Econ 219B
Psychology and Economics: Applications
(Lecture 4)

Stefano DellaVigna

February 9, 2011

Outline

1. Reference Dependence: Introduction
2. Reference Dependence: Endowment Effect
3. Methodology: Effect of Experience
4. Reference Dependence: Housing
5. Reference Dependence: Mergers
6. Reference Dependence: Insurance

1 Reference Dependence: Introduction

- Kahneman and Tversky (1979) — Anomalous behavior in experiments:

  1. *Concavity over gains.* Given \$1000, A=(500,1) $\succ$ B=(1000,0.5;0,0.5)

  2. *Convexity over losses.* Given \$2000, C=(-1000,0.5;0,0.5) $\succ$ D=(-500,1)

  3. *Framing Over Gains and Losses.* Notice that A=D and B=C

  4. *Loss Aversion.* (0,1) $\succ$ (-8,.5;10,.5)

  5. *Probability Weighting.* (5000,.001) $\succ$ (5,1) and (-5,1) $\succ$ (-5000,.001)

- Can one descriptive model theory fit these observations?

- **Prospect Theory** (Kahneman and Tversky, 1979)

- Subjects evaluate a lottery $(y, p; z, 1-p)$ as follows: $\pi(p)\,v(y-r) + \pi(1-p)\,v(z-r)$

- Five key components:

  1. Reference Dependence

     – Basic psychological intuition that changes, not levels, matter (applies also elsewhere)

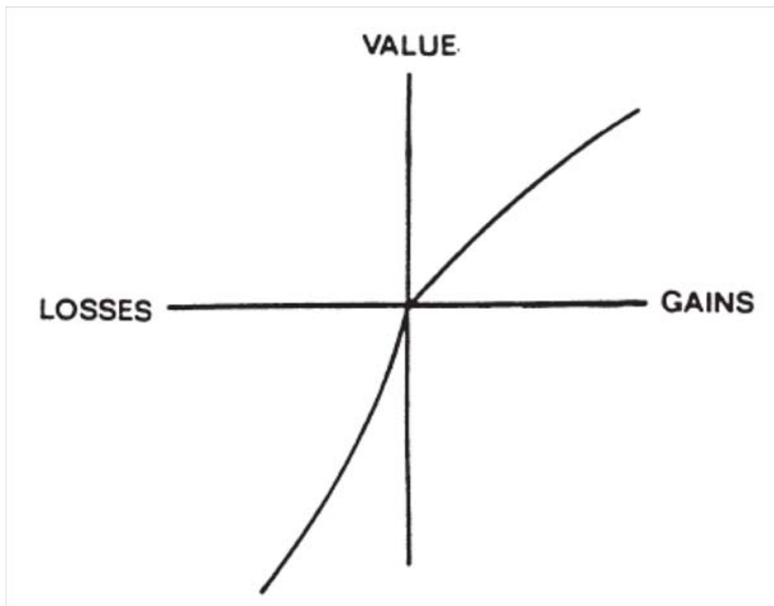
     – Utility is defined over differences from reference point r –> Explains Exp. 3

2. Diminishing sensitivity.

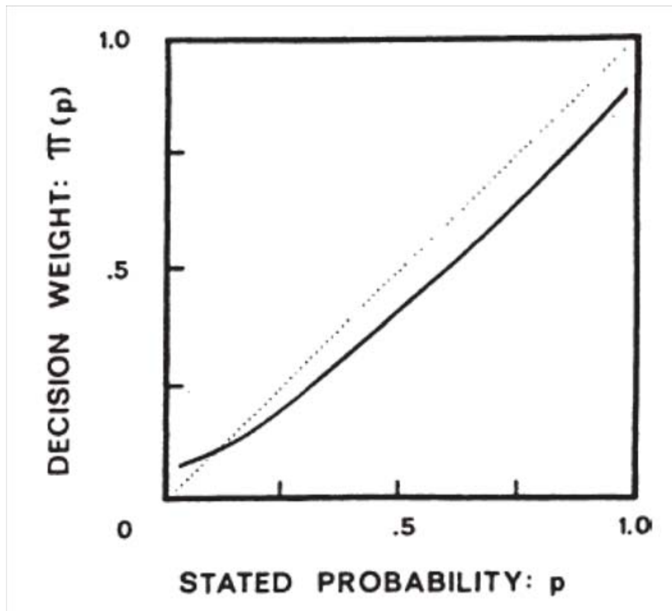
   - Concavity over gains of v –> Explains (500,1)$\succ$(1000,0.5;0,0.5)

   - Convexity over losses of v –> Explains (-1000,0.5;0,0.5)$\succ$(-500,1)

3. Loss Aversion –> Explains (0,1) $\succ$ (-8,.5;10,.5)



4. Probability weighting function π non-linear –> Explains (5000,.001) $\succ$ (5,1) and (-5,1) $\succ$ (-5000,.001)



- Overweight small probabilities + Premium for certainty

5. Narrow framing (Barberis, Huang, and Thaler, 2006; Rabin and Weizsäcker, forthcoming)

   - Consider only risk in isolation (labor supply, stock picking, house sale)

   - Neglect other relevant decisions

- Tversky and Kahneman (1992) propose calibrated version

$$v(x)=\begin{cases}(x-r)^{.88} & \text{if } x\geq r;\\ -2.25\left(-(x-r)\right)^{.88} & \text{if } x<r,\end{cases}$$

and

$$w(p)=\frac{p^{.65}}{\left(p^{.65}+(1-p)^{.65}\right)^{1/.65}}$$

- Reference point r?

- Open question – depends on context

- Koszegi-Rabin (2006 on): personal equilibrium with rational expectation outcome as reference point

- Most field applications use only (1)+(3), or (1)+(2)+(3)

$$v(x) = \begin{cases} x - r & \text{if } x \geq r; \\ \lambda(x - r) & \text{if } x < r, \end{cases}$$

- Assume backward looking reference point depending on context

2 Reference Dependence: Endowment Effect

- Plott and Zeiler (AER 2005) replicating Kahneman, Knetsch, and Thaler (JPE 1990)
  - Half of the subjects are given a mug and asked for WTA
  - Half of the subjects are shown a mug and asked for WTP
  - Finding: $WTA \simeq 2 * WTP$

Table 2: Individual Subject Data and Summary Statistics from KKT Replication

Treatment	Individual Responses (in U.S. dollars)	Mean	Median	Std. Dev.
WTP (n = 29)	0, 0, 0, 0, 0.50, 0.50, 0.50, 0.50, 0.50, 1, 1, 1, 1, 1, 1.50 2, 2, 2, 2, 2, 2.50, 2.50, 2.50, 3, 3, 3.50, 4.50, 5, 5	1.74	1.50	1.46
WTA (n = 29)	0, 1.50, 2, 2, 2.50, 2.50, 3, 3.50, 3.50, 3.50, 3.50, 3.50, 4, 4.50 4.50, 5.50, 5.50, 5.50, 6, 6, 6, 6.50, 7, 7, 7, 7.50, 7.50, 7.50, 8.50	4.72	4.50	2.17

- How do we interpret it? Use reference-dependence in piece-wise linear form
  - Assume only gain-loss utility, and assume piece-wise linear formulation (1)+(3)
  - Two components of utility: utility of owning the object $u(m)$ and (linear) utility of money p
  - Assumption: No loss-aversion over money
  - WTA: Given mug –> $r = \{mug\}$, so selling mug is a loss
  - WTP: Not given mug –> $r = \{\varnothing\}$, so getting mug is a gain
  - Assume $u\{\varnothing\} = 0$

- This implies:
  - WTA: Status-Quo $\sim$ Selling Mug

$$\begin{aligned} u\{mug\} - u\{mug\} &= \lambda \left[u\left\{ \varnothing \right\} - u\{mug\} \right] + p_{WTA} \text{ or} \\ p_{WTA} &= \lambda u\{mug\} \end{aligned}$$

  - WTP: Status-Quo $\sim$ Buying Mug

$$\begin{aligned} u\left\{ \varnothing \right\} - u\left\{ \varnothing \right\} &= u\{mug\} - u\left\{ \varnothing \right\} - p_{WTP} \text{ or} \\ p_{WTP} &= u\{mug\} \end{aligned}$$

  - It follows that

$$p_{WTA} = \lambda u\{mug\} = \lambda p_{WTP}$$

  - If loss-aversion over money,

$$p_{WTA} = \lambda^2 p_{WTP}$$

- Result $WTA \simeq 2 * WTP$ is consistent with loss-aversion $\lambda \simeq 2$

- Plott and Zeiler (*AER* 2005): The result disappears with
  - appropriate training
  - practice rounds
  - incentive-compatible procedure
  - anonymity

Pooled Data	WTP (n = 36)		6.62	6.00	4.20
	WTA (n = 38)		5.56	5.00	3.58

- What interpretation?

- Interpretation 1. Endowment effect and loss-aversion interpretation are wrong

  - Subjects feel bad selling a 'gift'

  - Not enough training

- Interpretation 2. In Plott-Zeiler (2005) experiment, subjects did not perceive the reference point to be the endowment

- Koszegi-Rabin: reference point is (.5, $\{mug\}$; .5, $\{\emptyset\}$) in both cases

  – WTA:

$$\left[\begin{array}{c} .5 * [u\{mug\} - u\{mug\}] \\ +.5 * [u\{mug\} - u\{\emptyset\}] \end{array}\right] = \left[\begin{array}{c} .5 * \lambda\,[u\{\emptyset\} - u\{mug\}] \\ +.5 * [u\{\emptyset\} - u\{\emptyset\}] \end{array}\right] + p_{WTA}$$

  – WTP:

$$\left[\begin{array}{c} .5 * \lambda\,[u\{\emptyset\} - u\{mug\}] \\ +.5 * [u\{\emptyset\} - u\{\emptyset\}] \end{array}\right] = \left[\begin{array}{c} .5 * [u\{mug\} - u\{mug\}] \\ +.5 * [u\{mug\} - u\{\emptyset\}] \end{array}\right] - p_{WTP}$$

  – This implies no endowment effect:

$$p_{WTA} = p_{WTP}$$

- Notice: Open question, with active follow-up literature
  - Plott-Zeiler (*AER* 2007): Similar experiment with different outcome variable: Rate of subjects switching
  - Isoni, Loomes, and Sugden (*AER* forthcoming):
    * In Plott-Zeiler data, there is endowment effect for lotteries in training rounds on lotteries!
    * New experiments: for lotteries, mean WTA is larger than the mean WTP by a factor of between 1.02 and 2.19
- Need for rejoinder paper(s)

- List (*QJE* 2003) – Further test of endowment effect and role of experience

- Protocol:

  - Get people to fill survey

  - Hand them memorabilia card A (B) as thank-you gift

  - After survey, show them memorabilia card B (A)

  - "Do you want to switch?"

