Econ 219B
Psychology and Economics: Applications
(Lecture 3)

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Outline

1. Health-Club Industry

2. Credit Card Industry

3. Deadlines and Task Completion

4. Seven Application of Present Bias

2 Health-club industry

- DellaVigna, Malmendier, "Overestimating Self-Control: Evidence from the Health Club Industry", November 2003

- Can present bias + naiveté explain other economic decisions?

- Health club industry!

- (See slides in Word)

Panel Data: US Health Clubs

Choice of Membership
(*Purchase Decision*)
→ Long-run plan

Attendance
(*Consumption Decision*)
→ Short-run action

Distinctive features

- Simple decision
- Sizeable and easily measurable monetary implications
- Persuasion by firm?

US Health Club Industry

- Revenues (as of 12/00): $11.6 billion.
- Number of Clubs: 16,983 (as of 1/01). Fast-growing.
- 1 publicly traded company (Bally): $1bn revenues, 4m members (2000).

Membership (as of 12/00)**:**

- 54.8m exercised at health clubs (= 30% US population of age 14-65).
- 32.8m members of health clubs (= 18% US population of age 14-65).

The data set

New panel data set from three US health clubs:

- Time period: April 1997 – August 2000 or March 2001.
- 7,978 members. (43% corporate members)

Attendance. Day-to-day individual attendance to health club:

- Swipe card technology – computer record.
- Incentives for correct reporting (reports to firms).
- High precision (plenty of time to swipe card).

Contract. Day-to-day record of customer payments:

- Data serves billing purposes.

Match attendance and contract data using individual ID number.

Contractual menu

1. Monthly contract

- No fee per visit
- Flat monthly fee ($85) -- Corporate discounts
- Initiation fee ($0 to $150)
- Automatic renewal. Cancellation by letter or in person

2. Annual contract

- No fee per visit
- Flat annual fee, paid at sign-up. Pay 10 months out of 12
- Initiation fee as in monthly contract
- Expiration after 12 months

3. Pay-per-visit contract

- $12 per visit or ten-visit pass for $100
- Attendance not tracked

- Switches from *flat-rate* to payment per visit:
  - effort cost k to switch to pay-per-visit
  - daily benefit b of switching
  - switching option every T periods

- *Monthly* contract:
  - $k = k_M > 0$
  - $T = 1$

- *Annual* contract:
  - $k = k_A < 0$
  - $T = 1$ after 1 year

- Same model as in Lecture 2

- **Exponential** consumer ($\beta = \hat{\beta} = 1$) switches if

$$k \leq \frac{\delta b}{1 - \delta}$$

- **Sophisticated** t.i. consumer ($\beta = \hat{\beta} < 1$) waits for at most t periods if

$$t \simeq \frac{(1 - \beta)\, k}{\beta b}$$

- **Naive** t.i. consumer ($\beta < \hat{\beta} = 1$) switches if

$$k \lessapprox \frac{\beta b}{1 - \beta} T$$

- Calibrations:
  - $k \approx \$10$ (time to visit club)

  - daily benefit:
    - $b = \$85/30 = \$2.83$ if expected no. monthly visits is 0
    - $b = \$\left(85 - 4 * 10\right)/30 = \$1.5$ if expected no. monthly visits is 4
    - $b = \$\left(85 - 8 * 10\right)/30 = .16$ if expected no. monthly visits is 8
    - $b = \$\left(85 - 10 * 10\right)/30 = -.5$ if expected no. monthly visits is 10

- When should k make a difference? Assume $\delta^{365} = .97$, $\beta = .8$.

- **Exponential** consumer ($\beta = \hat{\beta} = 1$) switches if:

$$k \leq \frac{\delta b}{1 - \delta} = 10,000b$$

- **Sophisticated** t.i. consumer ($\beta = \hat{\beta} < 1$) waits for at most t periods with

$$t \simeq \frac{(1 - \beta)\, k}{\beta b} = \frac{10}{4b}$$

- **Naive** t.i. consumer ($\beta < \hat{\beta} = 1$) switches if

$$k \lessapprox \frac{\beta b}{1 - \beta} T = 4b$$

Probability of contract renewal

	Time-consistent or sophisticated time-inconsistent agents	Naïve time-inconsistent agents
Enrollment under annual contract	P(b<0|annual)	0
Enrollment under monthly contract	P(b<0|monthly)	1

⇒ Survival probability of monthly and annual contract

(Probability of membership with a flat-rate contract 14 months after enrollment)

- Sorting (types more likely to quit club choose Monthly Contract)
- Temporary shocks (quit only under Monthly)

⇒ P(b<0|annual) > P(b<0|monthly) in standard model

Empirical test of sorting

- Average attendance in annual and monthly contract
- Sample: Early periods to avoid selective exit
- Sorting prediction: higher in annual contract

Table 7: Average Attendance (Sorting)

	Monthly contract (M) (s.e., no. obs.)	**Annual contract (A)** (s.e., no. obs.)
	Sample: First spell	
Month 2	5.500 (.066, N=6380)	5.797 (.187, N=874)
Month 3	4.998 (.069, N=5783)	5.583 (.191, N=858)
Month 4	4.592 (.070, N=5390)	5.151 (.188, N=839)

Renewal decision. Renewal probability under *Monthly* and *Annual contracts* after one year.

Model. Probit

$$\begin{aligned} r_i^* &= \alpha + \gamma M_i + BX_{i,t} + \varepsilon_{i,t}, \\ r_i &= 1 \text{ if } r_i^* \geq 0. \end{aligned}$$

- $r_i = 1$: individual i is enrolled after 13 months of active, paid membership (allow for freeze, quit and rejoin).

- M_i: dummy $= 1$ if first contract is monthly

- Predictions:
  - Expon+Soph: $\gamma < 0$
  - Naive: $\gamma > 0$

Table 8: Probit of Renewal Decision I

Dependent variable: Enrollment at 14th active month

Sample: First spell with non-missing controls

Controls:	no controls (1)	controls + time dummies (2)
Dummy for enrollment with monthly contract	0.0318 (0.0217)	0.0514 (0.0218)
Female		-0.0566 (0.0144)
Age		0.0204 (0.0047)
Age square		-0.0002 (0.0001)
Corporate member		0.0816 (0.0144)
Student member		-0.1370 (0.0498)
Month and year of enrollment		X
Baseline renewal probability for monthly=0	0.3993	0.4161
Number of observations	*N* =4905	*N* =4905

Alternative measure

Number of full months between last attendance and contract termination

Table 2b: Attendance Gap

	Sample: completed spells starting before 4/98, no initiation fee, no subsidy	
	Biggest gap	Gap before quitting
Consecutive full months of payment and no attendance		
Average	3.07	2.29
25th percentile	1	0
Median	2	1
75th percentile	4	3
90th percentile	8	7
95th percentile	13	11
P(gap>=4)	.2619	.1964
Average payment during gap	$244.30	$185.43
Number of observations	*N = 168*	*N = 168*

- Alternative interpretations
  - **Selection effect**
    * People that sign in gyms are already not the worst procrastinators
  - **Bounded rationality**
  - **Persuasion**
  - **Memory**

Choice of flat-rate vs. per-visit contract

- *Contractual elements.*
  - Per visit fee: p
  - Lump-sum periodic fee: L
- *Menu of contracts*
  - Flat-rate contract: $L > 0$, $p = 0$
  - Pay-per-visit contract: $L = 0$, $p > 0$
- *Health club attendance*
  - Immediate cost c_t
  - Delayed health benefit $h > 0$
  - Uncertainty: $c_t \sim G$, c_t i.i.d. $\forall t$.

Attendance decision.

