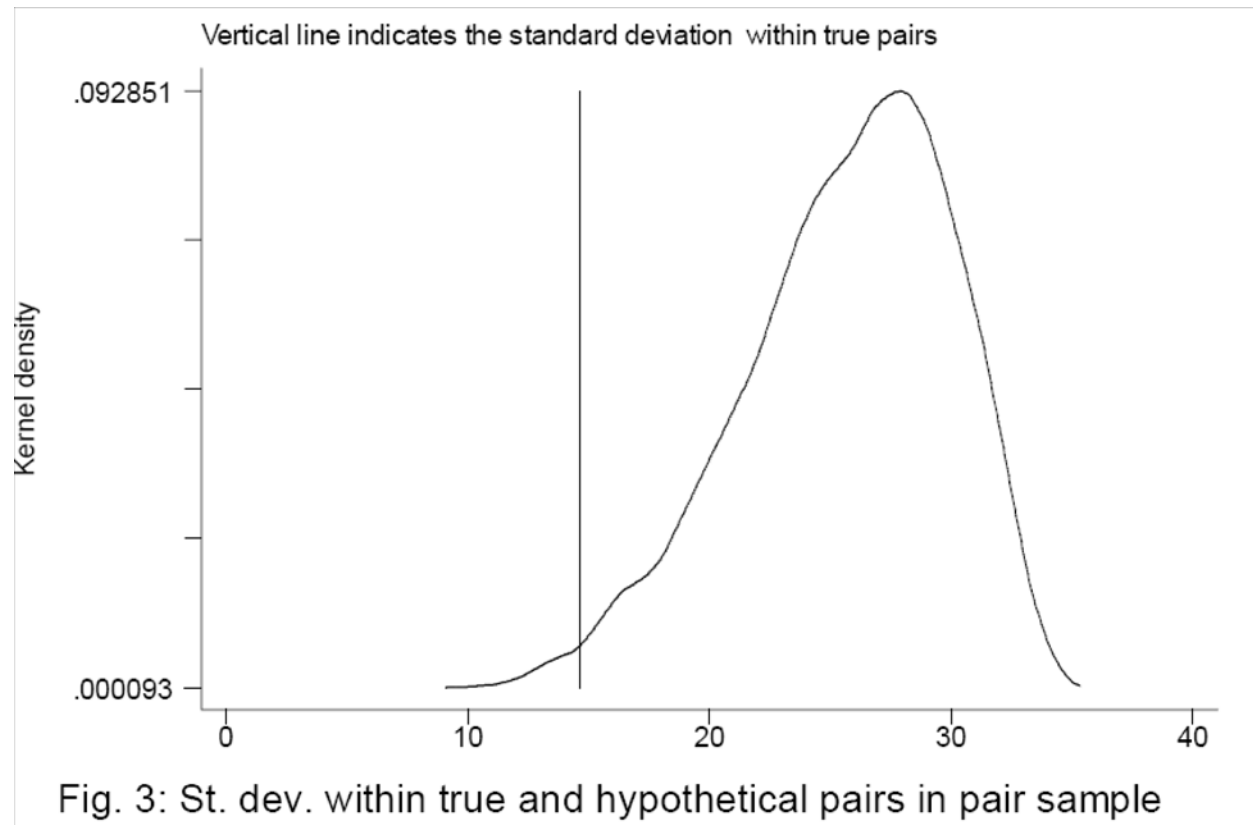
Statistic	[1]	[2]
<i>Constant</i>	3.50** (0.14)	3.11** (0.32)
<i>Score Difference</i>	<b>-1.53**</b> <b>(0.18)</b>	<b>-1.56**</b> <b>(0.18)</b>
<i>Year Effect</i>	0.81** (0.18)	0.7** (0.21)
<i>Year × Score Difference</i>	<b>-0.58*</b> <b>(0.23)</b>	<b>-0.52*</b> <b>(0.23)</b>
<i>Yellow Cards</i>		0.07** (0.02)