  - "Are you going to keep the object?"

  - Experiments I, II with different object

- Prediction of Endowment effect: too little trade

- Experiment I with Sport Cards – Table II

TABLE II

SUMMARY TRADING STATISTICS FOR EXPERIMENT I: SPORTSCARD SHOW

Variable	Percent traded	p-value for Fisher's exact test
Pooled sample (n = 148)		
Good A for Good B	32.8	<0.001
Good B for Good A	34.6	
Dealers (n = 74)		
Good A for Good B	45.7	0.194
Good B for Good A	43.6	
Nondealers (n = 74)		
Good A for Good B	20.0	<0.001
Good B for Good A	25.6	

a. Good A is a Cal Ripken, Jr. game ticket stub, circa 1996. Good B is a Nolan Ryan certificate, circa 1990.
b. Fisher's exact test has a null hypothesis of no endowment effect.

- Experiment II with Pins – Table V

TABLE V
SUMMARY TRADING STATISTICS FOR EXPERIMENT II: PIN TRADING STATION

Variable	Percent traded	p-value for Fisher's exact test
Pooled sample (n = 80)		
Good C for Good D	25.0	<0.001
Good D for Good C	32.5	
Inexperienced consumers (<7 trades monthly; n = 60)	25.0	<0.001
Experienced consumers (≥7 trades monthly; n = 20)	40.0	0.26
Inexperienced consumers (<5 trades monthly; n = 50)	18.0	<0.001
Experienced consumers (≥5 trades monthly; n = 30)	46.7	0.30

- **Finding 1.** Strong endowment effect for inexperienced dealers

- How to reconcile with Plott-Zeiler?
  - Not training? No, nothing difficult about switching cards)
  - Not practice? No, people used to exchanging cards)
  - Not incentive compatibility? No
  - Is it anonymity? Unlikely
  - Gift? Possible

- **Finding 2.** Substantial experience lowers the endowment effect to zero
  - Getting rid of loss aversion?
  - Expecting to trade cards again? (Koszegi-Rabin, 2005)

- Objection 1: Is it experience or is it just sorting?
- Experiment III with follow-up of experiment I – Table IX

TABLE IX
SUMMARY STATISTICS FOR EXPERIMENT III: FOLLOW-UP SPORTSCARD SHOW

	Increased number of trades	Stable number of trades	Decreased number of trades
No trade in Experiment I; trade in Experiment III	13	1	2
No trade in Experiment I; no trade in Experiment III	8	7	11
Trade in Experiment I; Trade in Experiment III	4	0	0
Trade in Experiment I; No trade in Experiment III	2	0	5
N	27	8	18

a. Columns denote changes in subjects' trading experience over the year; rows denote subjects' behavior in the two field trading experiments.
b. Fifty-three subjects participated in both Experiment I and the follow-up experiment.

- Objection 2. Are inexperienced people indifferent between different cards?

- People do not know own preferences – Table XI

TABLE XI
SELECTED CHARACTERISTICS OF TUCSON SPORTSCARD PARTICIPANTS

	Dealers		Nondealers	
	WTA mean (std. dev.)	WTP mean (std. dev.)	WTA mean (std. dev.)	WTP mean (std. dev.)
Bid or offer	8.15	6.27	18.53	3.32
	(9.66)	(6.90)	(19.96)	(3.02)
Trading experience	16.67	15.78	4.00	3.73
	(19.88)	(13.71)	(5.72)	(3.46)
Years of market experience	10.23	10.57	5.97	5.60
	(5.61)	(8.13)	(5.87)	(6.70)

- Objection 3. What are people learning about?

- Getting rid of loss-aversion?

- Learning better value of cards?

- If do not know value, adopt salesman technique

- Is learning localized or do people generalize the learning to other goods?

- List (*EMA*, 2004): Field experiment similar to experiment I in List (2003)

- Sports traders but objects are mugs and chocolate

- Trading in four groups:

  1. Mug: "Switch to Chocolate?"

  2. Chocolate: "Switch to Mug?"

  3. Neither: "Choose Mug or Chocolate?"

  4. Both: "Switch to Mug or Chocolate?"

	Preferred Exchange	p-Value for Fisher's Exact Test
Panel D. Trading Rates		
Pooled nondealers (n = 129)	.18 (.38)	< .01
Inexperienced consumers (< 6 trades monthly; n = 74)	.08 (.27)	< .01
Experienced consumers (≥ 6 trades monthly; n = 55)	.31 (.47)	< .01
Intense consumers (≥ 12 trades monthly; n = 16)	.56 (.51)	.64
Pooled dealers (n = 62)	.48 (.50)	.80

- Large endowment effect for inexperienced card dealers
- No endowment effect for experienced card dealers!
- Learning (or reference point formation) generalizes beyond original domain

3 Methodology: Effect of Experience

- Effect of experience is debated topic

- Does Experience eliminate behavioral biases?

- Argument for 'irrelevance' of Psychology and Economics

- Opportunities for learning:
  - Getting feedback from expert agents
  - Learning from past (own) experiences
  - Incentives for agents to provide advice

- This will drive away 'biases'

- However, four arguments to contrary:

  1. Feedback is often infrequent (house purchases) and noisy (financial investments) –> Slow convergence

  2. Feedback can exacerbate biases for non-standard agents:

     – Ego-utility (Koszegi, 2001): Do not want to learn

     – Learn on the wrong parameter

     – See Haigh and List (2004) below

3. No incentives for Experienced agents to provide advice

   – Exploit naives instead

   – Behavioral IO –> DellaVigna-Malmendier (2004) and Gabaix-Laibson (2006)

4. No learning on preferences:

   – Social Preferences or Self-control are non un-learnt

   – Preference features as much as taste for Italian red cars (undeniable)

- Empirically, four instances:

- **Case 1. Endowment Effect**. List (2003 and 2004)
  - Trading experience –> Less Endowment Effect
  - Effect applies across goods
  - Interpretations:
    - Loss aversion can be un-learnt
    - Experience leads to update reference point –> Expect to trade

- **Case 2. Nash Eq. in Zero-Sum Games.**

- Palacios-Huerta-Volij (2006): Soccer players practice –> Better Nash play

- Idea: Penalty kicks are practice for zero-sum game play

$1\backslash 2$	A	B
A	.60	.95
B	.90	.70

- How close are players to the Nash mixed strategies?

- Compare professional (2nd League) players and college students – 150 repetitions

Table E - Summary Statistics in Penalty Kick's Experiment

		Equilibrium	Professional Soccer Players	College Students Soccer Experience	College Students No Soccer Experience
I. Aggregate Data					
Row Player frequencies	*L*	0.363	0.333	0.392	0.401
	R	0.636	0.667	0.608	0.599
Column Player frequencies	*L*	0.454	0.462	0.419	0.397
	R	0.545	0.538	0.581	0.603
Row Player Win percentage		0.7909	0.7947	0.7927	0.7877
(std. deviation)		(0.0074)			
II. Number of Individual Rejections of Minimax Model at 5 (10) percent					
Row Player (All Cards)		1 (2)	0 (1)	1 (3)	2 (3)
Column Player (All Cards)		1 (2)	1 (2)	2 (2)	3 (10)
Both Players (All Cards)		1 (2)	1 (1)	1 (3)	3 (9)
All Cards		4 (8)	4 (7)	9 (12)	12 (20)

- Surprisingly close on average

- More deviations for students –> Experience helps (though people surprisingly good)

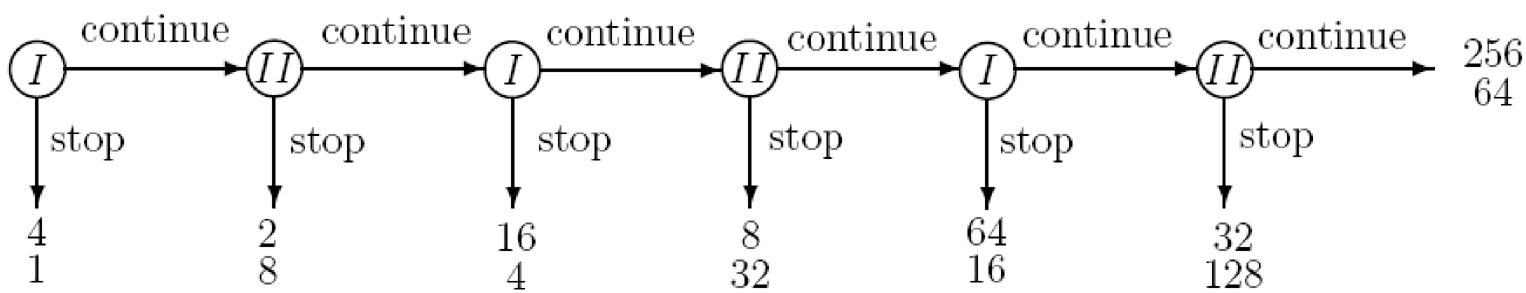
- However: Levitt-List-Reley (2007): Replicate in the US