- Long-run plans at time 0:

$$\text{Attend at } t \iff \beta\delta^t(-p - c_t + \delta h) > 0$$
$$\iff c_t < \delta h - p.$$

- Actual attendance decision at $t \geq 1$:

$$\text{Attend at } t \iff -p - c_t + \beta\delta h > 0$$
$$\iff c_t < \beta\delta h - p. \text{ (Time Incons.)}$$
$$\text{Actual } P(\text{attend}) = G(\beta\delta h - p)$$

- Forecast at $t = 0$ of attendance at $t \geq 1$:

$$\text{Attend at } t \iff -p - c_t + \hat{\beta}\delta h > 0$$
$$\iff c_t < \hat{\beta}\delta h - p. \text{ (Naiveté)}$$
$$\text{Forecasted } P(\text{attend}) = G(\hat{\beta}\delta h - p)$$

Choice of contracts at enrollment

Proposition 1. If an agent chooses the flat-rate contract over the pay-per-visit contract, then

$$\begin{aligned}\frac{(1-\delta)\,T}{1-\delta^T}L \;\leq\; & \; pTG(\beta\delta h) \\ & +(1-\hat{\beta})\delta bT\left(G(\hat{\beta}\delta h)-G(\hat{\beta}\delta h-p)\right) \\ & +pT\left(G(\hat{\beta}\delta h)-G(\beta\delta h)\right)\end{aligned}$$

Intuition:

1. *Exponentials* ($\beta = \hat{\beta} = 1$) pay at most p per expected attendance under flat-rate contract. They can always pay p per visit.

2. *Hyperbolic* agents may pay more than p per visit.
   (a) *Sophisticates* ($\beta = \hat{\beta} < 1$) pay for commitment device ($p = 0$). Align actual and desired attendance.
   (b) *Naïves* ($\beta < \hat{\beta} = 1$) overestimate usage.

Flat-rate vs. Pay-per-visit

Time consistency

Choose Flat-rate (Monthly, Annual) only if attend frequently enough:

(Flat fee) / (expected attendance) < $10

Time inconsistency

May choose Flat-rate even if:
(Flat fee) / (expected attendance) > $10

Reasons:

- commitment device;
- naivete' about future time-inconsistency==> overestimation of attendance.

Sample estimation

Estimate expected attendance with sample average attendance

Monthly contract. Estimate price per average attendance:

- First 6 month since joining.
- Users with *no subsidy* (> \$70 per month)
- Result: \$17.13 > \$10

Annual contract. Estimate price per average attendance:

- First year
- Result: \$15.15 > \$10

Table 5: Price per Average Attendance at Enrollment[+]

	Sample: First spell and no subsidy, all clubs		
	Average price per month (1)	Average attendance per month (2)	Average price per average attendance (3)
	Users initially enrolled with a monthly contract		
Month 1	55.09 (0.78) *N* = 873	3.45 (0.13) *N* = 873	15.98 (0.57) *N* = 873
Month 2	80.53 (0.44) *N* = 797	5.45 (0.18) *N* = 797	14.78 (0.51) *N* = 797
Month 3	70.02 (1.04) *N* = 780	4.97 (0.18) *N* = 780	14.09 (0.57) *N* = 780
Month 4	81.72 (0.26) *N* = 766	4.61 (0.19) *N* = 766	17.71 (0.72) *N* = 766
Month 5	81.87 (0.25) *N* = 701	4.43 (0.18) *N* = 701	18.50 (0.78) *N* = 701
Month 6	81.88 (0.28) *N* = 639	4.32 (0.19) *N* = 639	18.94 (0.82) *N* = 639
Months 1 to 6	83.00 (0.40) *N* = 912	4.85 (0.14) *N* = 912	17.13 (0.52) *N* = 912
	Users initially enrolled with an annual contract, join 14 month before the end of sample period		
Year 1	71.02 (0.50) *N* = 145	4.69 (0.38) *N* = 145	15.15 (1.24) *N* = 145

Figure 3. Price per average attendance.
Yearly contracts with yearly fee >=$700

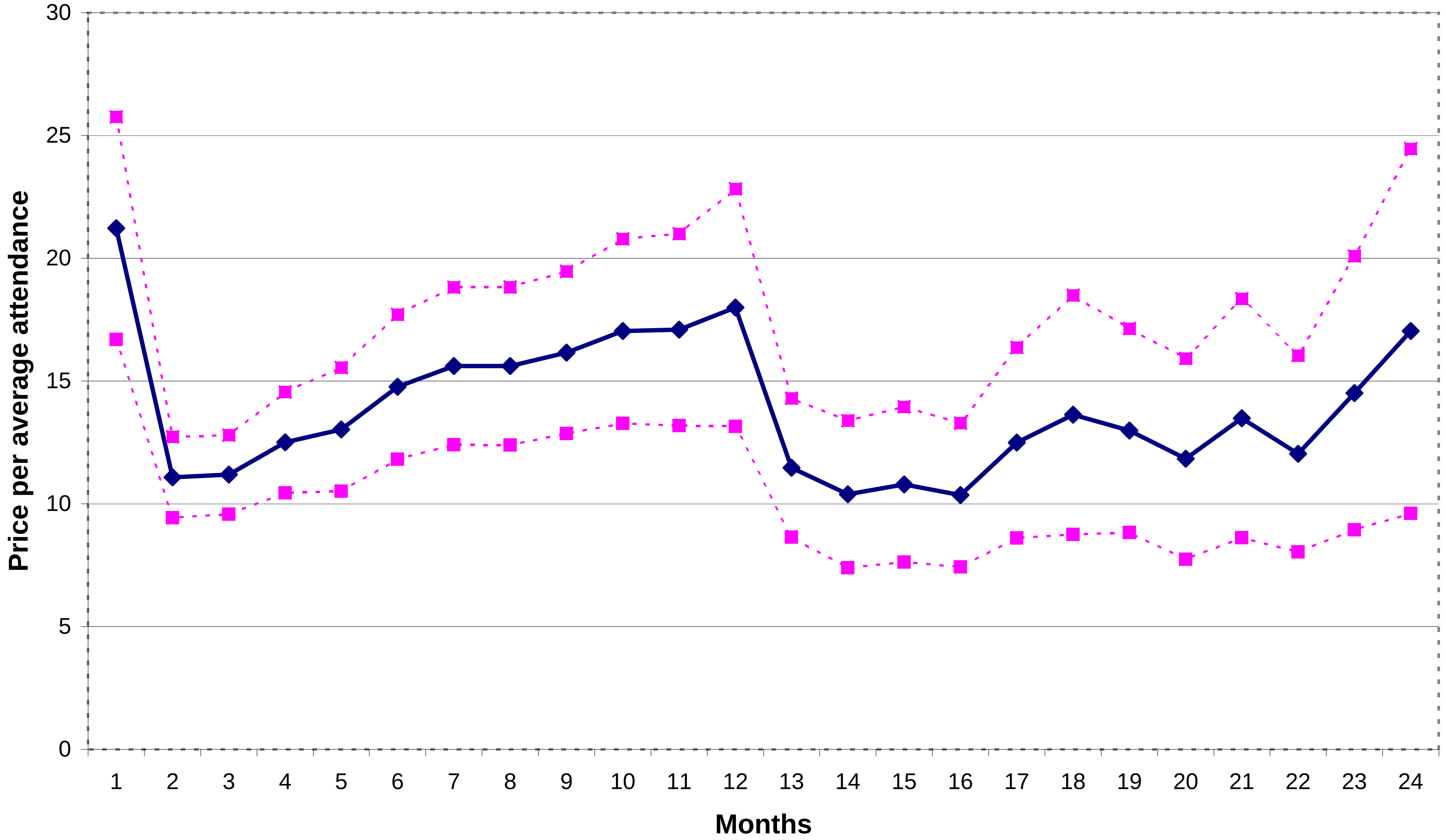


Figure 4. <u>Price per average attendance</u>.
Monthly contracts with monthly fee>= $70.

