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

Stefano DellaVigna

February 14, 2007

Outline

1. Leisure Goods: Consumption and Savings
2. Leisure Goods: Commitments and Savings
3. Five More Applications of Present Bias
4. Present Bias: Summary
5. Reference Dependence: Introduction
6. Reference Dependence: Endowment Effect

1 Leisure Goods: Consumption and Savings

- Laibson (1997) to Laibson, Repetto, and Tobacman (2005)

- Leisure Good: Temptation to overconsume at present

- Stylized facts:

  - low liquid wealth accumulation
  - substantial illiquid wealth (housing+401(k)s)
  - extensive credit card borrowing (SCF, Fed, Gross and Souleles 2000)
  - consumption-income excess comovement (Hall and Mishkin, 1982)

TABLE 1

SECOND-STAGE MOMENTS

Description and Name	$\overline{m}_{J_m}$	se($\overline{m}_{J_m}$)
% Borrowing on Visa: *"% Visa"*	0.678	0.015
Mean (Borrowing$_t$ / mean(Income$_t$)): *"mean Visa"*	0.117	0.009
Consumption-Income Comovement: *"CY"*	0.231	0.112
Average weighted $\frac{wealth}{income}$*:* *"wealth"*	2.60	0.13

Source: Authors' calculations based on data from the Survey of Consumer Finances, the Federal Reserve, and the Panel Study on Income Dynamics. Calculations pertain to households with heads who have high school diplomas but not college degrees. The variables are defined as follows: *% Visa* is the fraction of U.S. households borrowing and paying interest on credit cards (SCF 1995 and 1998); *mean Visa* is the average amount of credit card debt as a fraction of the mean income for the age group (SCF 1995 and 1998, weighted by Fed aggregates); *CY* is the marginal propensity to consume out of anticipated changes in income (PSID 1978-92); and *wealth* is the weighted average wealth-to-income ratio for households with heads aged 50-59 (SCF 1983-1998).

- Structural model (building on Gourinchas and Parker, 2002) with:
  - borrowing constraints
  - illiquid assets
  - realistic features of the economy
- Estimation using Method of Simulated Moments
  - Simulate model (cannot solve analytically)
  - Compare simulate moments to estimated moments
- (David Laibson's Slides follow)

3 Model

- We use simulation framework

- Institutionally rich environment, e.g., with income uncertainty and liquidity constraints

- Literature pioneered by Carroll (1992, 1997), Deaton (1991), and Zeldes (1989)

- Gourinchas and Parker (2001) use method of simulated moments (MSM) to estimate a structural model of life-cycle consumption

3.1 Demographics

- Mortality, Retirement (PSID), Dependents (PSID), HS educational group

3.2 Income from transfers and wages

- $Y_t =$ after-tax labor and bequest income plus govt transfers (assumed exog., calibrated from PSID)

- $y_t \equiv \ln(Y_t)$. During working life:

$$y_t = f^W(t) + u_t + \nu_t^W \tag{3}$$

- During retirement:

$$y_t = f^R(t) + \nu_t^R \tag{4}$$

3.3 Liquid assets and non-collateralized debt

- $X_t + Y_t$ represents liquid asset holdings at the beginning of period t.

- Credit limit: $X_t \geq -\lambda \cdot \bar{Y}_t$

- $\lambda = .30$, so average credit limit is approximately \$8,000 (SCF).

3.4 Illiquid assets

- Z_t represents illiquid asset holdings at age t.
- Z bounded below by zero.
- Z generates consumption flows each period of γZ.
- Conceive of Z as having some of the properties of home equity.
- Disallow withdrawals from Z; Z is perfectly illiquid.
- Z stylized to preserve computational tractability.

3.5 Dynamics

- Let I_t^X and I_t^Z represent net investment into assets X and Z during period t

- Dynamic budget constraints:

$$
\begin{aligned}
X_{t+1} &= R^X \cdot (X_t + I_t^X) \\
Z_{t+1} &= R^Z \cdot (Z_t + I_t^Z) \\
C_t &= Y_t - I_t^X - I_t^Z
\end{aligned}
$$

- Interest rates:

$$
R^X = \begin{cases} R^{CC} & \text{if} \quad X_t + I_t^X < 0 \\ R & \text{if} \quad X_t + I_t^X > 0 \end{cases} \quad ; \qquad R^Z = 1
$$

- Three assumptions for $\left[R^X, \gamma, R^{CC}\right]$:

Benchmark:	[1.0375, 0.05, 1.1175]
Aggressive:	[1.03, 0.06, 1.10]
Very Aggressive:	[1.02, 0.07, 1.09]

In full detail, self t has instantaneous payoff function

$$u(C_t, Z_t, n_t) = n_t \cdot \frac{\left(\frac{C_t+\gamma Z_t}{n_t}\right)^{1-\rho} - 1}{1-\rho}$$

and continuation payoffs given by:

$$\beta \sum_{i=1}^{T+N-t} \delta^i \left(\prod_{j=1}^{i-1} s_{t+j}\right)(s_{t+i}) \cdot u(C_{t+i}, Z_{t+i}, n_{t+i})...$$
$$+\beta \sum_{i=1}^{T+N-t} \delta^i \left(\prod_{j=1}^{i-1} s_{t+j}\right)(1 - s_{t+i}) \cdot B(X_{t+i}, Z_{t+i})$$