- Table 6. Response to social pressure: size of audience

TABLE 6.—EFFECT OF THE SIZE AND COMPOSITION OF THE CROWD ON REFEREE BI		
Statistic	[1]	[2]
<i>Constant</i>	3.23** (0.18)	2.94** (0.20)
<i>Score Difference</i>	<b>-0.93**</b> <b>(0.20)</b>	<b>-0.96**</b> <b>(0.21)</b>
<i>Year Effect</i>	0.36** (0.11)	0.33** (0.11)
<i>Attendance</i>	0.00 (0.00)	0.00 (0.00)
<i>Attendance × Score Difference</i>	<b>-0.02**</b> <b>(0.00)</b>	<b>-0.02**</b> <b>(0.00)</b>
<i>Yellow Cards</i>		0.07** (0.02)
<i>Budget Home</i>		

- *Peer effect* literature also points to social pressure
- **Falk-Ichino (JOLE, 2006)**: effect of peer pressure on task performance
  - Recruit High-school students in Switzerland to perform one-time job for flat payment
  - Stuff letters into envelopes for 4 hours
  - Control group of 8 students did the task individually
  - Treatment group of 16 students worked in pairs (but each student was instructed to stuff the envelopes individually)
- Results:
  - Students in treatment group stuffed more envelopes (221 vs. 190)

- Students in treatment group coordinated the effort within group: within-pair standard-deviation of output is significantly less than the (simulated) between-pairs standard deviation



- Final Example: Effect of Social Pressure on Voting

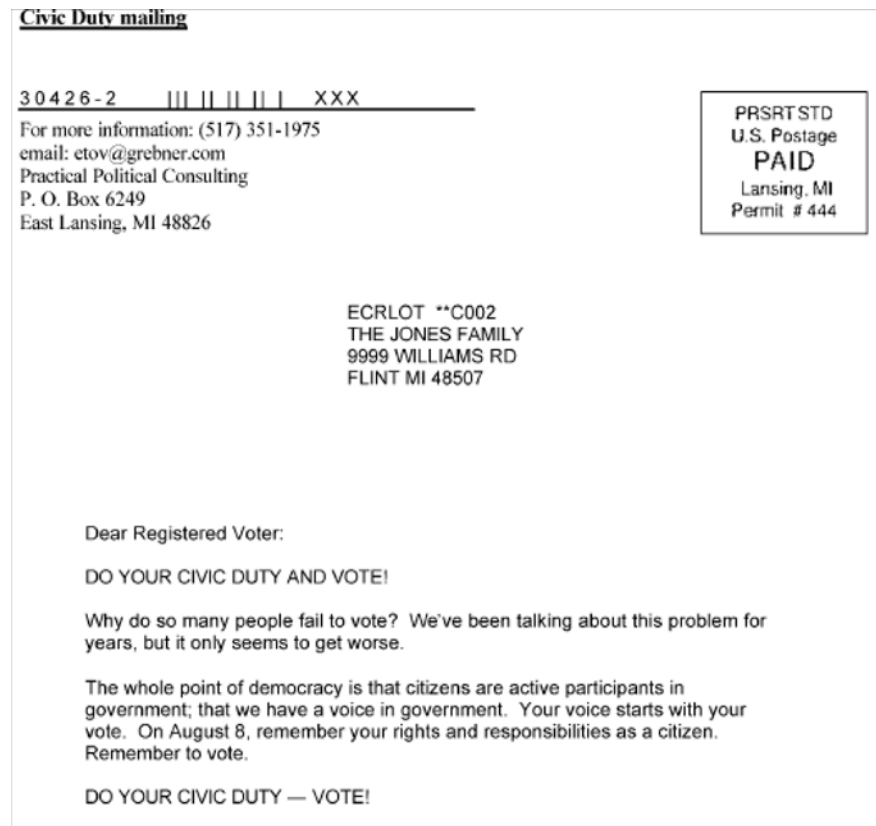
- Large literature of field experiments to impact voter turnout
- Typical design: Day before (local) election reach treatment household and encourage them to vote
- Some classical examples