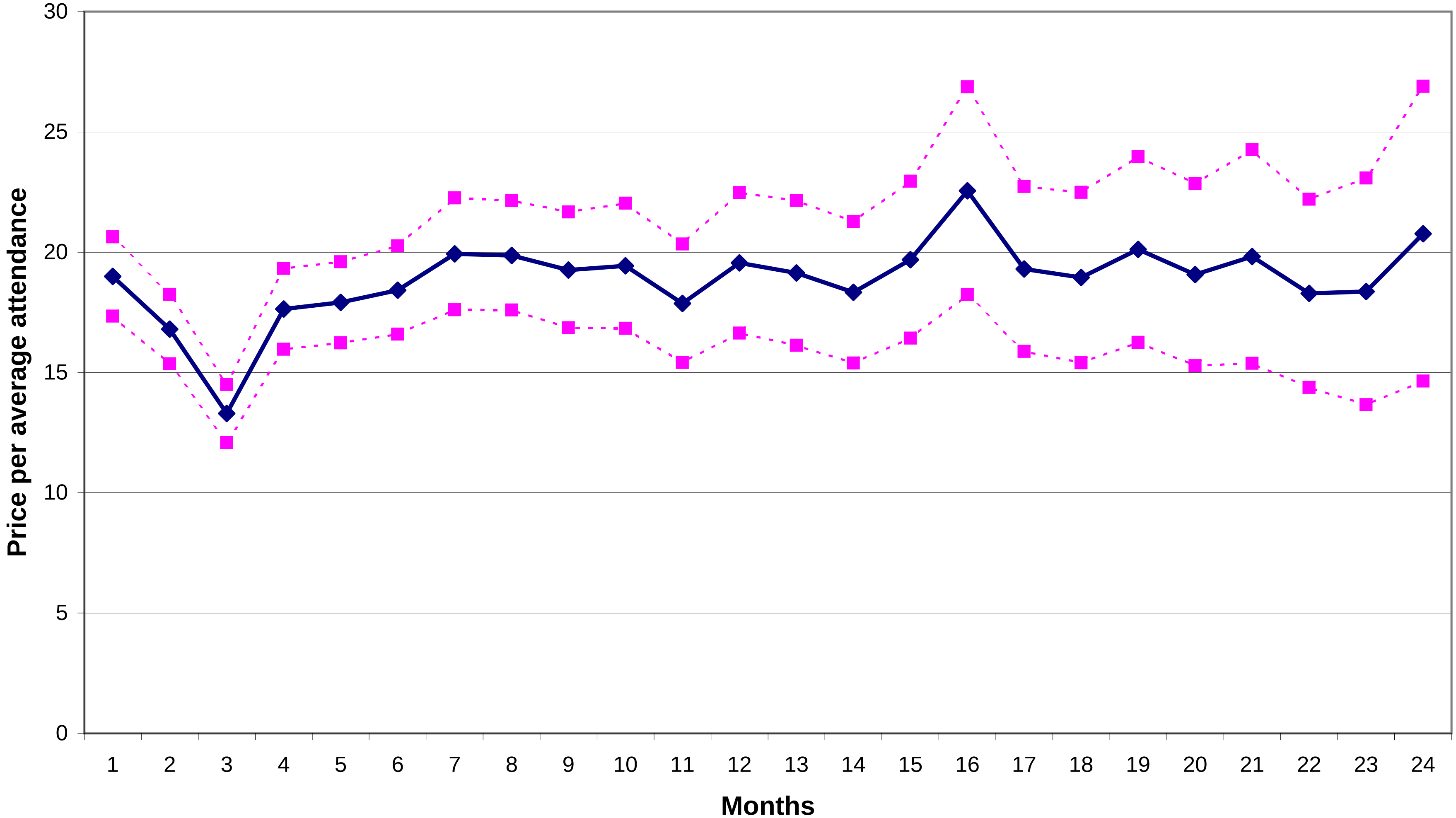


Table 1: Stylized Facts and Explanations

	Time-consistent agents (1)	Sophisticated time-inconsistent agents (2)	Partially naive time-inconsistent agents (3)	Trans. costs of payment per usage (4)	Overestimation of net benefits (5)	Salesman techniques (6)
Stylized fact 1. Price per average attendance > $10		commitment	commitment, overestimation of attendance	distaste of paym. per usage	overestimation of attendance	pressure of salesman
Stylized fact 2. Users predict 9.5 monthly visits; actual monthly visits are 4.2			overestimation of attendance		overestimation of attendance	
Stylized fact 3. Interval between last attendance and termination 2.3 full months			delay in cancellation	distaste of paym. per usage	overestimation of attendance	pressure of salesman
Stylized fact 4. Average attendance in first 4 months higher in annual than monthly contract	sorting	sorting	sorting	sorting	sorting	sorting
Stylized fact 5. Survival probability at 14th month 12.5 percent higher for monthly than for annual contract			delay in cancellation			pressure of salesman
Stylized fact 6. Survival probability at 14th month double for monthly than for annual contract for low past attendance			delay in cancellation			pressure of salesman
Stylized fact 7. Average attendance 46 percent higher in second year for annual contract	learning	learning	learning	learning	learning	learning
Stylized fact 8. Decreasing average attendance over time in monthly contract			delay in cancellation			pressure of salesman
Stylized fact 9. Positive correlation of price per average attendance and interval between last attendance and termination			heterogeneity in naiveté			

Adverse Selection in the Credit Market

Ausubel 1999

Two parts:

1. Adverse Selection story (parts 1-6)

2. Consumer Rationality story (part 7)

Focus on this part

Nature of Data

- Credit card solicitations to mailing lists
- “pre-approved” firm offers of credit
- Extensive data on observable characteristics of recipients
- dependent variable: response rate
- Control variables: “teaser rate”, duration of teaser rate, default or “post”-teaser rate.

Natural Experiments

- Three different “market experiments”
- Large data sets
  - 600,000; 863,876; 500,000 customer names
- Random Assignment into groups
  - 6 “market cells” in first, 5 in 2d, 5 in 3d
- Each “cell” gets a different offer
- Can measure demand sensitivity to offer characteristics

Auction model of credit card solicitation

- Credit card companies extend firm offers to consumers, with a rate set to maximize profit net of default
- Consumers receive multiple offers in interval
- Consumers select best offer
- Standard Winner’s curse story

Adverse selection story

- Consumers are responsive to teaser rates and duration of teaser rates in standard direction
- Least desirable terms are accepted by consumers with worse average credit
- As measured by observable measures, and
- As measured by subsequently revealed information

Adverse Selection Story (cont'd)

- Acceptance of inferior offer is a significant predictor of inferior credit even when controlling for observable characteristics.
- Not moral hazard (because stakes are so small)
- Lesson: like issuers of annuities or life insurance, issuers of cc need to distinguish characteristics of solicited pool from those who accept.
- Possibly lead to credit rationing

Consumer (ir)rationality story

- Are consumers “duped” by teaser rates?
- Do they choose credit cards without pricing the life cycle?
- Do they underestimate their cc use?
- Do they overestimate their ability to stop using a credit source when the teaser rate dries up?
- Can this data set answer these questions?