- n_t is effective household size: adults+(.4)(kids)
- γZ_t represents real after-tax net consumption flow
- s_{t+1} is survival probability
- $B(\cdot)$ represents the payoff in the death state

3.7 Computation

- Dynamic problem:

$$\max_{I_t^X, I_t^Z} \quad u(C_t, Z_t, n_t) + \beta\delta E_t V_{t,t+1}(\Lambda_{t+1})$$
$$s.t. \text{ Budget constraints}$$

- $\Lambda_t = (X_t + Y_t, Z_t, u_t)$ (state variables)

- Functional Equation:

$$V_{t-1,t}(\Lambda_t) =$$
$$\{s_t[u(C_t, Z_t, n_t) + \delta E_t V_{t,t+1}(\Lambda_{t+1})] + (1 - s_t) E_t B(\Lambda_t)\}$$

- Solve for eq strategies using backwards induction

- Simulate behavior

- Calculate descriptive moments of consumer behavior

4 Estimation

Estimate parameter vector θ and evaluate models wrt data.

- $m_e =$ N empirical moments, VCV matrix $= \Omega$
- $m_s(\theta) =$ analogous simulated moments
- $q(\theta) \equiv (m_s(\theta) - m_e)\,\Omega^{-1}\,(m_s(\theta) - m_e)'$, a scalar-valued loss function
- Minimize loss function: $\hat{\theta} = \arg\min_{\theta} q(\theta)$
- $\hat{\theta}$ is the MSM estimator.
- Pakes and Pollard (1989) prove asymptotic consistency and normality.
- Specification tests: $q(\hat{\theta}) \sim \chi^2(N - \#parameters)$

TABLE 3

BENCHMARK STRUCTURAL ESTIMATION RESULTS

	(1) Hyperbolic	(2) Exponential	(3) Hyperbolic Optimal Wts	(4) Exponential Optimal Wts	(5) Data
Parameter estimates $\hat{\theta}$					
$\hat{\beta}$	0.7031	1.0000	0.7150	1.0000	-
s.e. (i)	(0.1093)	-	(0.0948)	-	-
s.e. (ii)	(0.1090)	-	-	-	-
s.e. (iii)	(0.0170)	-	-	-	-
s.e. (iv)	(0.0150)	-	-	-	-
$\hat{\delta}$	0.9580	0.8459	0.9603	0.9419	-
s.e. (i)	(0.0068)	(0.0249)	(0.0081)	(0.0132)	-
s.e. (ii)	(0.0068)	(0.0247)	-	-	-
s.e. (iii)	(0.0010)	(0.0062)	-	-	-
s.e. (iv)	(0.0009)	(0.0056)	-	-	-
Second-stage moments					
% Visa	0.634	0.669	0.613	0.284	0.678
mean Visa	0.167	0.150	0.159	0.049	0.117
CY	0.314	0.293	0.269	0.074	0.231
wealth	2.69	-0.05	3.22	2.81	2.60
Goodness-of-fit					
$q(\hat{\theta},\hat{\chi})$	67.2	436	2.48	34.4	-
$\xi(\hat{\theta},\hat{\chi})$	3.01	217	8.91	258.7	-
p-value	0.222	<1e-10	0.0116	<2e-7	-

Source: Authors' calculations.

Note on standard errors: (i) includes both the first stage correction and the simulation correction, (ii) includes just the first stage correction, (iii) includes just the simulation correction, and (iv) includes neither correction.

TABLE 4
ROBUSTNESS

	(1) Benchmark	(2) $\gamma = 3.38\%$	(3) $\gamma = 6.59\%$	(4) $r^{CC} = 10\%$	(5) $r^{CC} = 13\%$	(6) $\rho = 1$	(7) $\rho = 3$
Hyperbolic							
Parameter Estimates $\hat{\theta}$							
$\hat{\beta}$	0.7031	0.5071	0.8024	0.7235	0.6732	0.8186	0.5776
s.e. (i)	(0.1093)	(0.0441)	(0.0614)	(0.1053)	(0.1167)	(0.0959)	(0.1339)
$\hat{\delta}$	0.9580	0.9731	0.9425	0.9567	0.9595	0.9610	0.9545
s.e. (i)	(0.0068)	(0.0188)	(0.0093)	(0.0071)	(0.0045)	(0.0037)	(0.0096)
Goodness-of-fit							
$q(\hat{\theta}, \hat{\chi})$	67.2	108.4	49.7	64.1	70.7	63.0	67.7
$\xi(\hat{\theta}, \hat{\chi})$	3.01	16.79	5.27	12.09	10.97	7.97	1.85
p-value	0.222	0.0002	0.0717	0.0024	0.0041	0.0186	0.3965
Exponential							
Parameter Estimates $\hat{\theta}$							
$\hat{\beta}$	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
s.e. (i)	-	-	-	-	-	-	-
$\hat{\delta}$	0.8459	0.8459	0.8459	0.8520	0.8354	0.8924	0.7841
s.e. (i)	(0.0249)	(0.0249)	(0.0250)	(0.0267)	(0.0262)	(0.0204)	(0.0357)
Goodness-of-fit							
$q(\hat{\theta}, \hat{\chi})$	435.6	435.6	435.6	434.7	436.6	438.1	435.5
$\xi(\hat{\theta}, \hat{\chi})$	217	217	263	177	339	349	310
p-value	<1e-10	<1e-10	<1e-10	<1e-10	<1e-10	<1e-10	<1e-10