  - Soccer and Poker players, 150 repetition

  - No better at Nash Play than students

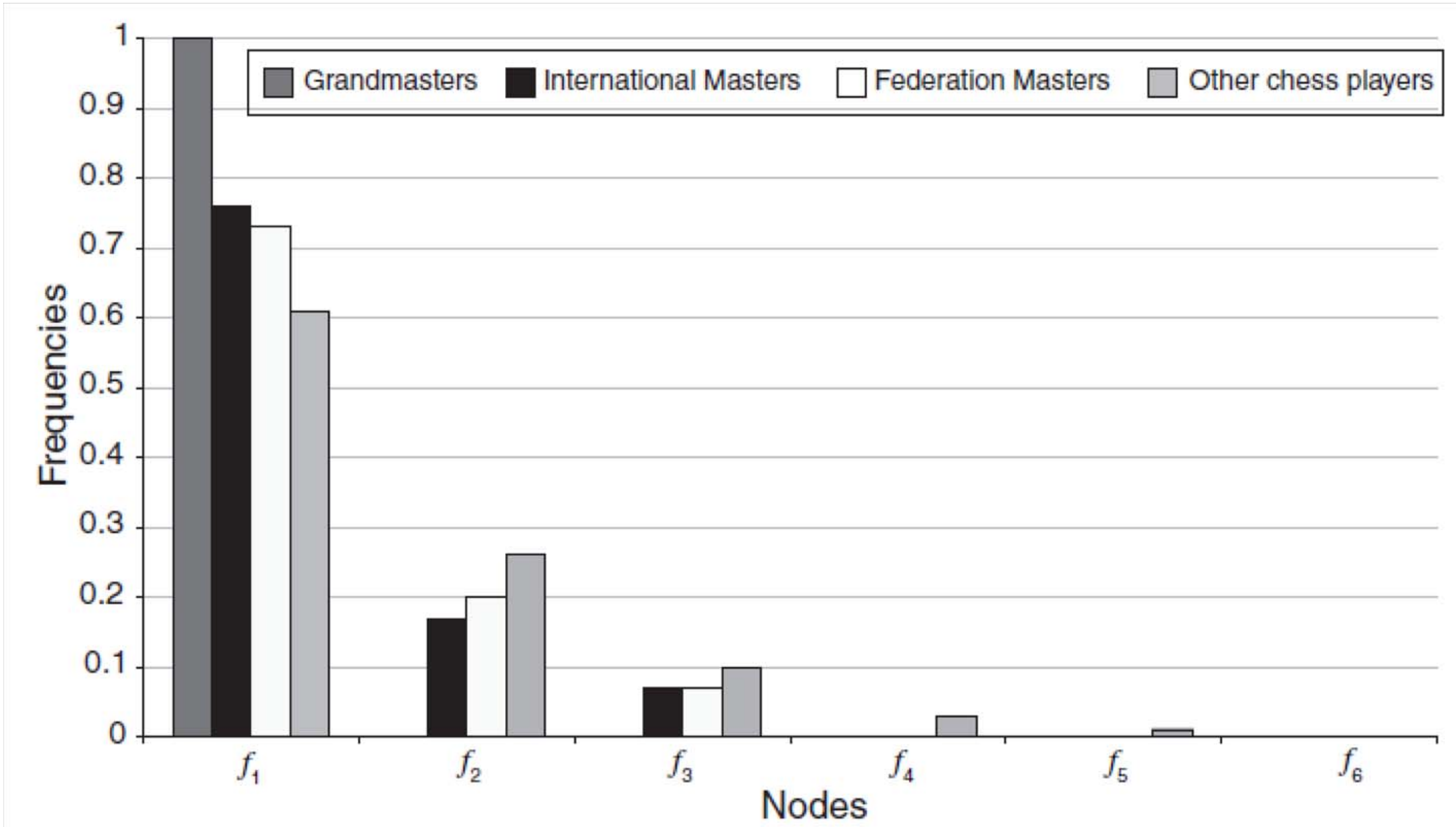
- Maybe hard to test given that even students are remarkably good

- **Case 3. Backward Induction.** Palacios-Huerta-Volij (2007)

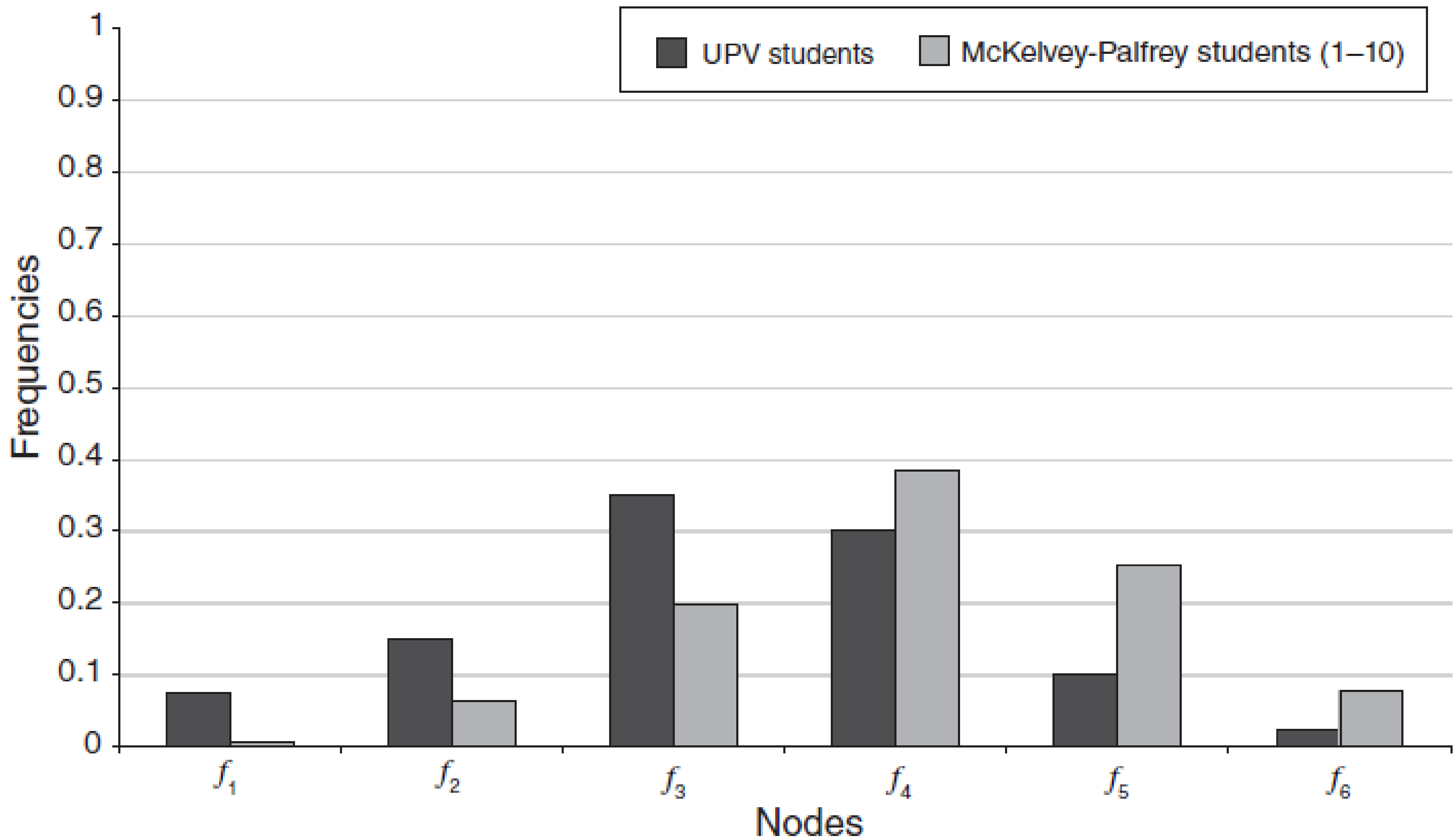


- Play in centipede game
  - Optimal strategy (by backward induction) –> Exit immediately
  - Continue if
    - ∗ No induction
    - ∗ Higher altruism

- Test of backward induction: Take Chess players
  - 211 pairs of chess players at Chess Tournament
  - Randomly matched, anonymity
  - 40 college students
  - Games with SMS messages
- Results:
  - Chess Players end sooner
  - More so the more experience



Grandmasters
International Masters
Federation Masters
Other chess players
Frequencies
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
f_1
f_2
f_3
f_4
f_5
f_6
Nodes


UPV students
McKelvey-Palfrey students (1–10)
Frequencies
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
f_1
f_2
f_3
f_4
f_5
f_6
Nodes

- Interpretations:
  - Cognition: Better at backward induction
  - Preferences More selfish
- Open questions:
  - Who earned the higher payoffs? almost surely the students
  - What would happen if you mix groups and people know it?

- Laboratory experiment (added after the initial study)
  - Recruit students and chess players (not masters) in Bilbao
  - Create 2*2 combinations, with composition common knowledge

TABLE 5—PROPORTION OF OBSERVATIONS AND IMPLIED STOP PROBABILITIES AT EACH TERMINAL NODE

	Session	N	f_1	f_2	f_3	f_4	f_5	f_6	f_7
Panel A: Proportion of observations f_i									
I. Students versus	1	100	0.04	0.15	0.40	0.27	0.13	0.01	0
students	2	100	0.02	0.18	0.28	0.33	0.14	0.04	0.01
	Total 1–2	200	0.030	0.165	0.340	0.300	0.135	0.025	0.005
II. Students versus	3	100	0.28	0.36	0.19	0.11	0.06	0	0
chess players	4	100	0.32	0.37	0.22	0.07	0.02	0	0
	Total 3–4	200	0.300	0.365	0.205	0.090	0.040	0	0
III. Chess players	5	100	0.37	0.26	0.22	0.09	0.06	0	0
versus students	6	100	0.38	0.29	0.17	0.10	0.06	0	0
	Total 5–6	200	0.375	0.275	0.195	0.095	0.060	0	0
IV. Chess players	7	100	0.69	0.19	0.11	0.01	0	0	0
versus chess players	8	100	0.76	0.16	0.07	0.01	0	0	0
	Total 7–8	200	0.725	0.175	0.090	0.010	0	0	0

- Mixed groups exhibit very different behavior

- Possibility 1: Social preferences
  - Students care less about chess players than about other students
  - Chess players care more about chess players than about other chess players
  - Part 2 is very unlikely

- Possibility 2: Knowledge of rationality matters
  - It is common knowledge that chess players stop early, and that students stop late
  - Where exactly does this belief come from?