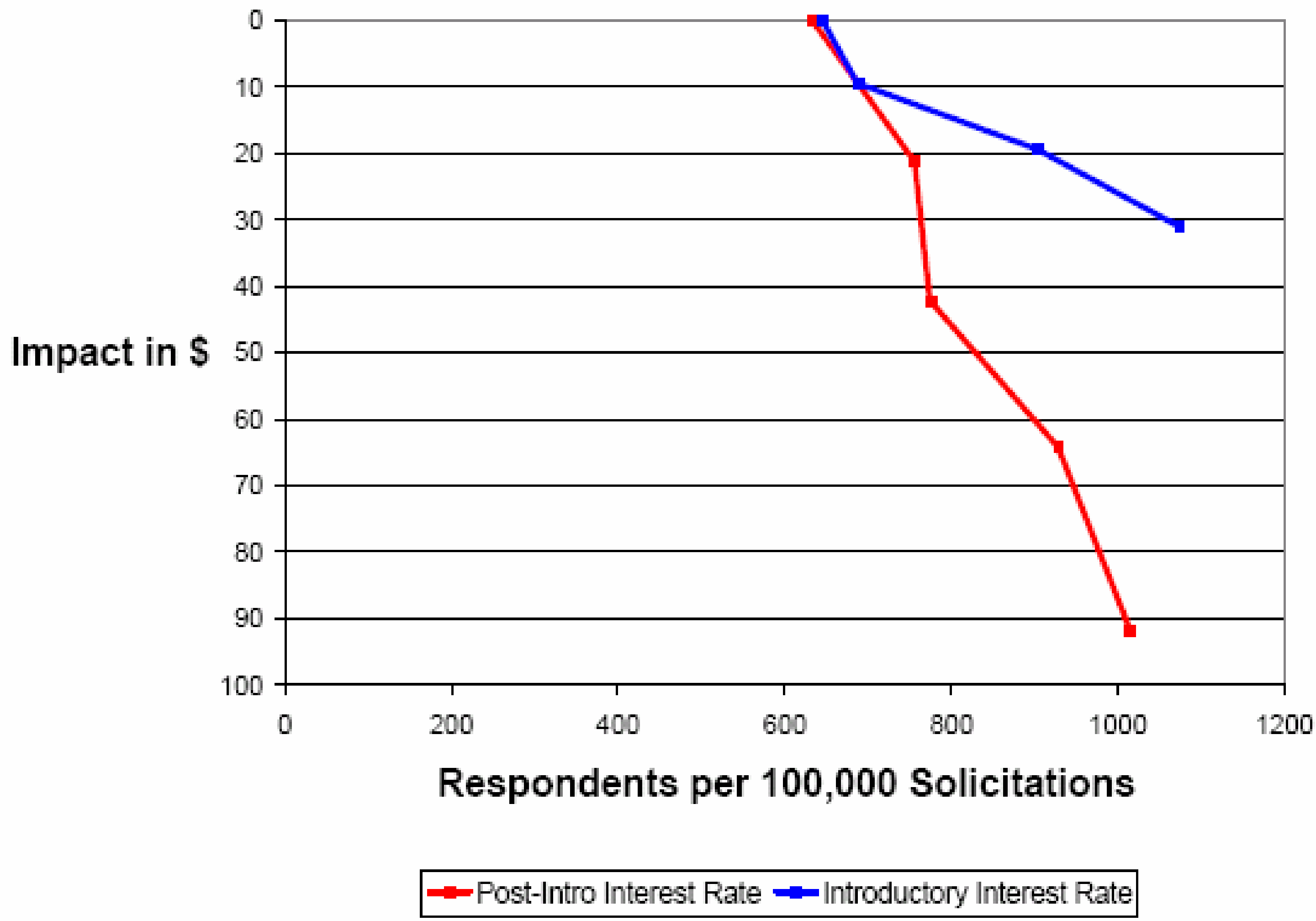
Proposed method for answering

- If consumers are rational, they should have the same demand curve for a product regardless of how the price is denominated.
- Example: if it's a "life cycle" product, they should exhibit the same demand when the PV (life cost) is the same regardless of how much is at $t=0$ and how much at $t>1$.

Demand as f (teaser rate)

TABLE 1: SUMMARY OF MARKET EXPERIMENTS

MARKET EXPERIMENT	MARKET CELL	NUMBER OF SOLICITATIONS MAILED	EFFECTIVE RESPONSE RATE	PERCENT GOLD CARDS	AVERAGE CREDIT LIMIT
MKT EXP I	A: 4.9% Intro Rate 6 months	100,000	1.073%	83.97%	$6,446
MKT EXP I	B: 5.9% Intro Rate 6 months	100,000	0.903%	80.18%	$6,207
MKT EXP I	C: 6.9% Intro Rate 6 months	100,000	0.687%	80.06%	$5,973
MKT EXP I	D: 7.9% Intro Rate 6 months	100,000	0.645%	76.74%	$5,827


Impact in $
0
10
20
30
40
50
60
70
80
90
100
0
200
400
600
800
1000
1200
Respondents per 100,000 Solicitations
Post-Intro Interest Rate
Introductory Interest Rate

Computing the demand curve

- Blue curve based on teaser rate
- Look at actual use of credit card
- Assume this use is not affected by rate
- Translate rate difference into dollar savings if rate went down 1%
- or into extra interest if rate went up 1%
- Take the average ≈ price of 1% change

Demand as f (post rate)

MKT EXP III	A: Post-Intro Rate Standard - 4%	100,000	1.015%	82.96%	$5,666
MKT EXP III	B: Post-Intro Rate Standard - 2%	100,000	0.928%	77.69%	$5,346
MKT EXP III	C: Post-Intro Rate Standard + 0%	100,000	0.774%	76.67%	$5,167
MKT EXP III	D: Post-Intro Rate Standard + 2%	100,000	0.756%	76.98%	$5,265
MKT EXP III	E: Post-Intro Rate Standard + 4%	100,000	0.633%	73.62%	$5,095

Computing the demand curve

- Red curve based on post-teaser rate
- All consumers were given 6 month rate of 5.9%.
- Use actual credit use history over 21 months of data (ignores differences beyond this period)
- Compute dollar impact of change in post interest rate

Conclusion of first comparison

- Consumers are (at least) three times more responsive to teaser rates than longer term rates even when they have the same dollar impact.
- Problems with test?

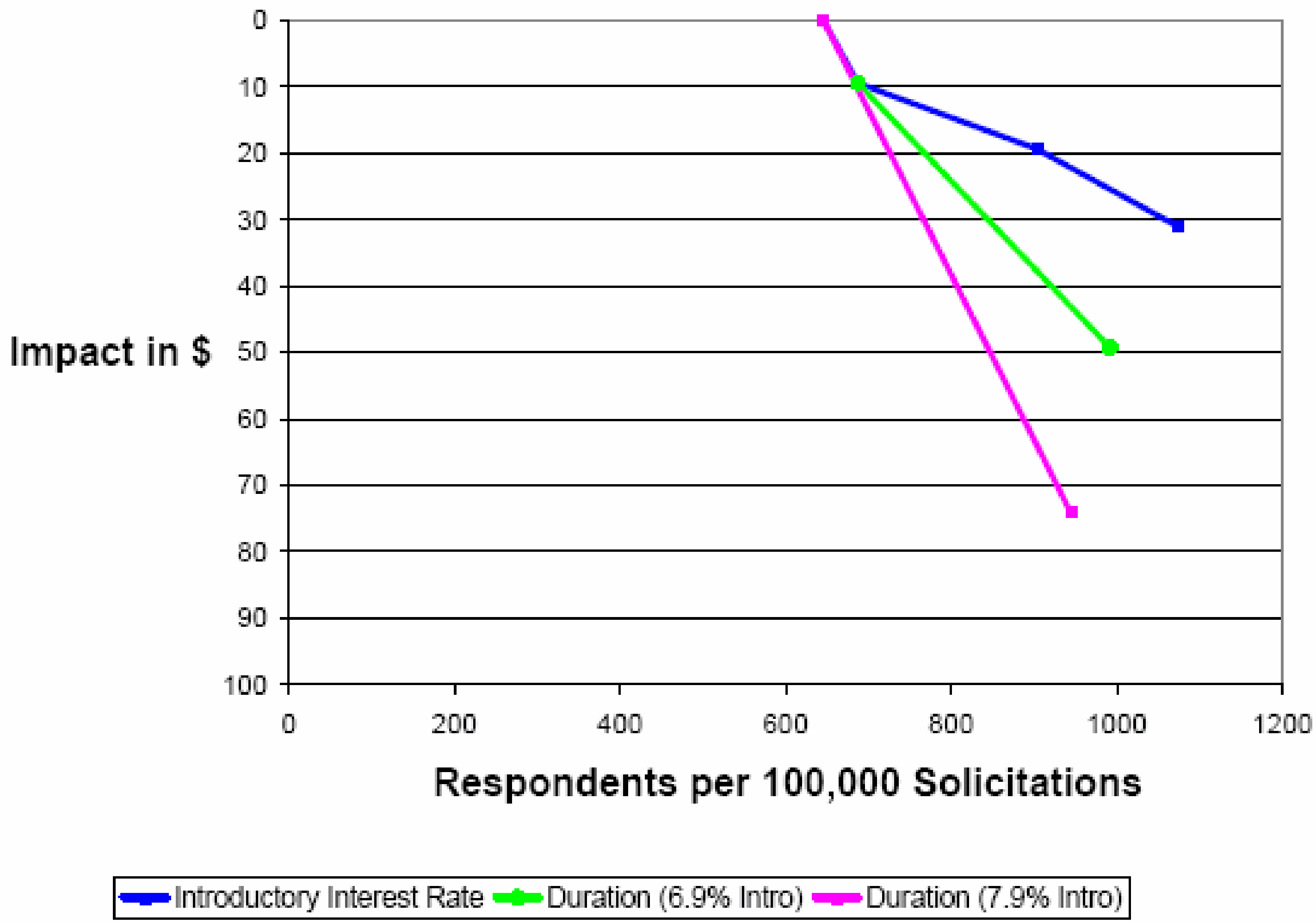
Duration of teaser rate

- Similarly, we can look at demand as a function of dollar savings due to the duration of the teaser offer.
- Compare this demand curve to the demand curve as a function of the teaser rate