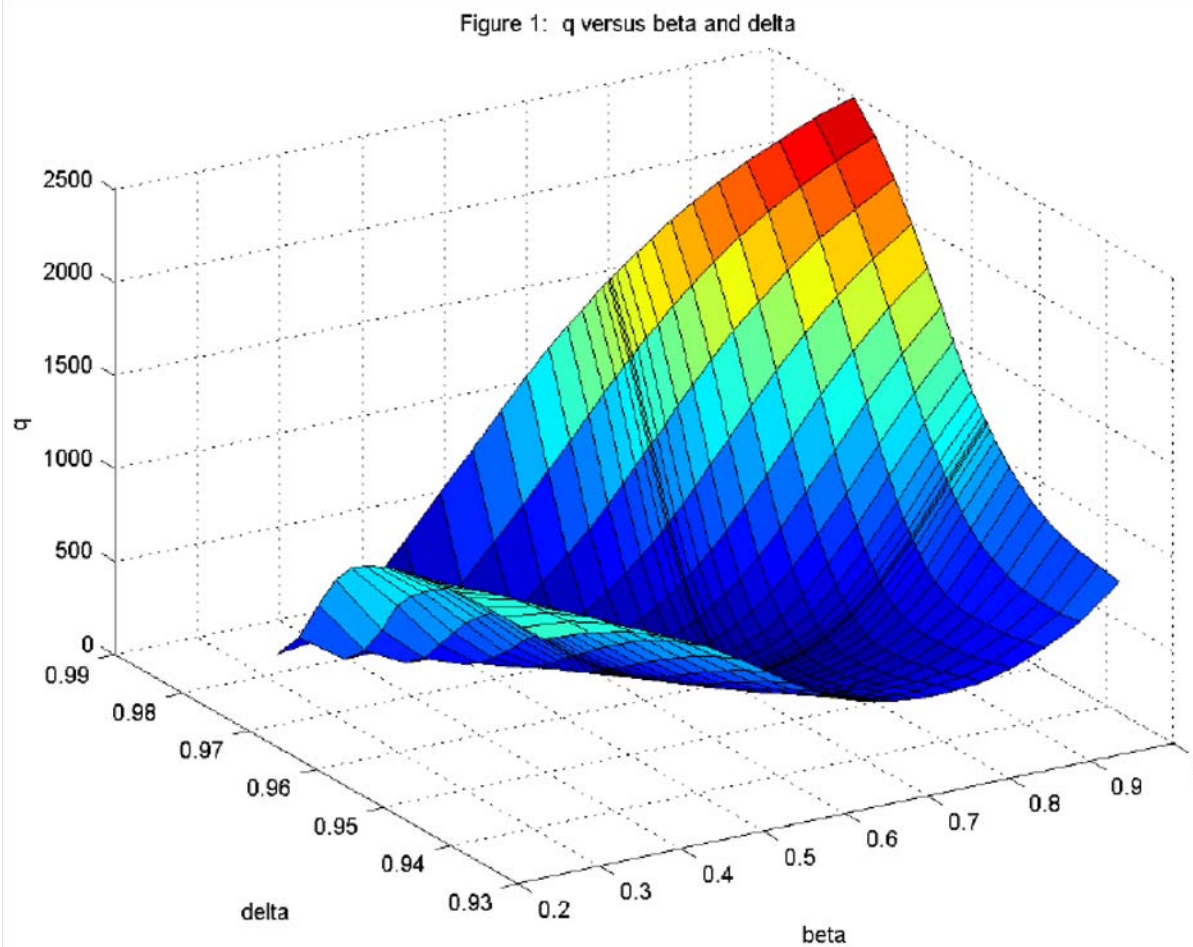


Figure 1: This figure plots the MSM objective function with respect to beta and delta under the paper's benchmark assumptions. The objective, q, equals a weighted sum of squared deviations of the empirical moments from the moments predicted by the model. Lower values of q represent a better fit of the model, and the (beta,delta) pair that minimizes q is the MSM estimator.