Paper	Treatment (1)	Election type or question (2)	Variable $t$ (3)	Year (4)	Place (5)	Sample size (6)	Control group $t_T$ (7)	Treatment group $t_C$ (8)	Exposure rate $e_T - e_C$ (9)	Persuasion rate (10)
Field Experiments										
Gerber and Green [2000]	Door-to-door canvassing	Federal elect.	Turnout	1998	New Haven	$N = 14,473$	0.422	0.463	0.270	0.263
	Canvassing + mail + calls	Federal elect.	Turnout	1998	New Haven	$N = 14,850$	0.422	0.448	0.270	0.167
Green, Gerber, and Nickerson [2003]	Door-to-door canvassing	Local elect.	Turnout	2001	6 cities	$N = 18,933$	0.286	0.310	0.293	0.118
Green and Gerber [2001]	Phone calls by youth vote	General elect.	Turnout	2000	4 cities	$N = 4,377$	0.660	0.711	0.737	0.205
	Phone calls 18-30-year-olds	General elect.	Turnout	2000	2 cities	$N = 4,377$	0.405	0.416	0.414	0.045

- In these experiments, typically mailings are the cheapest, but also the least effective get-out-the-vote treatment
- **Gerber, Green, and Larimer (APSR, 2008):** Add social pressure to these treatments
- Setting:
  - August 2006, Michigan
  - Primary election for statewide offices
  - Voter turnout 17.7% registered voters
- Experimental sample: 180,000 households on Voter File
- Mailing sent 11 days prior to election



- Experimental design:
  - Control households get no mail (N=100,000)
  - *Civic Duty Treatment*. ‘DO YOUR CIVIC DUTY—VOTE!’’



- – *Hawthorne Treatment*. Information that voters turnout records are being studied

Dear Registered Voter:

**YOU ARE BEING STUDIED!**

Why do so many people fail to vote? We've been talking about this problem for years, but it only seems to get worse.

This year, we're trying to figure out why people do or do not vote. We'll be studying voter turnout in the August 8 primary election.

Our analysis will be based on public records, so you will not be contacted again or disturbed in any way. Anything we learn about your voting or not voting will remain confidential and will not be disclosed to anyone else.

**DO YOUR CIVIC DUTY — VOTE!**

- – *Self-Information Treatment*. Give information on own voting record

Dear Registered Voter:

**WHO VOTES IS PUBLIC INFORMATION!**

Why do so many people fail to vote? We've been talking about the problem for years, but it only seems to get worse.

This year, we're taking a different approach. We are reminding people that who votes is a matter of public record.

The chart shows your name from the list of registered voters, showing past votes, as well as an empty box which we will fill in to show whether you vote in the August 8 primary election. We intend to mail you an updated chart when we have that information.

We will leave the box blank if you do not vote.

**DO YOUR CIVIC DUTY—VOTE!**

---

OAK ST	Aug 04	Nov 04	Aug 06
9999 ROBERT WAYNE		Voted	_____
9999 LAURA WAYNE	Voted	Voted	_____

- – *Other-Information Treatment.* Know if neighbors voted!

Dear Registered Voter:

WHAT IF YOUR NEIGHBORS KNEW WHETHER YOU VOTED?

Why do so many people fail to vote? We've been talking about the problem for years, but it only seems to get worse. This year, we're taking a new approach. We're sending this mailing to you and your neighbors to publicize who does and does not vote.

The chart shows the names of some of your neighbors, showing which have voted in the past. After the August 8 election, we intend to mail an updated chart. You and your neighbors will all know who voted and who did not.

DO YOUR CIVIC DUTY — VOTE!

---

MAPLE DR	Aug 04	Nov 04	Aug 06
9995 JOSEPH JAMES SMITH	Voted	Voted	_____
9995 JENNIFER KAY SMITH		Voted	_____
9997 RICHARD B JACKSON		Voted	_____

- Results:
  - Substantial impacts especially when neighbors get to see
  - All the results are highly statistically significant
  - Results huge given that 1/3 of recipients probably never opened the mailer
  - Impact: Obama campaign considered using this, but decided too risky

**TABLE 2. Effects of Four Mail Treatments on Voter Turnout in the August 2006 Primary Election**

	Experimental Group				
	Control	Civic Duty	Hawthorne	Self	Neighbors
Percentage Voting	29.7%	31.5%	32.2%	34.5%	37.8%
N of Individuals	191,243	38,218	38,204	38,218	38,201

## 8 Next Lecture

- Emotions
- Methodology: Human Subjects Approval
- Market Response to Biases
  - Behavioral IO
  - Behavioral Finance
  - Behavioral Political Economy