- **Case 4. Myopic Loss Aversion.**

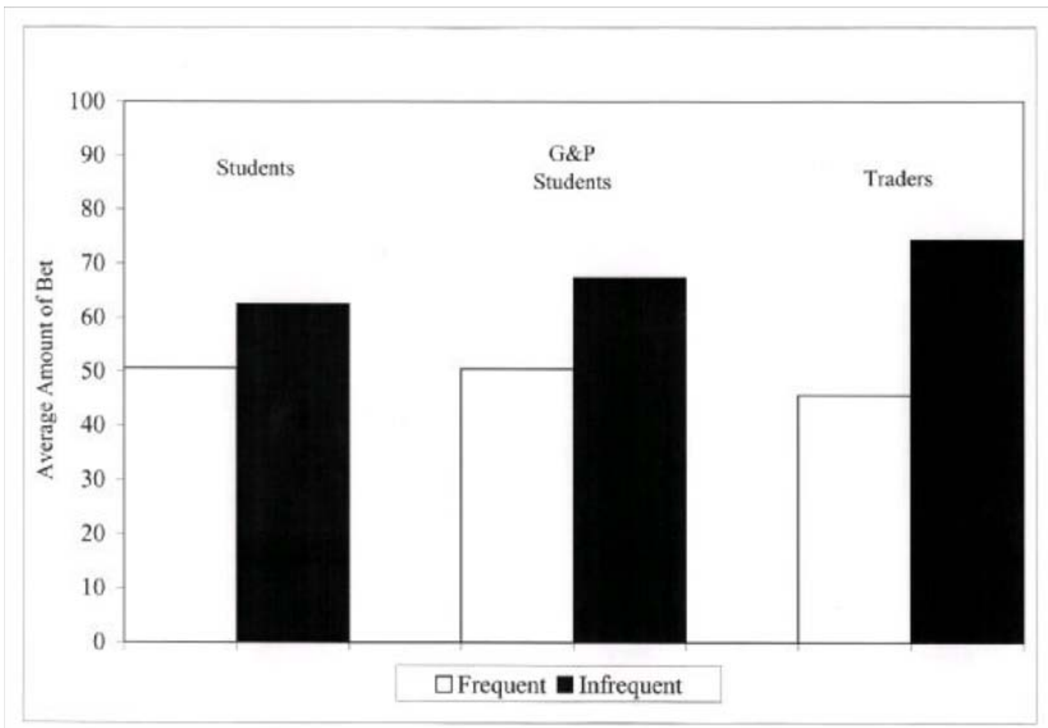
- Lottery: 2/3 chance to win 2.5X, 1/3 chance to lose X
  - Treatment F (Frequent): Make choice 9 times
  - Treatment I (Infrequent): Make choice 3 times in blocks of 3

- Standard theory: Essentially no difference between F and I

- Prospect Theory with Narrow Framing: More risk-taking when lotteries are chosen together —> Lower probability of a loss

- Gneezy-Potters (*QJE*, 1997): Strong evidence of myopic loss aversion with student population

- Haigh and List (2004): Replicate with
  - Students
  - Professional Traders –> *More* Myopic Loss Aversion



- Summary: Effect of Experience?
  - Can go either way
  - Open question

4 Reference Dependence: Housing

- **Genesove-Mayer (QJE, 2001)**
  - For houses sales, natural reference point is previous purchase price
  - Loss Aversion –> Unwilling to sell house at a loss

- Formalize intuition.
  - Seller chooses price P at sale
  - Higher Price P
    * lowers probability of sale $p(P)$ (hence $p'(P) < 0$)
    * increases utility of sale $U(P)$
  - If no sale, utility is $\bar{U} < U(P)$ (for all relevant P)

- Maximization problem:

$$\max_{P} p(P)U(P) + (1 - p(P))\bar{U}$$

- F.o.c. implies

$$MG = p(P^*)U'(P^*) = -p'(P^*)(U(P^*) - \bar{U}) = MC$$

- Interpretation: Marginal Gain of increasing price equals Marginal Cost

- S.o.c are

$$2p'(P^*)U'(P^*) + p(P^*)U''(P^*) + p''(P^*)(U(P^*) - \bar{U}) < 0$$

- Need $p''(P^*)(U(P^*) - \bar{U}) < 0$ or not too positive

- Reference-dependent preferences with reference price P_0:

$$v(P|P_0) = \begin{cases} P - P_0 & \text{if } P \geq P_0; \\ \lambda(P - P_0) & \text{if } P < P_0, \end{cases}$$

  - Can write as

$$\begin{aligned} p(P) &= -p'(P)(P - P_0 - \bar{U}) \text{ if } P \geq P_0 \\ p(P)\lambda &= -p'(P)(\lambda(P - P_0) - \bar{U}) \text{ if } P < P_0 \end{aligned}$$

  - Plot Effect on MG and MC of loss aversion

- Compare $P^*_{\lambda=1}$ (equilibrium with no loss aversion) and $P^*_{\lambda>1}$ (equilibrium with loss aversion)

- Case 1. Loss Aversion λ increase price $(P^*_{\lambda=1} < P_0)$

- Case 2. Loss Aversion λ induces bunching at $P = P_0$ $(P^*_{\lambda=1} < P_0)$

- Case 3. Loss Aversion has no effect ($P^*_{\lambda=1} > P_0$)

- General predictions. When aggregate prices are low:
  - High prices P relative to fundamentals
  - Bunching at purchase price P_0
  - Lower probability of sale $p(P)$
  - Longer waiting on market

- Evidence: Data on Boston Condominiums, 1990-1997

- Substantial market fluctuations of price

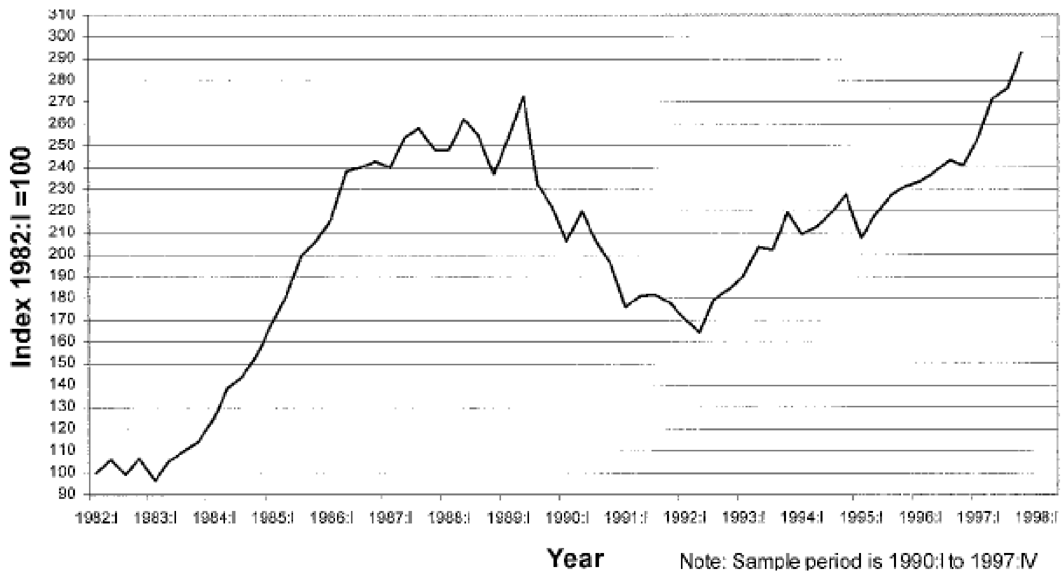


FIGURE I
Boston Condominium Price Index

- Observe:
  - Listing price $L_{i,t}$ and last purchase price P_0
  - Observed Characteristics of property X_i
  - Time Trend of prices δ_t
- Define:
  - $\hat{P}_{i,t}$ is market value of property i at time t
- Ideal Specification:

$$
\begin{aligned}
L_{i,t} &= \hat{P}_{i,t} + m\mathbf{1}_{\hat{P}_{i,t} < P_0}\left(P_0 - \hat{P}_{i,t}\right) + \varepsilon_{i,t} \\
&= \beta X_i + \delta_t + v_i + mLoss^* + \varepsilon_{i,t}
\end{aligned}
$$

- However:
  - Do not observe $\hat{P}_{i,t}$, given v_i (unobserved quality)
  - Hence do not observe $Loss^*$

- Two estimation strategies to bound estimates. *Model 1:*

$$L_{i,t} = \beta X_i + \delta_t + m\mathbf{1}_{\hat{P}_{i,t}<P_0}(P_0 - \beta X_i - \delta_t) + \varepsilon_{i,t}$$

  - This model overstate the loss for high unobservable homes (high v_i)
  - Bias upwards in $\hat{m}$, since high unobservable homes should have high $L_{i,i}$

- *Model 2:*

$$L_{i,t} = \beta X_i + \delta_t + \alpha(P_0 - \beta X_i - \delta_t) + m\mathbf{1}_{\hat{P}_{i,t}<P_0}(P_0 - \beta X_i - \delta_t) + \varepsilon_{i,t}$$

- Estimates of impact on sale price

TABLE II

LOSS AVERSION AND LIST PRICES

DEPENDENT VARIABLE: LOG (ORIGINAL ASKING PRICE),

OLS equations, standard errors are in parentheses.