2 Leisure Goods: Commitments and Savings

- Ashraf, Karlan, and Yin (2005) also on Savings and Demand for Illiquid Savings Devices
  - Different Methodology: Field Experiment
  - Different Setting: Philippines

- Three treatments:
  - SEED Treatment (N=842): Encourage to save, Offer commitment device (account with savings goal)
  - Marketing Treatment (N=466): Encourage to save, Offer no commitment
  - Control Treatment (N=469)

- Evaluation:
  - Compare SEED to Marketing Treatment: Effect of Commitment Device in addition to encouragement
  - Measure the effect on total savings (also on non-committed account) – This was not true in 401(k) studies
- SEED Treatment:
  - Out of 842 treated people, 202 take up SEED
  - 167 also got lock-up box (did not observe savings there)

- Effect of SEED Treatment on Total Savings, Compared to Marketing
  - (Remember: Include all 842 people, Intent-to-Treat)
  - Total Balances increase for 5.6 percent of people
  - Total Balances increase by at least 20 percent for 6.4 percent
  - Total Balances increase by 287 Pesos
- To compute Treatment-on-The-Treated, divide by 202/842

TABLE VI
Impact on Change in Savings Held at Bank
OLS, Probit

INTENT TO TREAT EFFECT

	OLS				Probit			
Length	6 months		12 months		12 months			
Dependent Variable:	Change in Total Balance	Change in Total Balance	Change in Total Balance	Change in Total Balance	Binary Outcome = 1 if Change in Balance > 0%	Binary Outcome = 1 if Change in Balance > 0%	Binary Outcome = 1 if Change in Balance > 20%	Binary Outcome = 1 if Change in Balance > 20%
Sample	All	Commitment & Marketing Only	All	Commitment & Marketing Only	All	Commitment & Marketing Only	All	Commitment & Marketing Only
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Commitment Treatment	234.678*	49.828	411.466*	287.575	0.102***	0.056**	0.101***	0.064***
	(101.748)	(156.027)	(244.021)	(228.523)	(3.82)	(0.026)	(0.022)	(0.021)
Marketing Treatment	184.851		123.891		0.048		0.041	
	(146.982)		(153.440)		(1.56)		(0.027)	
Constant	40.626	225.476*	65.183	189.074**				
	(61.676)	(133.405)	(124.215)	(90.072)				
Observations	1777	1308	1777	1308	1777	1308	1777	1308
R-squared	0.00	0.00	0.00	0.00				

Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. The dependent variable in the first two column is the change in total savings held at the Green Bank after six months. Column (1) regresses chnage in total savings balances on indicators for assignment in the commitment- and marketing-treatment groups. The omitted group indicator in this regression corresponds to the control group. Column (2) shows the regression restricting the sample to commitment- and marketing-treatment groups. Columns (3) and (4) repeat this regression, using change in savings balances after 12 months as a dependent variable. The dependent variable in columns (5)-(8) is a binary variable equal to 1 if balances increased by x%. 154 clients had pre-intervention a savings balance equal to zero. 24 of them had positive savings after 12 months. These individuals were coded as "one," and those that remain at zero were coded as zero for the outcome variables for columns (5) through (8). Exchange rate is 50 pesos for US $1.00.

- In addition, examine correlation with a survey response to hyperbolic-discounting-type question:
  - Preference between 200 Pesos now and in 1 month
  - Preference between 200 Pesos in 6 months and in 7 months

TABLE III
Tabulations of Responses to Hypothetical Time Preference Questions

			Indifferent between 200 pesos in 6 months and X in 7 months			
			Patient X<250	Somewhat Impatient 250<X<300	Most Impatient 300<X	Total
Indifferent between 200 pesos now and X in one month	Patient	X<250	**606** **34.4%**	**126** **7.2%**	**73** **4.1%**	**805** **45.7%**
	Somewhat Impatient	250<X<300	**206** **11.7%**	**146** **8.3%**	**59** **3.3%**	**411** **23.3%**
	Most Impatient	300<X	**154** **8.7%**	**93** **5.3%**	**299** **17%**	**546** **31%**
	Total		**966** **54.8%**	**365** **20.7%**	**431** **24.5%**	**1,762** **100%**

"Hyperbolic": More patient over future tradeoffs than current tradeoffs

"Patient Now, Impatient Later": Less patient over future tradeoffs than current tradeoffs.

Time inconsistent (direction of inconsistency depends on answer to open-ended question).

- On average, evidence on hyperbolic-discounting-type preferences

- Interesting idea: Correlate survey response with response to treatment (also in Fehr-Goette paper next lecture)

- Evidence of correlation for women, not for men

TABLE V
Determinants of SEED Takeup
Probit

	(1) All	(2) All	(3) Female	(4) Male
Time inconsistent	0.125*	0.005	0.158*	0.046
	(0.067)	(0.080)	(0.085)	(0.098)
Impatient, Now versus 1 Month	-0.030	-0.039	-0.036	-0.041
	(0.050)	(0.050)	(0.062)	(0.075)
Patient, Now versus 1 Month	0.076	0.070	0.035	0.119
	(0.072)	(0.072)	(0.089)	(0.110)
Impatient, 6 months versus 7 Months	0.097	0.108*	0.124	0.078
	(0.065)	(0.065)	(0.087)	(0.091)
Patient, 6 months versus 7 Months	0.015	0.022	0.057	-0.021
	(0.064)	(0.064)	(0.081)	(0.093)

3 Five More Applications of Present Bias

- Large number of papers on time preferences/self-control/hyperbolic discounting/present bias

- Two categories:

  1. **Field test (F)**. Use evidence to test theory

  2. **Theory (T).** Applied theory paper

  3. **(Experiments (E).** Laboratory test (Few)**)**

- Some common features in this literature:
  - Identify puzzling stylized facts
  - Structural or reduced form models
  - Sophistication typically assumed
  - Common errors on naivete':
    - Claims that procrastination comes from present bias
    - Estimate procrastination with naivete' assuming decision is taken quarterly rather than daily (Ex.: switch credit card)

3.1 Addiction

- Standard model: Rational addiction (Becker and Murphy, 1988)
  - Past consumption lowers current total utility...
  - ...but raises current marginal utility

- Stylized facts:
  - Diffusion of addictions (drugs, alcohol, tobacco, obesity)
  - Repeated efforts of quitters
  - Antabuse
  - Rational addiction?