Demand as f (teaser duration)

MKT EXP II	A: 5.9% Intro Rate 6 months	149,810	0.610%	68.82%	$4,794
MKT EXP II	B: 5.9% Intro Rate 9 months	137,332	0.760%	74.62%	$5,186
MKT EXP II	C: 5.9% Intro Rate 12 months	124,854	1.135%	76.85%	$5,495

MKT EXP I	C: 6.9% Intro Rate 6 months	100,000	0.687%	80.06%	$5,973
MKT EXP I	E: 6.9% Intro Rate 9 months	100,000	0.992%	81.15%	$6,279
MKT EXP I	D: 7.9% Intro Rate 6 months	100,000	0.645%	76.74%	$5,827
MKT EXP I	F: 7.9% Intro Rate 12 months	100,000	0.944%	82.31%	$6,296



Impact in $
0
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200
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1200
Respondents per 100,000 Solicitations
Introductory Interest Rate
Duration (6.9% Intro)
Duration (7.9% Intro)

Ranking Reversal

- Consumers should have a higher response rate for cards which offered lower overall effective interest rate over life cycle.
- Again, look at actual credit use and determine effective interest rate over first 13 months

TABLE 9: REEXAMINATION OF MARKET EXPERIMENT I

MARKET CELL	EFFECTIVE RESPONSE RATE	RANK BY RESPONSE RATE	EFFECTIVE INTEREST RATE	RANK BY INTEREST RATE
A: 4.9% Intro Rate 6 months	0.01073 (0.00033)	1	10.23%	3
B: 5.9% Intro Rate 6 months	0.00903 (0.00030)	4	11.35%	4
C: 6.9% Intro Rate 6 months	0.00687 (0.00026)	5	11.86%	5
D: 7.9% Intro Rate 6 months	0.00645 0.00025	6	12.35%	6
E: 6.9% Intro Rate 9 months	0.00992 (0.00031)	2	9.23%	2
F: 7.9% Intro Rate 12 months	0.00944 (0.00031)	3	8.32%	1

Preference Reversals (cont'd)

- If all consumers were rational, then we should find that the average consumer in any group would be better off if and only if he had a card with a higher response rate (assuming fixed borrowing behavior).
- Problems with this story?

Customers in Market Cell A:

Average improvement from obtaining terms of market cell B:	$10.98
Percent who would improve by more than $10:	35.6%
Percent who would worsen by more than $10:	16.2%

Customers in Market Cell B:

Average worsening from obtaining terms of market cell A:	$35.52
Percent who would improve by more than $10:	6.9%
Percent who would worsen by more than $10:	47.1%

Customers in Market Cell E:

Average improvement from obtaining terms of market cell F:	$14.52
Percent who would improve by more than $10:	33.1%
Percent who would worsen by more than $10:	10.2%

Customers in Market Cell F:

Average worsening from obtaining terms of market cell E:	$36.27
Percent who would improve by more than $10:	6.0%
Percent who would worsen by more than $10:	48.1%

4 Deadlines and Task Completion

- Most previous evidence consistent with:
  - present bias;
  - naiveté about present bias.

- Is this the *right* model?

- Additional evidence on deadlines

- Wertenbroch-Ariely, “Procrastination, Deadlines, and Performance", *Psychological Science,* 2002.

- Field experiment 1 in classroom:
  - sophisticated people: executives at MIT;
  - high incentives: reimbursement of fees
  - submission of 3 papers
  - 1% grade penalty for late submission

- Two groups:
  - Group A: evenly-spaced deadlines
  - Group B: no deadlines

- Results:
  - Group B sets deadlines but quite close to end
  - No late submission!
  - Papers: Grades in Group A (88.7) higher than grades in Group B (85.67)
  - Final projects: Grades in Group A (88.7) higher than grades in Group B (85.67)

- Experiment 2. Proofreading exercise.
  - Group A: evenly-spaced deadlines
  - Group B: no deadlines
  - Group C: self-imposed deadlines

- Predictions:
  - Standard Theory: $B = C > A$
  - Sophisticated Time-Inconsistent: $C > A > B$
  - Fully Naive Time-Inconsistent: $A > B = C$
  - Partially Naive Time-Inconsistent: $A > C > B$

- Results:
  - Performance: $A > C > B$

5 Seven 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:

  – Puzzling stylized facts

  – Structural or reduced form models

  – Sophistication typically assumed

  – Some claims that procrastination comes from present bias

5.1 Consumption-savings Choice

- Laibson (1997) to Laibson, Repetto, and Tobacman (2003)

- Stylized facts:
  - low liquid wealth
  - substantial iliquid wealth (housing+401(k)s)
  - high credit card borrowing
  - consumption drop-off at retirement

- **T.-F.** Structural model, MSM (building on Gourinchas and Parker, 2002) with:
  - borrowing constraints
  - illiquid assets
  - realistic features

- Estimated $\beta = .66$

2.1 Data

Statistic	m_e	se_{m_e}
% borrowing on 'Visa'? (*% Visa*)	0.68	0.015
borrowing / mean income ($mean$ *Visa*)	0.12	0.01
C-Y comovement (*CY*)	0.23	0.11
retirement C drop (*C drop*)	0.09	0.07
median 50-59 $\frac{wealth}{income}$	3.88	0.25
weighted mean 50-59 $\frac{wealth}{income}$ (*wealth*)	2.60	0.13

Benchmark Model	Exponential	Hyperbolic	Data	Std err
Statistic:	$m_s(1, \hat{\delta})$ $\hat{\delta} = .857$	$m_s(\hat{\beta}, \hat{\delta})$ $\hat{\beta} = .661$ $\hat{\delta} = .956$	m_e	se_{m_e}
% $Visa$	0.62	0.65	0.68	0.015
$mean\ Visa$	0.14	0.17	0.12	0.01
CY	0.26	0.35	0.23	0.11
$Cdrop$	0.16	0.18	0.09	0.07
$wealth$	0.04	2.51	2.60	0.13
$q(\hat{\theta})$	512	75		

- Soph. or naiveté – does not matter

- **T.** Consumption-savings within growth model (Barro, 1999):
  - complete markets
  - log utility
  - equivalence of exponential and (soph) hyperbolic preferences

5.2 401(k) Savings

- Madrian and Shea (2001); Choi et al. (2002)

- Stylized Facts:

  - Status-quo effects in:

    * participation,

    * contribution rate,

    * portfolio composition

- **F.** See above

- Need naiveté to get large status quo

TABLE 1. Automatic Enrollment in Three Companies

	Company A	Company B	Company C
Industry	Office Equipment	Health Services	Food Products
Employment	32,000	30,000	18,000
Date automatic enrollment implemented	January 1, 1997	April 1, 1998	A) January 1, 1998[a] B) November 1, 1999[a]
Employees affected by automatic enrollment	Hired on or after January 1, 1997	Hired on or after April 1, 1998	A) Eligible on or after January 1, 1998[a] B) Eligible before January 1, 1998 and not participating on November 1, 1999[a]
Length of opt-out period	60 days	30 days	30 days
Default contribution rate	2%	3%	3%
Default investment fund	Stable value	Money market	Stable value
Matching provisions	$0.67/$1 up to 6% of pay put into company stock	$0.50/$1 up to 6% of pay after 1 year of employment	$0.50/$1 up to 6% of pay
Other changes in 401(k) plan over study period	Three new funds in 1999 One fund closed in 1999	1 year length of service requirement eliminated on April 1, 1998	1 year length of service requirement for employees under age 40 eliminated on January 1, 1998

Source: Summary plan descriptions and conversations with company officials.
[a] In Company C, the first round of automatic enrollment affected employees eligible on or after January 1, 1998. This includes all employees hired on or after January 1, 1998 as well as any employees hired during 1997 who were under the age of 40 on December 31, 1997. The second round of automatic enrollment in Company C affected all employees not subject to automatic enrollment during the first round: those hired prior to 1997 and employees hired during 1997 who had reached the age of 40 by December 31, 1997.