Variable	(1) All listings	(2) All listings	(3) All listings	(4) All listings	(5) All listings	(6) All listings
LOSS	0.35	0.25	0.63	0.53	0.35	0.24
	(0.06)	(0.06)	(0.04)	(0.04)	(0.06)	(0.06)
LOSS-squared			−0.26	−0.26		
			(0.04)	(0.04)		
LTV	0.06	0.05	0.03	0.03	0.06	0.05
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Estimated value in 1990	1.09 (0.01)	1.09 (0.01)	1.09 (0.01)	1.09 (0.01)	1.09 (0.01)	1.09 (0.01)
Estimated price index at quarter of entry	0.86 (0.04)	0.80 (0.04)	0.91 (0.03)	0.85 (0.03)		
Residual from last sale price		0.11 (0.02)		0.11 (0.02)		0.11 (0.02)
Months since last sale	−0.0002 (0.0001)	−0.0003 (0.0001)	−0.0002 (0.0001)	−0.0003 (0.0001)	−0.0002 (0.0001)	−0.0003 (0.0001)
Dummy variables for quarter of entry	No	No	No	No	Yes	Yes
Constant	−0.77	−0.70	−0.84	−0.77	−0.88	−0.86
	(0.14)	(0.14)	(0.13)	(0.14)	(0.10)	(0.10)
R^2	0.85	0.86	0.86	0.86	0.86	0.86
Number of observations	5792	5792	5792	5792	5792	5792

- Effect of experience: Larger effect for owner-occupied

TABLE IV

Loss Aversion and List Prices: Owner-Occupants versus Investors

Dependent variable: Log (Original asking price)

OLS equations, standard errors are in parentheses.

Variable	(1) All listings	(2) All listings	(3) All listings	(4) All listings
LOSS × owner-occupant	0.50	0.42	0.66	0.58
	(0.09)	(0.09)	(0.08)	(0.09)
LOSS × investor	0.24	0.16	0.58	0.49
	(0.12)	(0.12)	(0.06)	(0.06)
LOSS-squared × owner-occupant			−0.16	−0.17
			(0.14)	(0.15)
LOSS-squared × investor			−0.30	−0.29
			(0.02)	(0.02)
LTV × owner-occupant	0.03	0.03	0.01	0.01
	(0.02)	(0.02)	(0.01)	(0.01)
LTV × investor	0.053	0.053	0.02	0.02
	(0.027)	(0.027)	(0.02)	(0.02)
Dummy for investor	−0.02	−0.02	−0.03	−0.03
	(0.014)	(0.01)	(0.01)	(0.01)
Estimated value in 1990	1.09	1.09	1.09	1.09
	(0.01)	(0.01)	(0.01)	(0.01)
Estimated price index at quarter of	0.84	0.80	0.86	0.82
entry	(0.05)	(0.04)	(0.04)	(0.04)
Residual from last sale price		0.08		0.08
		(0.02)		(0.02)

- Some effect also on final transaction price

TABLE VI
LOSS AVERSION AND TRANSACTION PRICES
DEPENDENT VARIABLE: LOG (TRANSACTION PRICE)
NLLS equations, standard errors are in parentheses.

Variable	(1) All listings	(2) All listings
LOSS	0.18	0.03
	(0.03)	(0.08)
LTV	0.07	0.06
	(0.02)	(0.01)
Residual from last sale price		0.16
		(0.02)
Months since last sale	−0.0001	−0.0004
	(0.0001)	(0.0001)
Dummy variables for quarter of entry	Yes	Yes
Number of observations	3413	3413

- Lowers the exit rate (lengthens time on the market)

TABLE VII
HAZARD RATE OF SALE
Duration variable is the number of weeks the property is listed on the market.
Cox proportional hazard equations, standard errors are in parentheses.

Variable	(1) All listings	(2) All listings	(3) All listings	(4) All listings
LOSS	−0.33	−0.63	−0.59	−0.90
	(0.13)	(0.15)	(0.16)	(0.18)
LOSS-squared			0.27	0.28
			(0.07)	(0.07)
LTV	−0.08	−0.09	−0.06	−0.06
	(0.04)	(0.04)	(0.04)	(0.04)
Estimated value in 1990	0.27	0.27	0.27	0.27
	(0.04)	(0.04)	(0.04)	(0.04)
Residual from last sale		0.29		0.29
		(0.07)		(0.07)

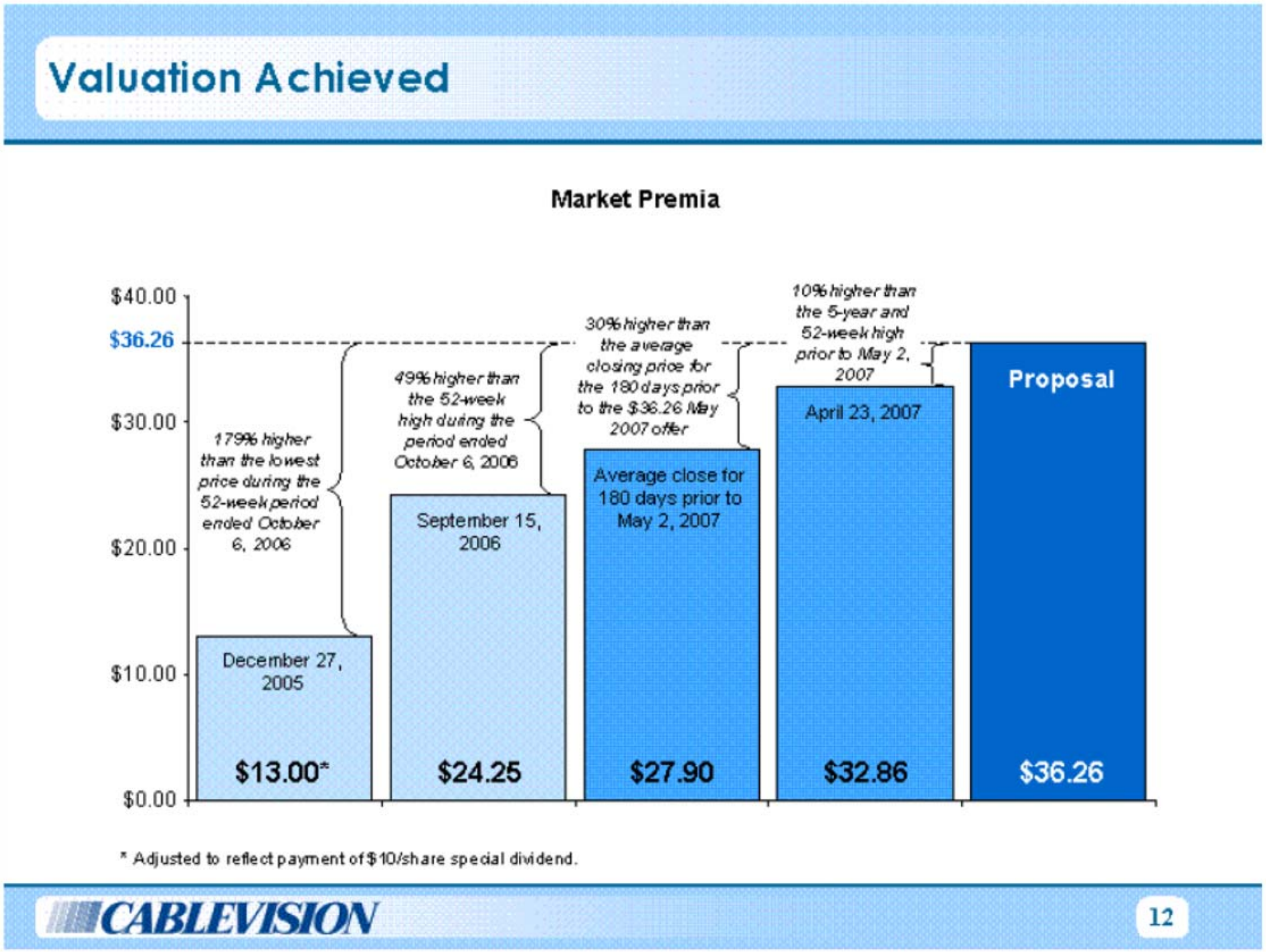
- – Overall, plausible set of results that show impact of reference point
  – Important to tie to model (Gagnon-Bartsch, Rosato, and Xia, 2010)

5 Reference Dependence: Mergers

- On the appearance, very different set-up:
  - Firm A (Acquirer)
  - Firm T (Target)

- After negotiation, Firm A announces a price P for merger with Firm T
  - Price P typically at a 20-50 percent premium over current price
  - About 70 percent of mergers go through at price proposed
  - Comparison price for P often used is highest price in previous 52 weeks, P_{52}
  - Example of how Cablevision (Target) trumpets deal

Figure 1. Slide from Cablevision Presentation to Shareholders, October 24, 2007. The management of Cablevision recommended acceptance of a \$36.26 per share cash bid from the Dolan family. The slide compares this bid price to various recent prices including 52-week highs.