- **(F.)-T.** Data on response of consumption to present and future taxes (Gruber and Koszegi, 2001): cannot separate present bias vs. rational addition

- **F.** Data on happiness (Gruber and Mullainathan, 2006): (predicted) smokers happier in states one year after smoking taxes are raised

- **T.** Optimal taxes for present-biased addiction (O'Donoghue and Rabin, 2003; Gruber and Koszegi, 2003)

- **F.** Data on increase in obesity over time (Cutler, Glaeser, and Shapiro, 2003). Decrease in fixed cost of preparing food + self-control

3.2 Job Search

- DellaVigna and Paserman (2003)

- Stylized facts:

  - time devoted to job search by unemployed workers: 9 hours/week

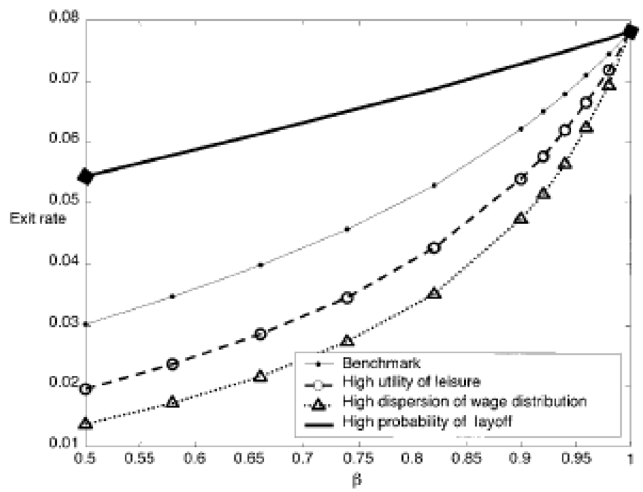
  - search effort predicts exit rates from unemployment better than reservation wage choice

- **T.** Model with costly search effort and reservation wage decision:

  - search effort — immediate cost, benefits in near future — driven by β

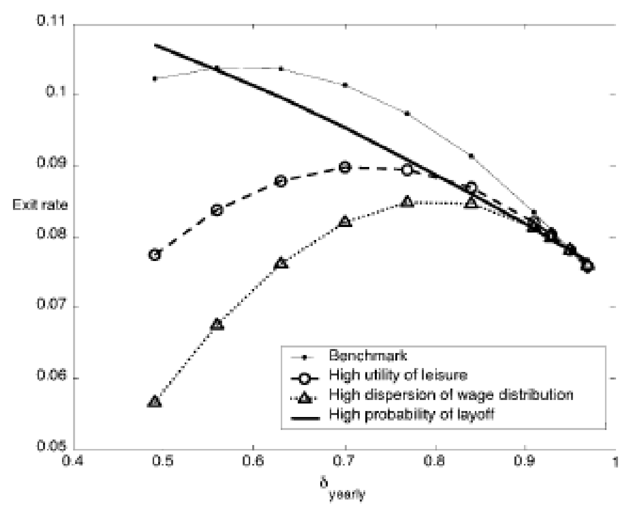
  - reservation wage — long-term payoffs — driven by δ

a



Exit rate
β
Benchmark
High utility of leisure
High dispersion of wage distribution
High probability of layoff

b



Exit rate
δ_{yearly}
Benchmark
High utility of leisure
High dispersion of wage distribution
High probability of layoff

- **F.** Correlation between measures of impatience (smoking, impatience in interview, vocational clubs) and job search outcomes:

  - Impatience $\uparrow \Longrightarrow$ search effort $\downarrow$

  - Impatience $\uparrow \Longrightarrow$ reservation wage $\longleftrightarrow$

  - Impatience $\uparrow \Longrightarrow$ exit rate from unemployment $\downarrow$

- Impatience captures variation in β

- Sophisticated or naive – does not matter

- **F.** Paserman (2003): structural model estimated by max. likelyhood: $\beta = .40$ (low-wage workers), $\beta = .89$ (high-wage workers)