TABLE 2. The Distribution of 401(k) Contribution Rates by Tenure for Employees Hired Before and After Automatic Enrollment

Tenure (months)	Hired Before Automatic Enrollment				Hired After Automatic Enrollment			
	Non-Participant	< Default	Default	> Default	Non-Participant	< Default	Default	> Default
Company A								
6-11	--	--	--	--	8.4%	1.3%	63.4%	26.9%
12-17	--	--	--	--	8.5	1.4	61.0	29.1
18-23	--	--	--	--	8.8	1.4	56.5	33.4
24-29	46.9%	1.7%	12.0%	39.4%	9.0	1.7	53.3	36.1
30-35	40.8	1.4	10.9	46.9	8.4	1.6	50.3	39.7
36-41	40.2	1.7	12.7	45.5	6.8	1.3	48.5	43.4
42-47	35.3	0.9	10.7	53.2	8.3	1.6	45.8	44.3
48-53	31.5	1.9	13.4	53.3	--	--	--	--
Company B								
3-5	68.9%	3.0%	3.6%	24.5%	13.5%	1.2%	71.8%	13.6%
6-11	64.0	3.0	4.4	28.6	13.7	1.3	66.2	18.9
12-17	64.2	2.7	3.4	29.8	12.7	1.6	54.9	30.8
18-23	53.4	3.4	4.5	38.8	12.0	1.5	47.5	39.0
24-26	47.3	3.9	5.3	43.6	12.1	1.4	41.4	45.0

Authors' calculations. The sample in the first four columns is employees hired before automatic enrollment. The sample in the second four columns is employees hired after automatic enrollment.

TABLE 3. The Distribution of 401(k) Fund Allocations by Tenure for Employees Hired Before and After Automatic Enrollment

	Hired Before Automatic Enrollment				Hired After Automatic Enrollment			
Tenure (months)	Non-Participant	Zero Balances	100% Default Fund	Other Allocation	Non-Participant	Zero Balances	100% Default Fund	Other Allocation
Company A								
6-11	--	--	--	--	8.4%	4.6%	58.7%	28.4%
12-17	--	--	--	--	8.5	4.4	57.2	30.0
18-23	--	--	--	--	8.8	2.3	54.7	34.3
24-29	46.9%	2.3%	8.9%	42.0%	9.0	2.1	52.7	36.3
30-35	40.8	1.9	6.2	51.1	8.4	1.4	49.8	40.4
36-41	40.2	1.5	8.8	49.4	6.8	1.3	49.1	42.8
42-47	35.3	0.8	6.7	57.2	8.3	1.2	47.2	43.2
48-53	31.5	0.9	8.8	58.8	--	--	--	--
Company B								
3-5	68.9%	--	0.7%	30.4%	13.6%	--	76.7%	9.7%
6-11	64.0	--	0.9	35.1	13.5	--	71.2	15.3
12-17	64.2	--	2.9	32.9	13.7	--	64.0	22.3
18-23	53.4	--	2.2	44.4	12.0	--	50.0	38.0
24-26	47.3	--	2.3	50.4	12.1	--	43.6	44.3

Authors' calculations. The sample in the first four columns is employees hired before automatic enrollment. The sample in the last four columns is employees hired after automatic enrollment.

5.3 Addiction

- Gruber and Koszegi (2001) and Gruber and Mullainathan (2002)

- 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, 2002): smokers happier in states one year after smoking taxes are raised

Table 2: Relation Between Cigarette Taxes and Unhappiness

	Very Happy	Pretty Happy	Not Happy	Very Happy	Somewhat Happy	Unhappy
	US Data			Canadian Data		
Tax	-0.027	-0.005	0.032	0.000	0.013	0.000
	(.033)	(.034)	(.020)	(.029)	(.023)	(.011)
Predicted Smoking	-0.069	-0.014	0.075	0.198	0.194	0.096
	(.038)	(.040)	(.026)	(.051)	(.055)	(.040)
Predicted Smoking*Tax	**0.047**	**0.109**	**-0.156**	**0.072**	**-0.058**	**-0.048**
	(.078)	**(.070)**	**(.045)**	**(.062)**	**(.052)**	**(.020)**
Married	0.176	-0.079	-0.095	0.118	-0.098	-0.020
	(.009)	(.011)	(.008)	(.005)	(.004)	(.004)
Separated/Divorced	0.022	-0.020	-0.005	-0.029	-0.025	0.023
	(.009)	(.012)	(.009)	(.008)	(.009)	(.004)
Widowed	0.036	0.005	-0.041	-0.010	-0.034	0.023
	(.012)	(.015)	(.010)	(.009)	(.009)	(.004)
High School Dropout	0.053	0.011	0.029	0.135	0.144	0.022
	(.049)	(.042)	(.028)	(.013)	(.018)	(.005)
High School Graduate	0.052	0.032	0.007	0.191	0.123	0.012
	(.047)	(.043)	(.028)	(.014)	(.019)	(.004)
Some College	0.055	0.037	0.000	0.210	0.124	0.015
	(.049)	(.047)	(.029)	(.021)	(.014)	(.005)
College Graduate	0.064	0.023	0.003	0.220	0.135	0.017
	(.046)	(.046)	(.030)	(.027)	(.017)	(.003)
Father High School	0.002	0.007	-0.008			
Dropout	(.004)	(.005)	(.004)			
Mother High School	-0.007	0.007	0.001			
Dropout	(.007)	(.007)	(.005)			
Father High School	0.006	0.016	-0.020			
Graduate	(.007)	(.008)	(.005)			
Mother High School	0.004	0.007	-0.009			
Graduate	(.008)	(.010)	(.006)			
Father Some College	0.009	0.000	-0.009			
	(.012)	(.011)	(.007)			
Mother Some College	0.005	0.012	-0.014			
	(.013)	(.014)	(.007)			
Father College Graduate	0.024	-0.001	-0.020			
	(.010)	(.010)	(.007)			
Mother College Graduate	0.029	-0.009	-0.017			
	(.014)	(.013)	(.009)			
Lowest Household Income	-0.044	0.025	0.027	-0.049	0.036	0.021
Quartile	(.011)	(.012)	(.010)	(.023)	(.015)	(.009)
2nd Household Income	-0.023	0.045	-0.014	-0.026	0.039	0.001
Quartile	(.010)	(.011)	(.010)	(.011)	(.008)	(.004)
3rd Household Income	0.009	0.033	-0.033	-0.010	0.020	0.006
Quartile	(.012)	(.011)	(.009)	(.004)	(.005)	(.003)

Table 4: "Effect" of Other Taxes

Panel A: US Data

	Beer Tax	Gas Tax	Sales Tax	Total Revenues
Cigarette Tax	0.038	0.035	0.033	0.029
	(.024)	(.020)	(.020)	(.019)
Other Tax	-0.017	-0.001	0.003	-0.004
	(.008)	(.001)	(.004)	(.023)
Predicted Smoking	0.055	0.060	0.060	0.125
	(.031)	(.048)	(.033)	(.038)
Predicted Smoking*Cigarette Tax	**-0.181**	**-0.162**	**-0.159**	**-0.144**
	(.055)	**(.043)**	**(.045)**	**(.043)**
Predicted Smoking*OtherTax	**0.034**	**0.001**	**0.003**	**-0.037**
	(.014)	**(.003)**	**(.006)**	**(.021)**

Panel B: Canadian Data

	Beer Tax	Gas Tax	Sales Tax	Total Revenues
Cigarette Tax	0.003	0.008	0.004	0.002
	(.008)	(.006)	(.010)	(.009)
Other Tax	-0.006	-0.002	-0.004	-0.006
	(.002)	(.001)	(.001)	(.004)
Predicted Smoking	0.082	0.072	0.067	0.059
	(.048)	(.044)	(.041)	(.034)
Predicted Smoking*Cigarette Tax	**-0.045**	**-0.047**	**-0.048**	**-0.049**
	(.020)	**(.021)**	**(.019)**	**(.020)**
Predicted Smoking*OtherTax	**0.001**	**0.002**	**0.004**	**0.009**
	(.002)	**(.001)**	**(.001)**	**(.007)**
Demographic Controls	Yes	Yes	Yes	Yes
State Dummies	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes

Notes: The depent vaiable in each column is a dummy for unhappiness. "Other Tax" refers to a different tax in each column. It refers to a beer or alcohol tax in column (1), gas tax in column (2), sales tax in column (3) and Total state/province revenues in column (4).