- Assume that Firm T chooses price P, and A decides accept reject

- As a function of price P, probability $p(P)$ that deal is accepted (depends on perception of values of synergy of A)

- If deal rejected, go back to outside value $\bar{U}$

- Then maximization problem is same as for housing sale:

$$\max_{P} p(P)U(P) + (1 - p(P))\bar{U}$$

- Can assume T reference-dependent with respect to

$$v(P|P_0) = \begin{cases} P - P_{52} & \text{if } P \geq P_{52}; \\ \lambda(P - P_{52}) & \text{if } P < P_{52}, \end{cases}$$

- Obtain same predictions as in housing market

- (This neglects possible reference dependence of A)

- Baker, Pan, and Wurgler (2009): Test reference dependence in mergers

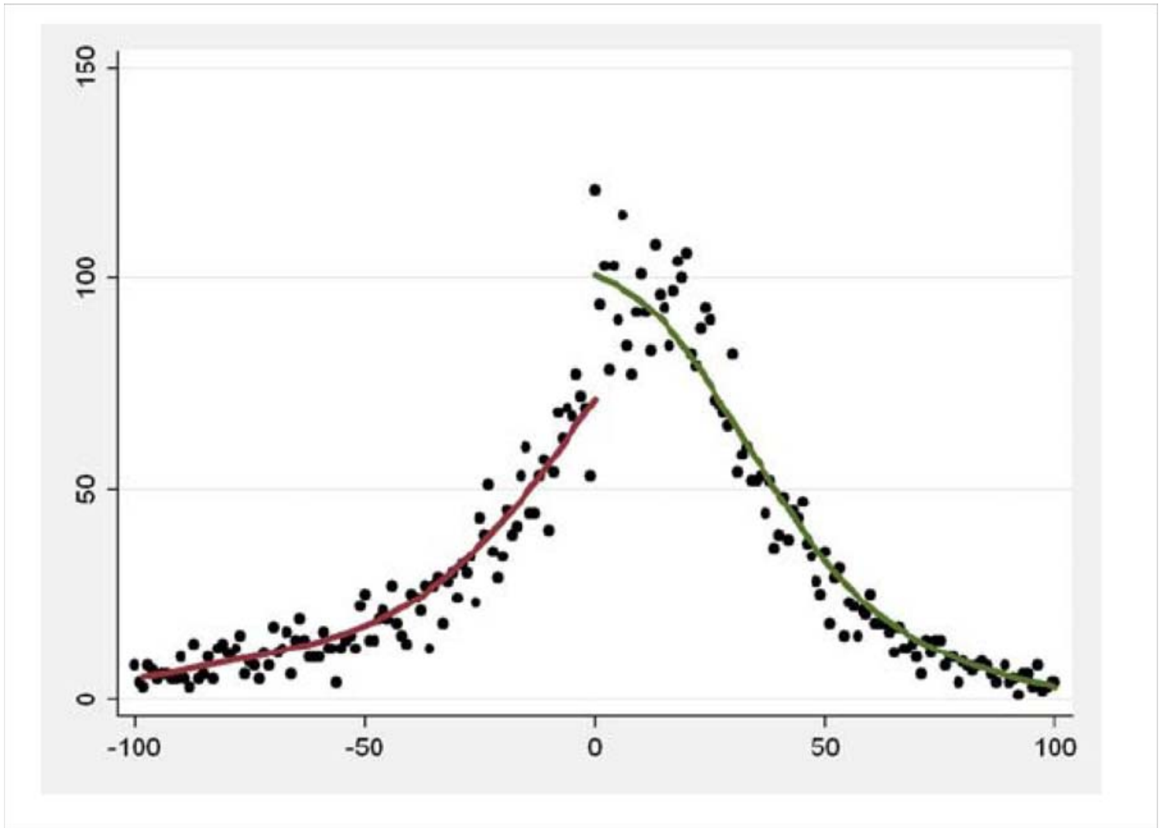
  - Test 1: Is there bunching around P_{52}? (GM did not do this)

  - Test 2: Is there effect of P_{52} on price offered?

  - Test 3: Is there effect on probability of acceptance?

  - Test 4: What do investors think? Use returns at announcement

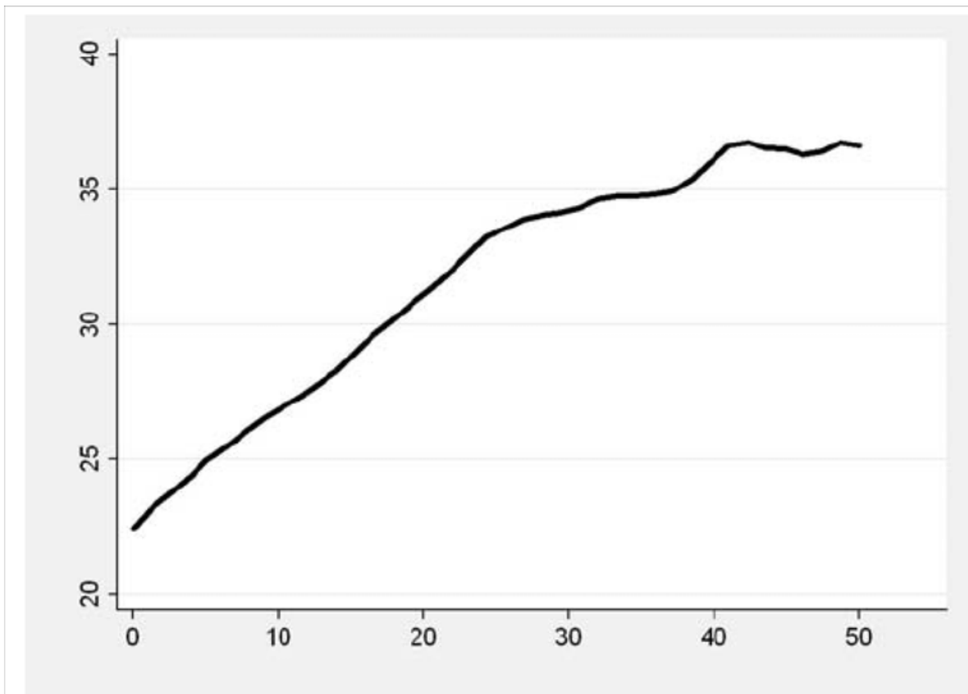
- Test 1: Offer price P around P_{52}
  - Some bunching, missing left tail of distribution



- Notice that this does not tell us how the missing left tail occurs:
  - Firms in left tail raise price to P_{52}?
  - Firms in left tail wait for merger until 12 months after past peak, so P_{52} is higher?
  - Preliminary negotiations break down for firms in left tail
- Would be useful to compare characteristics of firms to right and left of P_{52}

- Test 2: Kernel regression of P_{52} on price offered P (Renormalized by price 30 days before, P_{-30}, to avoid heterosked.):

$$\frac{P}{P_{-30}} = \alpha + \beta \frac{P_{52}}{P_{-30}} + \varepsilon$$



- Test 3: Probability of final acquisition is higher when offer price is above P_{52} (Skip)

- Test 4: What do investors think of the effect of P_{52}?
  - Holding constant current price, investors should think that the higher P_{52}, the more expensive the Target is to acquire
  - Standard methodology to examine this:
    * 3-day stock returns around merger announcement: $CAR_{t-1,t+1}$
    * This assumes investor rationality
    * Notice that merger announcements are typically kept top secret until last minute –> On announcement day, often big impact

- Regression (Columns 3 and 5):

$$CAR_{t-1,t+1} = \alpha + \beta \frac{P}{P_{-30}} + \varepsilon$$

where P/P_{-30} is instrumented with P_{52}/P_{-30}

Table 8. Mergers and Acquisitions: Market Reaction. Ordinary and two-stage least squares regressions of the 3-day CAR of the bidder on the offer premium.

$$r_{t-1\to t+1} = a + b\frac{Offer_{it}}{P_{i,t-30}} + e_{it}$$

$$\left(\frac{Offer_{it}}{P_{i,t-30}} - 1\right)\cdot 100 = a + b_1 \min\left(\left(\frac{52WeekHigh_{i,t-30}}{P_{i,t-30}} - 1\right)\cdot 100, 25\right) + b_2 \max\left(0, \min\left(\left(\frac{52WeekHigh_{i,t-30}}{P_{i,t-30}} - 1.25\right)\cdot 100, 50\right)\right) + b_3 \max\left(\left(\frac{52WeekHigh_{i,t-30}}{P_{i,t-30}} - 1.75\right)\cdot 100, 0\right) + e_{it}$$

where r is the market-adjusted return of the bidder for the three-day period centered on the announcement date, *Offer* is the offer price from Thomson, P is the target stock price from CRSP, and *52WeekHigh* is the high stock price over the 365 calendar days ending 30 days prior to the announcement date. The first, second, and fourth columns use ordinary least squares. The third and the fifth columns instrument for the offer premium using *52WeekHigh*. Robust t-statistics with standard errors clustered by month are in parentheses.

	OLS	*OLS*	*IV*	*OLS*	*IV*
	1	2	3	4	5
Offer Premium:					
b	-0.0186***	-0.0204***	-0.215***	-0.0443***	-0.253***
	(-2.64)	(-2.74)	(-3.48)	(-4.21)	(-4.39)

- Results very supportive of reference dependence hypothesis – Also alternative anchoring story

6 Reference Dependence: Insurance

- Much of the laboratory evidence on prospect theory is on risk taking

- Field evidence considered so far (mostly) does not involve risk:
  - Trading behavior – Endowment Effect
  - House Sale
  - Merger Offer

- Field evidence on risk taking?