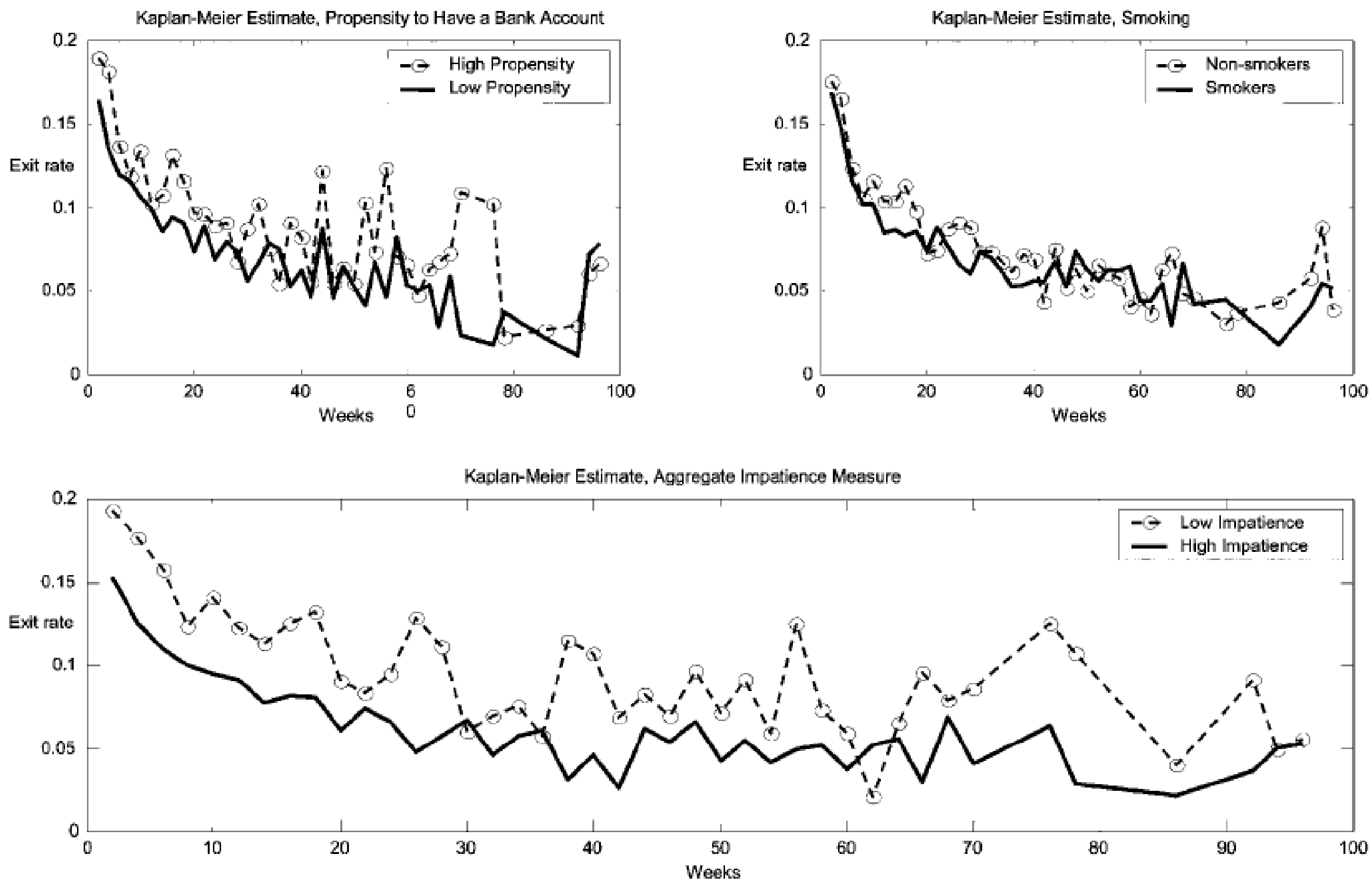


FIG. 3.—Exit rates in the NLSY

3.3 Welfare programs

- Fang, Silverman (2002, 2003)

- Stylized Facts:
  - limited transition from welfare to work
  - (more importantly) large share of mothers staying home and not claiming benefits

- Examines decisions of single mothers with kids. Three states: Welfare (leisure + benefits), Work (wages), Home (leisure)

- Mothers stay home because of one-time social disapproval of claiming benefits

- Naiveté crucial here

3.4 Firm pricing

- **T.** Two-part tariffs chosen by firms to sell investment and leisure goods (DellaVigna and Malmendier, 2004)

- **F.** Pricing of magazines (Oster and Scott-Morton, 2005)

- See later Section on Firm Response

3.5 Payday effects

- Shapiro (2003), Melvin (2003), Huffman and Barenstein (2003)

- Stylized facts:

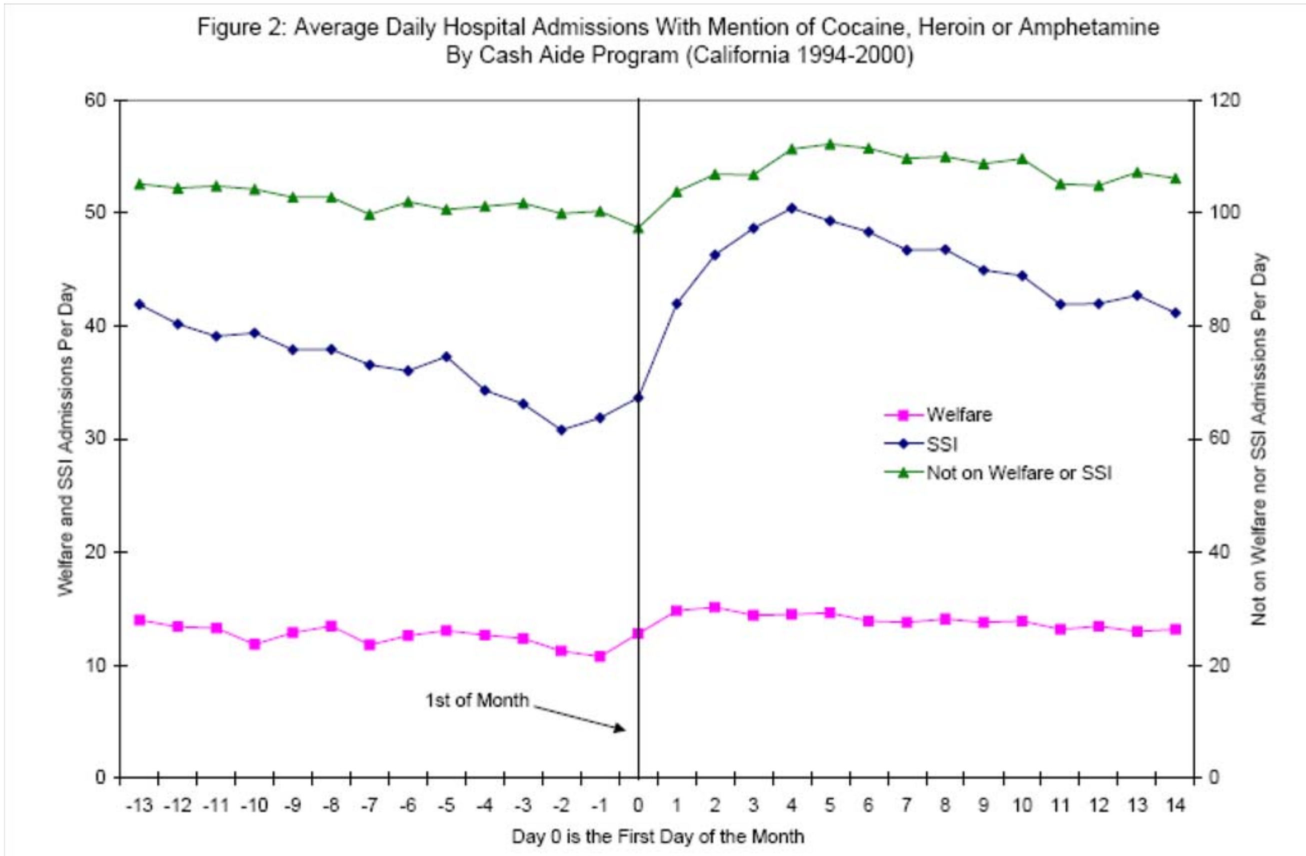
  - Purchases increase discretely on payday

  - Effect more pronounced for more tempting goods

  - Food intake increases as well on payday

  - Drug arrests and hospitalization spike on payday (Dobkin and Puller, 2007)

- SSI payments made on 1st of the month



4 Present Bias: Final Lessons

- Four methodologies so far:

1. Empirical evidence of type 1 (DellaVigna and Malmendier, 2004; Miravete, 2004; Souleles, 2004):

   - **Menu choice**. Need to observe:

     (a) menu of options –> Use revealed preferences to make inferences

     (b) later consumption decision –> Compared to revealed preferences in (a)

   - Worries: hard to distinguish unusual preferences (self-control) and wrong beliefs (naiveté, overconfidence)

2. Empirical evidence of type 2 (Madrian and Shea, 1999; Choi et al.:, 2001):

- **Natural Experiments.** Observe variable:

(a) At time t, change in regime – Look at (After t - Before t)

(b) Possibly have control group (Diff-in-Diff)

- Worries:
  - Endogeneity of change
  - Other changes occurring at same time
  - How many observations? Maybe $n = 1$?

3. Empirical evidence of type 3 (Ashraf et al., 2005; Ausubel, 1999):

- **Field experiment.**

  (a) Naturalistic setting

  (b) Randomize treatment – Compare Treatment and Control group

- Plus: Randomization ensures clean identification

- Minus: Not easy to run

4. Empirical evidence of type 5 (Laibson, Repetto, and Tobacman, 2005; Paserman, 2005):

   - **Structural Identification.**

     (a) Write model explicitly

     (b) Identify parameters

   - Plus: Can better link theory and evidence

   - Plus: More amenable to welfare and policy evaluations

   - Minus: Identification less transparent – Results can depend critically on model assumptions

- Present bias/Hyperbolic Discounting

- Reasons for success:

  1. Simple model (one-, then two- parameter deviation). YES

  2. Powerful intuition (immediate gratification) YES

  3. Support in the laboratory OK

  4. Support from field data YES

- Lead to new subfield (behavioral contract theory/behavioral IO)

- Next: Reference Dependence

- Status:

  1. Simple model (four new features). YES

  2. Powerful intuition (reference points) YES

  3. Support in the laboratory YES

  4. Support from field data OK, more needed

5 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. Narrow Framing over gains and losses