- **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

5.4 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 of job search 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

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

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

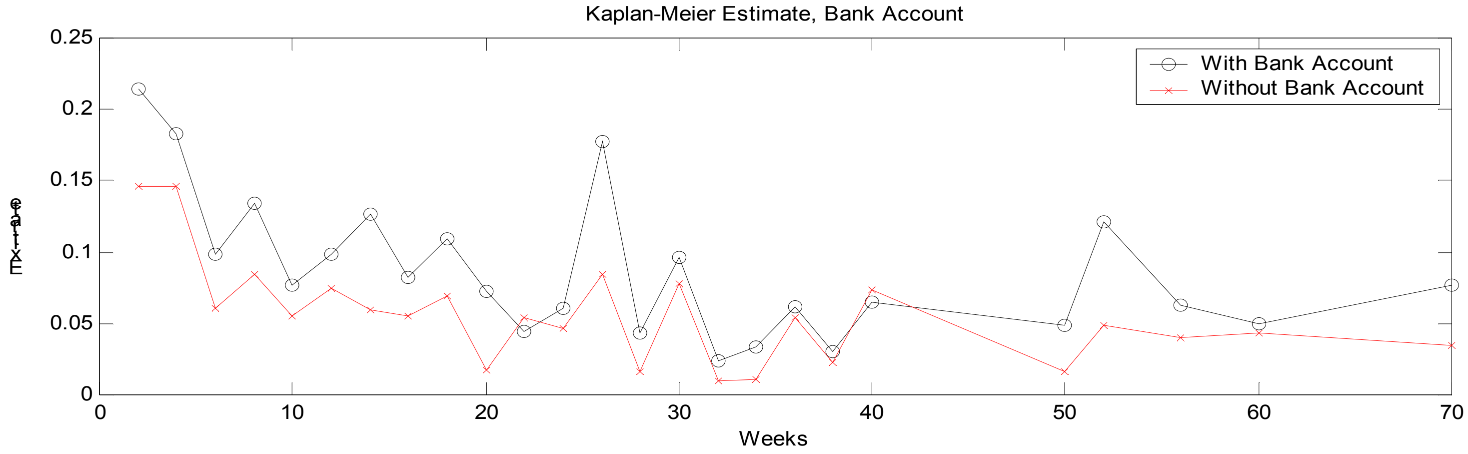
  - Impatience $\uparrow \Longrightarrow$ reservation wage $\longleftrightarrow$