- Sydnor (2010) on deductible choice in the life insurance industry

- Uses Menu Choice as identification strategy as in DellaVigna and Malmendier (2006)

- Slides courtesy of Justin Sydnor

Dataset

- 50,000 Homeowners-Insurance Policies
  - 12% were new customers
- Single western state
- One recent year (post 2000)
- Observe
  - Policy characteristics including deductible
    - 1000, 500, 250, 100
  - Full available deductible-premium menu
  - Claims filed and payouts by company

Features of Contracts

- Standard homeowners-insurance policies (no renters, condominiums)
- Contracts differ only by deductible
- Deductible is *per claim*
- No experience rating
  - Though underwriting practices not clear
- Sold through agents
  - Paid commission
  - No “default” deductible
- Regulated state

Summary Statistics

Variable	Full Sample	Chosen Deductible 1000	500	250	100
Insured home value	206,917	266,461	205,026	180,895	164,485
	(91,178)	(127,773)	(81,834)	(65,089)	(53,808)
Number of years insured by the company	8.4	5.1	5.8	13.5	12.8
	(7.1)	(5.6)	(5.2)	(7.0)	(6.7)
Average age of H.H. members	53.7	50.1	50.5	59.8	66.6
	(15.8)	(14.5)	(14.9)	(15.9)	(15.5)
Number of paid claims in sample year (claim rate)	0.042	0.025	0.043	0.049	0.047
	(0.22)	(0.17)	(0.22)	(0.23)	(0.21)
Yearly premium paid	719.80	798.60	715.60	687.19	709.78
	(312.76)	(405.78)	(300.39)	(267.82)	(269.34)
N	49,992	8,525	23,782	17,536	149
Percent of sample	100%	17.05%	47.57%	35.08%	0.30%

* Means with standard errors in parentheses.

Deductible Pricing

- X_i = matrix of policy characteristics
- $f(X_i)$ = “base premium”
  - Approx. linear in home value
- Premium for deductible D
  - $P_i^D = \delta_D f(X_i)$
- Premium differences
  - $\Delta P_i = \Delta\delta f(X_i)$
- $\Rightarrow$Premium differences depend on base premiums (insured home value).

Premium-Deductible Menu

Available Deductible	Full Sample
1000	$615.82 (292.59)
500	+99.91 (45.82)
250	+86.59 (39.71)
100	+133.22 (61.09)

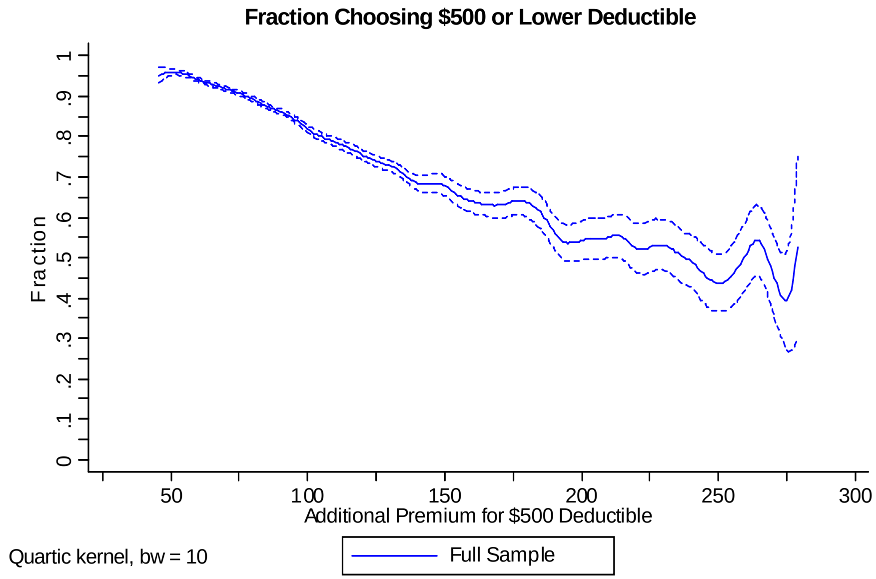
* Means with standard deviations in parentheses

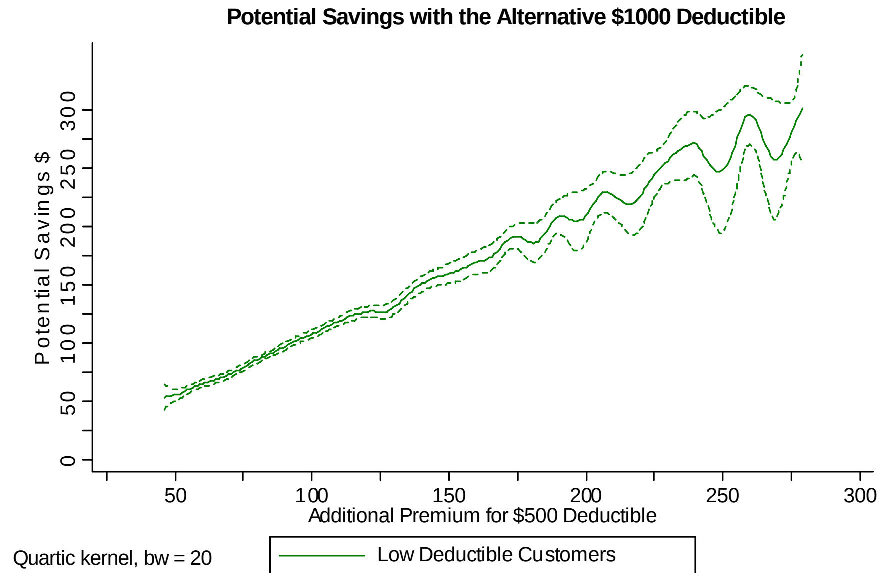
Risk Neutral Claim Rates?

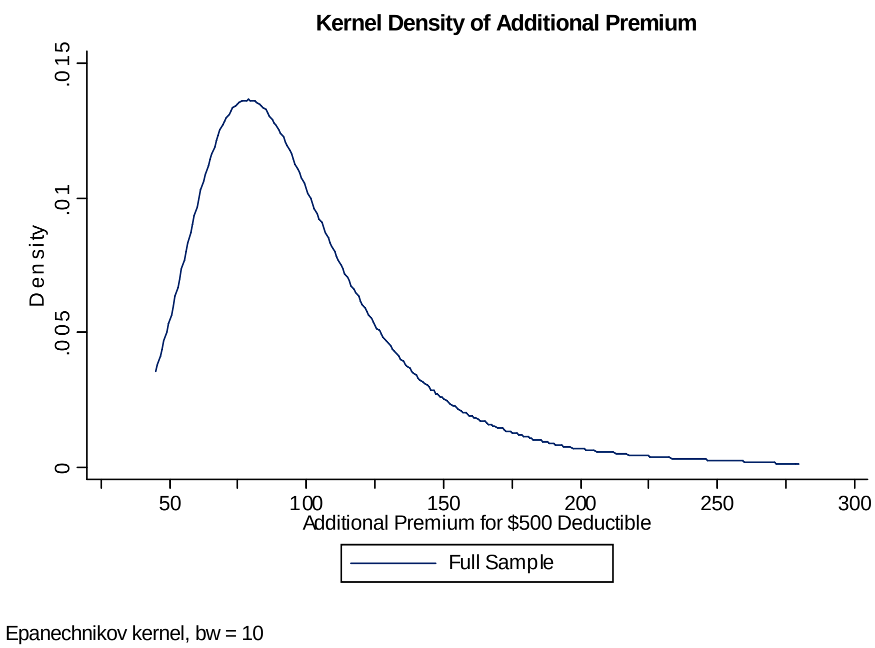
100/500 = 20%

87/250 = 35%

133/150 = 89%







What if the x-axis were insured home value?

Potential Savings with 1000 Ded

Claim rate?

Value of lower deductible?

Additional premium?

Potential savings?

Chosen Deductible	Number of claims per policy	Increase in out-of-pocket payments *per claim* with a $1000 deductible	Increase in out-of-pocket payments *per policy* with a $1000 deductible	Reduction in yearly premium per policy with $1000 deductible	Savings per policy with $1000 deductible
$500	0.043	469.86	19.93	99.85	79.93
N=23,782 (47.6%)	(.0014)	(2.91)	(0.67)	(0.26)	(0.71)
$250	0.049	651.61	31.98	158.93	126.95
N=17,536 (35.1%)	(.0018)	(6.59)	(1.20)	(0.45)	(1.28)

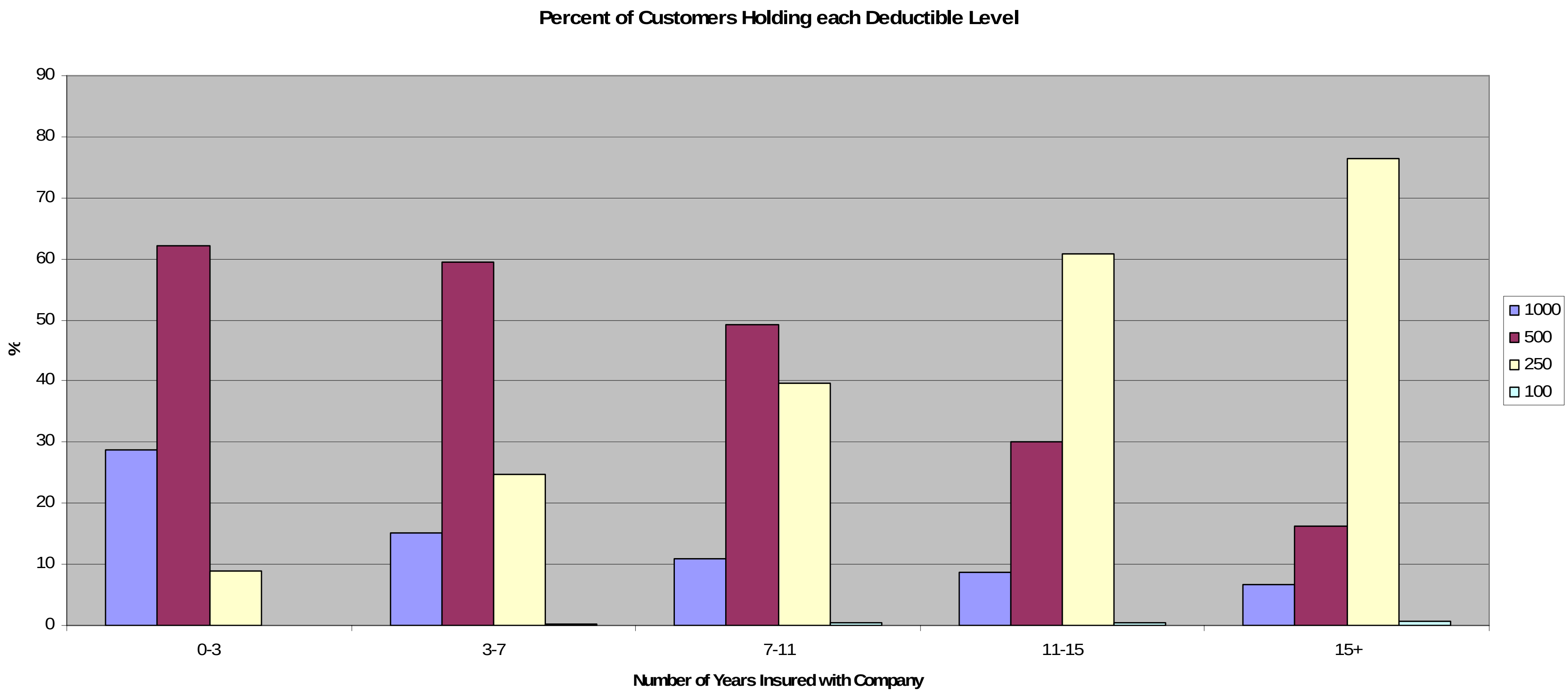
Average forgone expected savings for all low-deductible customers: $99.88