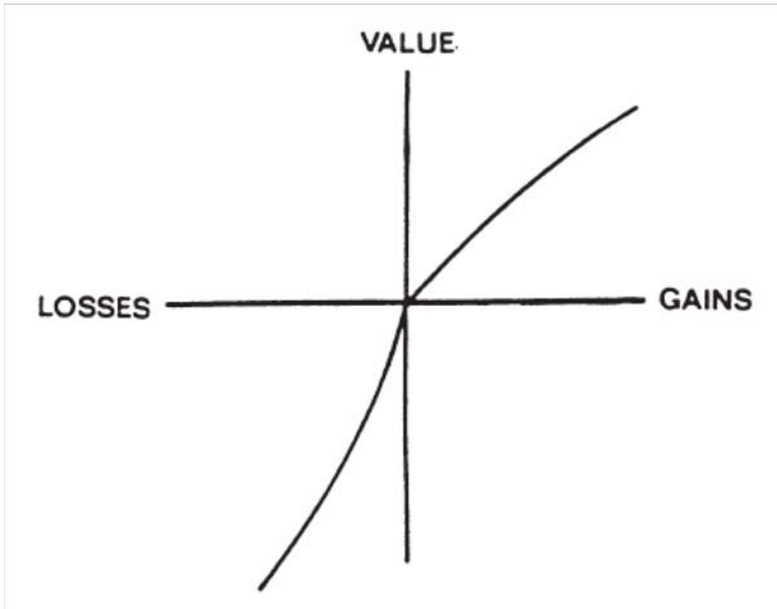
     – Basic psychological intuition that changes, not levels, matter (applies also elsewhere)

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

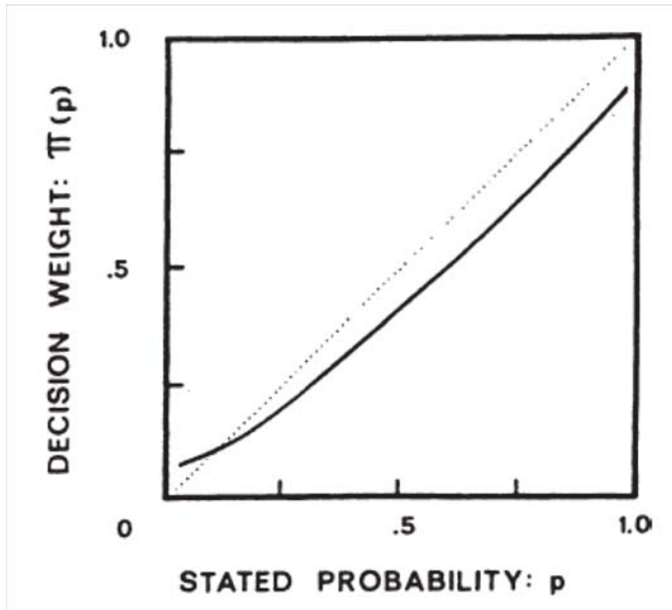
2. Concavity over gains of v –> Explains (500,1)$\succ$(1000,0.5;0,0.5)

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

4. Loss Aversion around reference point –> Explains (0,1) $\succ$ (-8,.5;10,.5)



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



- Overweight small probabilities + Premium for certainty

- 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

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

- Most field applications use only (1)+(4), or (1)+(2)+(3)+(4)

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

- Reference point r?

- Open question – depends on context

- Koszegi-Rabin (2004): rational expectations equilibrium

- Narrow framing?

- Consider only problem at hand (labor supply, stock picking, house sale)

- Neglect other relevant decisions

6 Reference Dependence: Endowment Effect

- Plott and Zeiler (2005) replicating Kahneman, Knetsch, and Thaler (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
  - Utility is sum of utility of owning the object $u(m-r)$ plus utility of money p
  - Assumption: No loss-aversion over money
  - If given mug, $r=1$, so selling money feels like a loss
  - If not given mug, $r=0$, so getting money feels like a gain

- This implies:
  - WTA: $u(1-1) = u(0-1) + WTA$
  - WTP: $u(0-0) = u(1-0) - WTP$
  - Assuming $u(1-1) = u(0-0) = 0$, it follows that

$$WTA = -u(-1) = \lambda u(1) = \lambda WTP$$

- Result $WTA \simeq 2 * WTP$ is consistent with loss-aversion $\lambda \simeq 2$
- Plott and Zeiler (2005): The result disappears with
  - appropriate training
  - practice rounds
  - double auction
  - 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

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

- Suppose that, as in Koszegi-Rabin, the reference point is (.5, mug; .5, no mug) in both cases
  - WTA: $.5*u(1-1)+.5*u(1-0) = .5*u(0-1)+.5*u(0-0)+WTA$
  - WTP: $.5*u(0-1)+.5*u(0-0) = .5*u(1-1)+.5*u(1-0)-WTP$
  - This implies: $WTA = WTP$

7 Next Lecture

- Reference-Dependent Preferences

  - Financial markets: Disposition Effect

  - Labor Supply

  - Insurance Decisions

- Problem Set 2 due next Wednesday February 21