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

- Impatience captures variation in β

- Sophisticated or naive – does not matter

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



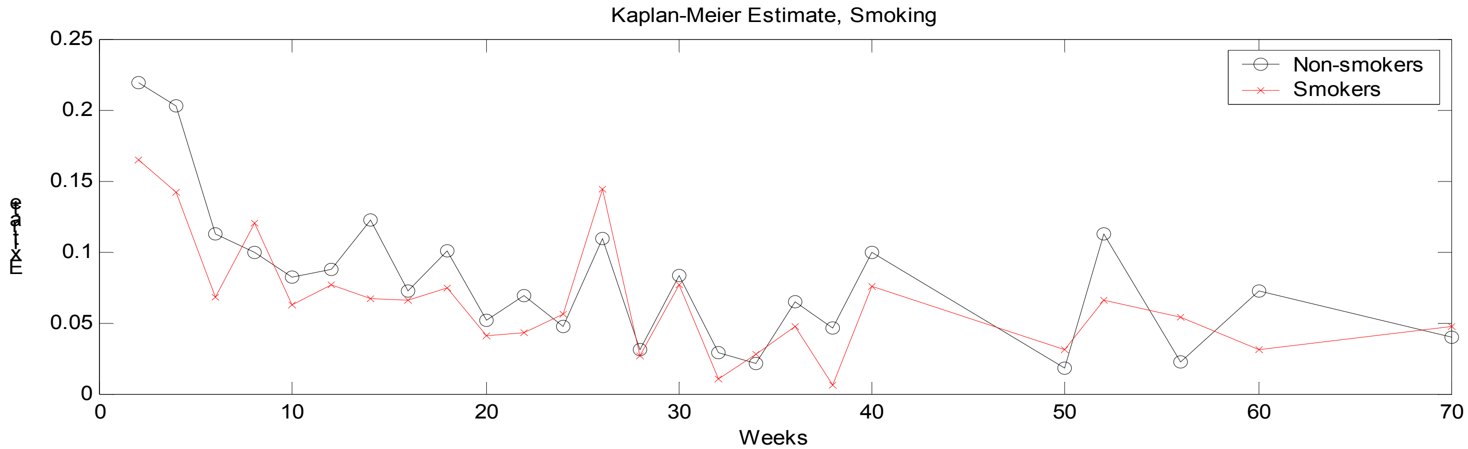


FIGURE 2: Exit Rates in the PSID

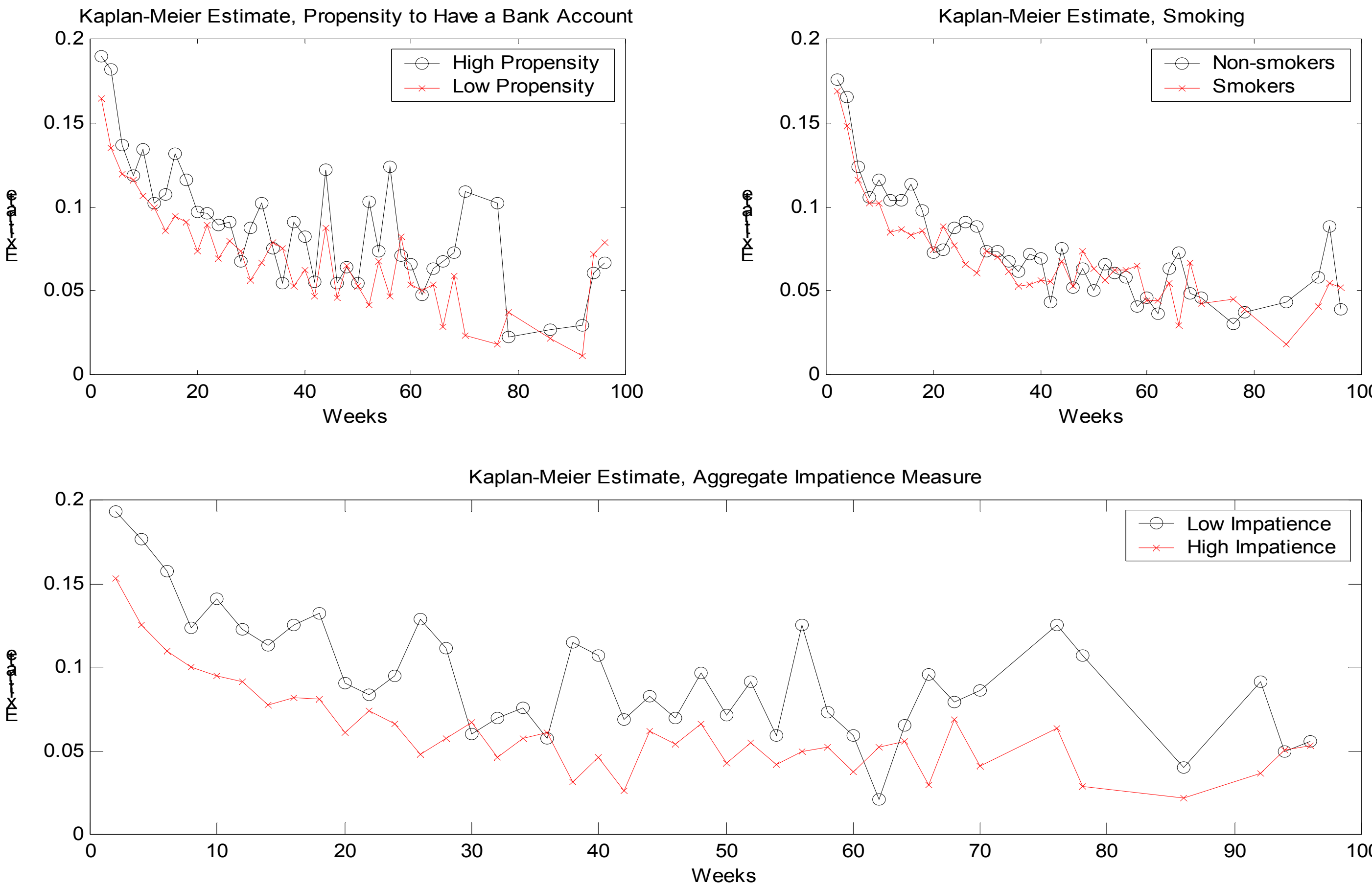


Figure 3: Exit Rates in the NLSY

Table 4: Benchmark Models †

	NLSY Sample	
	(1)	(2)
Controls	No	Yes
Aggregate Impatience Measure	-0.1501** (.0159) [5664]	-0.089** (.0177) [5664]
1. NLSY Assessment of Impatience Measure of impatience during Interview	-0.0552** (.0138) [8778]	-0.0431** (.0135) [8778]
2. Bank Account Did not have a bank account	-0.135** (.0131) [8532]	-0.0793** (.0141) [8532]
3. Contraceptive Use Had unprotected sex	-0.0827** (.0141) [6696]	-0.0243 (.0148) [6696]
4. Life Insurance Did not have life insurance At job	-0.0456** (.0146) [7671]	-0.0131 (.0150) [7671]
5. Smoking Smoked before Unemployment spells	-0.0484** (.0136) [8594]	-0.0294** (.0136) [8594]
6. Alcohol Average number of hangovers In past 30 days	-0.0044 (.0140) [8764]	-0.0115 (.0140) [8764]
7. Vocational Clubs Measure of non-participation In vocational clubs in HS	-0.0438** (.0130) [8400]	-0.0320** (.0126) [8400]
	PSID Sample	
Controls	No	Yes
1. Bank Account [1] Did not have a checking account	-0.1974** (.0336) [1426]	-0.1622** (.0383) [1409]
2. Smoking Smoked before Unemployment spells	-0.1149** (.0283) [1649]	-0.0964** (.0288) [1639]

† **Notes:** Entries in the table represent the coefficient on the relevant variable from *separate* Cox proportional hazard models. Robust standard errors in parentheses. Number of spells used in each regression is in brackets. Observations with missing values for any of the control variables were discarded. All measures of impatience are standardized (see Notes to Table 3). All the impatience variables (with one exception specified below) are measured prior to the occurrence of the unemployment spells. The aggregate impatience measure is constructed using factor analysis (see Appendix for details).

Control Variables in the NLSY: age, education, marital status, race, dummy for kids, self-reported health status, AFQT score, father's occupation/presence (4 dummies), parental education, received magazines while growing up, received papers, had a library card, urban dummy, SMSA dummy, central city dummy, local unemployment rate (5 dummies), dummy for receipt of UI benefits, region (3 dummies), 8 occupation dummies, 12 industry dummies, log (hourly wage) before unemployment spell, tenure on last job.

Control variables in the PSID: age, education, race, marital status, self-reported health in 1986 (2 dummies), father's occupation (2 dummies), parental education (2 dummies), county unemployment rate, dummy for receipt of UI benefits, 7 industry dummies, 4 occupation dummies, log (hourly wage) before the unemployment spell.

[1] The bank account proxy in the PSID is measured after the occurrence of the spells.

5.5 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

Table 2: Transition Matrix, Never-married Women with at Least One Child

	Choice (t)		
Choice (t-1)	Welfare	Work	Home
Welfare			
Row %	84.3	3.5	12.3
Column %	76.7	6.3	17.9
Work			
Row %	5.3	79.3	15.3
Column %	2.6	76.4	12.1
Home			
Row %	28.3	12.0	59.7
Column %	20.7	17.3	70.0

of those who chose welfare in period t, 76.7% had chosen welfare in the previous period. Of those who chose work in period $t-1$, 79.3% went on to choose it again in period t. Decisions to remain at home are considerably less persistent. Of those who chose to stay home in period $t-1$, 59.7% chose it again in period t.

6 Results

6.1 Estimates of Θ'

The parameters of the government benefits and fertility functions (Θ'), estimated in the first stage, are presented in Tables 9 and 12 of the appendix, respectively. As has been often noted, there is considerable variation in benefits levels across states. In our sample, the estimated average annual benefit for a mother with two children ranges from $4,856 (1987 dollars) to $9,490. Patterns of welfare participation vary with the level of benefits in ways consistent with optimizing behavior. In our sample, residents of the 5 states with the highest benefits spend 56 percent of the period observed on welfare; in the 5 states with the lowest benefits the participation rate is 37 percent.

The estimate of the fertility function's parameters suggests that the probability of an additional birth is decreasing with age and with the number of children. The estimate also indicates that, relative to those who stay home, the probability of an additional birth is lower for workers and higher for those on welfare. We note, however, that our simple exogenous model of subsequent valid in this more realistic model, and that in practice the two discount parameters are separately identified with reasonable precision.

6.3 Parameter Estimates and Simulations

Table 4 presents estimates of the parameters of the model under the assumption that agents are naive. Estimation of the model with sophisticated agents remains in progress. The estimated present-bias factor $\beta = 0.61$ and the estimated standard discount factor $\delta = 0.92$ together imply a one-year ahead discount rate of 78%. Inferential studies such as Hausman (1979), and Warner and Pleeter (2001) estimate (one-year ahead) discount rates ranging from 0 to 89% depending on the characteristics of the individual and intertemporal trade-offs at stake. Experimental studies have estimated this figure to be approximately 40% in an average population.

Table 4: Parameter Estimates, Naïve Agents

		parameter	point estimate	std. error
utility parameters	time discounts	β	0.61	0.33
		δ	0.92	0.05
	net stigma	ϕ	4046.74	1123.81
	home production	e_0	3953.13	545.79
		e_1	370.55	150.52
		e_2	-148.1	56.09
		η	5101.51	522.17
wage & skill parameters	constant	ln(r) + ha0	8.22	0.15
	yrs. of school	α_1	0.037	0.012
	experience	α_2	0.115	0.016
	experience^2	α_3	-0.0064	0.001
	1st yr. exper.	α_4	0.086	0.041
	exper. decay	α_5	0.191	0.091
continuation values	no. children	ω_1	510.04	479.97
	no. children^2	ω_2	-6143.43	1294.87
	experience	ω_3	29.03	43.36
	experience^2	ω_4	107.39	38.16
	welfare lag	ω_5	-5325.95	4066.26
	work lag	ω_6	1147.05	1256.76
variance/ covariance	std. dev. ε_0	$\sigma_{\varepsilon 0}$	3174.12	901.47
	std. dev. ε_1	$\sigma_{\varepsilon 1}$	0.342	0.099
	std. dev. ε_2	$\sigma_{\varepsilon 2}$	5050.12	909.82
	cov(ε_0,ε_2)	$\sigma_{\varepsilon 0 \varepsilon 2}$	-2550.08	674.2
	std. dev. meas err.	σ_{me}	0.272	0.12

N=4487 log likelihood = -3821.45

5.6 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, 2003)

- See later Section on Firm Response

5.7 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

- **F.** Next lecture