* Means with standard errors in parentheses

Back of the Envelope

- BOE 1: Buy house at 30, retire at 65, 3% interest rate $\Rightarrow$ \$6,300 expected
  - With 5% Poisson claim rate, only 0.06% chance of losing money
- BOE 2: (Very partial equilibrium) 80% of 60 million homeowners could expect to save \$100 a year with “high” deductibles $\Rightarrow$ \$4.8 billion per year

Consumer Inertia?



Look Only at New Customers

Chosen Deductible	Number of claims per policy	Increase in out-of-pocket payments *per claim* with a $1000 deductible	Increase in out-of-pocket payments *per policy* with a $1000 deductible	Reduction in yearly premium per policy with $1000 deductible	Savings per policy with $1000 deductible
$500	0.037	475.05	17.16	94.53	77.37
N = 3,424 (54.6%)	(.0035)	(7.96)	(1.66)	(0.55)	(1.74)
$250	0.057	641.20	35.68	154.90	119.21
N = 367 (5.9%)	(.0127)	(43.78)	(8.05)	(2.73)	(8.43)

Average forgone expected savings for all low-deductible customers: $81.42

Risk Aversion?

- Simple Standard Model
  - Expected utility of wealth maximization
  - Free borrowing and savings
  - Rational expectations
  - Static, single-period insurance decision
  - No other variation in lifetime wealth

What level of wealth? Chetty (2005)

- Consumption maximization:

$$\max_{c_t} U(c_1, c_2, \ldots, c_T),$$

$$s.t.\ c_1 + c_2 + \ldots + c_T = y_1 + y_2 + \ldots y_T .$$

- (Indirect) utility of wealth maximization

$$\max_{w} u(w),$$

where $u(w) = \max_{c_t} U(c_1, c_2, \ldots, c_T),$

$$s.t.\ c_1 + c_2 + \ldots + c_T = y_1 + y_2 + \ldots + y_T = w$$

$\Rightarrow$ *w* is lifetime wealth

Model of Deductible Choice

- Choice between (P_L, D_L) and (P_H, D_H)
- π = probability of loss
  - Simple case: only one loss
- EU of contract:
  - $U(P,D,\pi) = \pi u(w-P-D) + (1-\pi)u(w-P)$

Bounding Risk Aversion

Assume CRRA form for u:

$$u(x) = \frac{x^{(1-\rho)}}{(1-\rho)} \quad for\ \rho \neq 1, \quad and \quad u(x) = \ln(x)\ \ for\ \rho = 1$$

Indifferent between contracts iff:

$$\pi \frac{(w-P_L-D_L)^{(1-\rho)}}{(1-\rho)} + (1-\pi)\frac{(w-P_L)^{(1-\rho)}}{(1-\rho)} = \pi \frac{(w-P_H-D_H)^{(1-\rho)}}{(1-\rho)} + (1-\pi)\frac{(w-P_H)^{(1-\rho)}}{(1-\rho)}$$

Getting the bounds

- Search algorithm at individual level
  - New customers
- Claim rates: Poisson regressions
  - Cap at 5 possible claims for the year
- Lifetime wealth:
  - Conservative: $1 million (40 years at $25k)
  - More conservative: Insured Home Value

CRRA Bounds

	Measure of Lifetime Wealth (W): (Insured Home Value)		
Chosen Deductible	W	min ρ	max ρ
$1,000	256,900	- infinity	794
N = 2,474 (39.5%)	{113,565}		(9.242)
$500	190,317	397	1,055
N = 3,424 (54.6%)	{64,634}	(3.679)	(8.794)
$250	166,007	780	2,467
N = 367 (5.9%)	{57,613}	(20.380)	(59.130)

Interpreting Magnitude

- 50-50 gamble:
  Lose $1,000/ Gain $10 million
  - 99.8% of low-ded customers would reject
  - Rabin (2000), Rabin & Thaler (2001)
- Labor-supply calibrations, consumption-savings behavior $\Rightarrow \rho < 10$
  - Gourinchas and Parker (2002) -- 0.5 to 1.4
  - Chetty (2005) -- < 2

Wrong level of wealth?

- Lifetime wealth inappropriate if borrowing constraints.
- \$94 for \$500 insurance, 4% claim rate
  - W = \$1 million $\Rightarrow \rho = 2{,}013$
  - W = \$100k $\Rightarrow \rho = 199$
  - W = \$25k $\Rightarrow \rho = 48$

Prospect Theory

- Kahneman & Tversky (1979, 1992)
- Reference dependence
  - Not final wealth states
- Value function
  - Loss Aversion
  - Concave over gains, convex over losses
- Non-linear probability weighting

Model of Deductible Choice

- Choice between (P_L, D_L) and (P_H, D_H)
- π = probability of loss
- EU of contract:
  - $U(P,D,\pi) = \pi u(w-P-D) + (1-\pi)u(w-P)$
- PT value:
  - $V(P,D,\pi) = v(-P) + w(\pi)v(-D)$
- Prefer (P_L, D_L) to (P_H, D_H)
  - $v(-P_L) - v(-P_H) < w(\pi)[v(-D_H) - v(-D_L)]$

Loss Aversion and Insurance

- Slovic et al (1982)
  - Choice A
    - 25% chance of $200 loss **[80%]**
    - Sure loss of $50 **[20%]**
  - Choice B
    - 25% chance of $200 loss **[35%]**
    - Insurance costing $50 **[65%]**

No loss aversion in buying

- Novemsky and Kahneman (2005) (Also Kahneman, Knetsch & Thaler (1991))
  - Endowment effect experiments
  - Coefficient of loss aversion = 1 for “transaction money”
- Köszegi and Rabin (forthcoming QJE, 2005)
  - Expected payments
- Marginal value of deductible payment > premium payment (2 times)

So we have:

- Prefer (P_L, D_L) to (P_H, D_H):

$$v(-P_L) - v(-P_H) < w(\pi)[v(-D_H) - v(-D_L)]$$

- Which leads to:

$$P_L^{\beta} - P_H^{\beta} < w(\pi)\lambda[D_H^{\beta} - D_L^{\beta}]$$

- Linear value function:

$$WTP = \Delta P = \boxed{w(\pi)\lambda}\Delta D$$

= 4 to 6 times EV

Parameter values

- Kahneman and Tversky (1992)
  - λ = 2.25
  - β = 0.88
- Weighting function

$$w(\pi) = \frac{\pi^{\gamma}}{(\pi^{\gamma} + (1-\pi)^{\gamma})^{1/\gamma}}$$

  - γ = 0.69

WTP from Model

- Typical new customer with $500 ded
  - Premium with $1000 ded = $572
  - Premium with $500 ded = +$94.53
  - 4% claim rate
- Model predicts WTP = $107
- Would model predict $250 instead?
  - WTP = $166. Cost = $177, so no.

Choices: Observed vs. Model

Chosen Deductible	Predicted Deductible Choice from Prospect Theory NLIB Specification: λ = 2.25, γ = 0.69, β = 0.88				Predicted Deductible Choice from EU(W) CRRA Utility: ρ = 10, W = Insured Home Value			
	1000	500	250	100	1000	500	250	100
$1,000 N = 2,474 (39.5%)	**87.39%**	11.88%	0.73%	0.00%	**100.00%**	0.00%	0.00%	0.00%
$500 N = 3,424 (54.6%)	18.78%	**59.43%**	21.79%	0.00%	100.00%	**0.00%**	0.00%	0.00%
$250 N = 367 (5.9%)	3.00%	44.41%	**52.59%**	0.00%	100.00%	0.00%	**0.00%**	0.00%
$100 N = 3 (0.1%)	33.33%	66.67%	0.00%	**0.00%**	100.00%	0.00%	0.00%	**0.00%**

Conclusions

- (Extreme) aversion to moderate risks is an empirical reality in an important market
- Seemingly anomalous in Standard Model where risk aversion = DMU
- Fits with existing parameter estimates of leading psychology-based alternative model of decision making
- Mehra & Prescott (1985), Benartzi & Thaler (1995)

Alternative Explanations

- Misestimated probabilities
  - ≈ 20% for single-digit CRRA
  - Older (age) new customers just as likely
- Liquidity constraints
- Sales agent effects
  - Hard sell?
  - Not giving menu? ($500?, data patterns)
  - Misleading about claim rates?
- Menu effects

7 Next Lecture

- Reference-Dependent Preferences
  - Workplace
  - Finance
  - Labor Supply
- Problem Set due next week