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

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Outline

1. Status-Quo: Alternative Explanations
2. Health-Club Industry
3. Credit Card Industry
4. Deadlines and Task Completion
5. Seven Application of Present Bias

1 Status-Quo: Alternative explanations

1. Super-Rational stories

   (a) Time effect between 1998 and 1999

   - compare Window and New cohort
   - BUT: No time effect

   (b) Change is endogenous (political economy)

   - trends before and after
   - other changes? No.

(c) Cost of choosing plan is very high

- HR staff very unfriendly
- Switch investment elsewhere (no net effect on savings)

(d) Selection effect

- People choose this firm because they know of commitment device for 401(k)
- Or choose because 401(k) available right away rather than after 1 year.
- BUT: Why choose a firm, though, with default at 3%?

2. Bounded Rationality: Problem is too hard

- Individual cannot solve problem

- Estimated benefits b small

- BUT: In surveys employees say they would like to save more

- Would be nice to measure losses more directly (health club data)

3. Persuasion

   (a) Implicit suggestion of firm

   (b) Conformity

- BUT: Why should individuals trust firms?

- BUT: Window cohort should resemble New cohort

- Window cohort instead is like Old cohort, except for riskyness of investment

4. Memory

- Individuals forget that they should invest

- BUT: If individuals are aware of this, they should absolutely invest before they forget!

- Need limited memory + naiveté

5. Reference point and loss aversion relative to firm-chosen status-quo

   - First couple month people get used to current consumption level

   - Under NonAut., employees unwilling to cut consumption

   - BUT: Why wait for couple of months to chose?

   - BUT: Forward-looking individuals do not want to raise reference point today

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

$\Rightarrow$ 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)

$\Rightarrow$ 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	controls + time dummies
	(1)	(2)
Dummy for enrollment with monthly contract	0.0318	0.0514
	(0.0217)	(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:

Attend at $t \iff \beta\delta^t(-p - c_t + \delta h) > 0$

$$\iff c_t < \delta h - p.$$

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

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 $t \geq 1$:

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

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

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

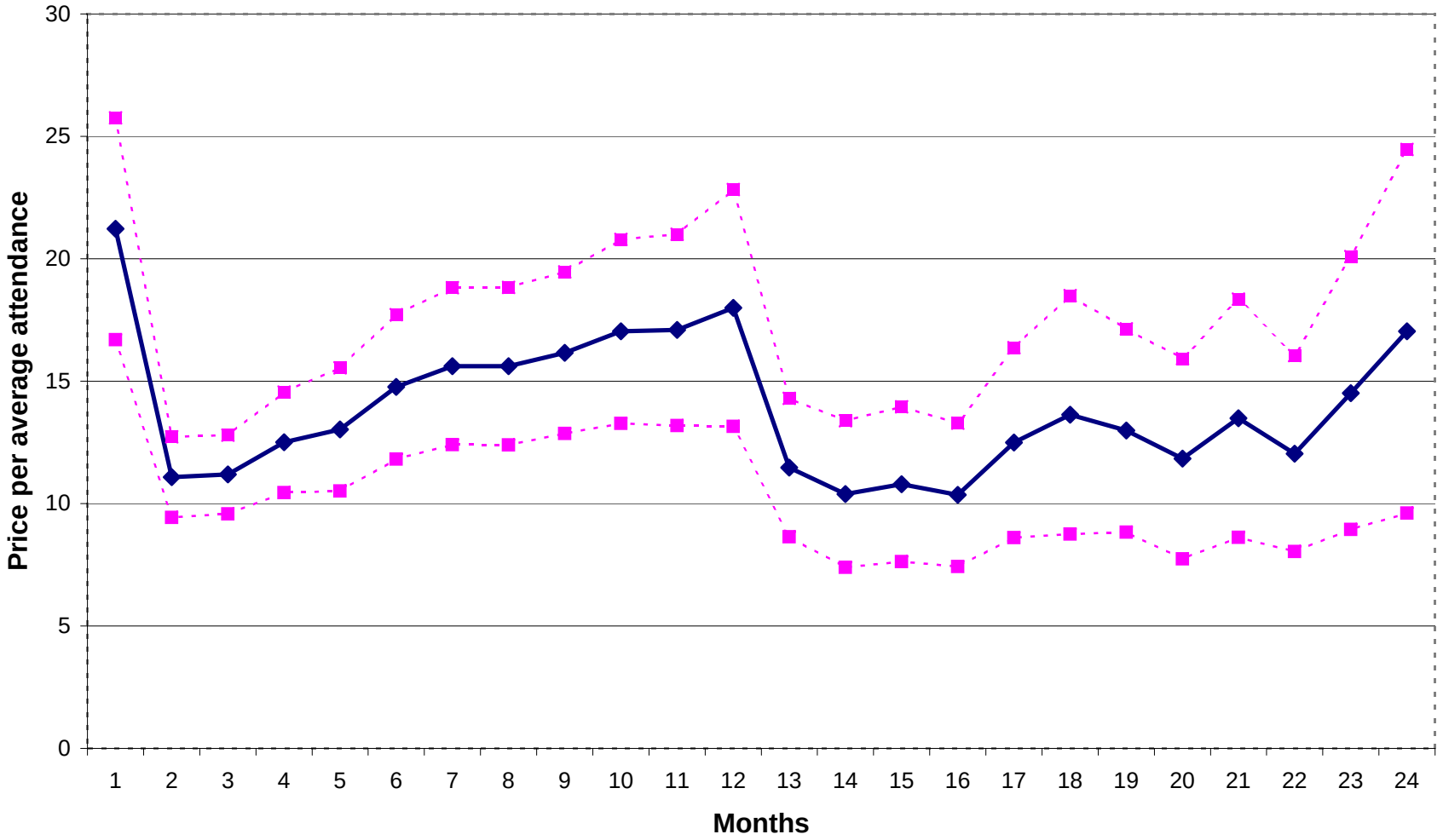


Figure 4. Price per average attendance.
Monthly contracts with monthly fee>= $70.

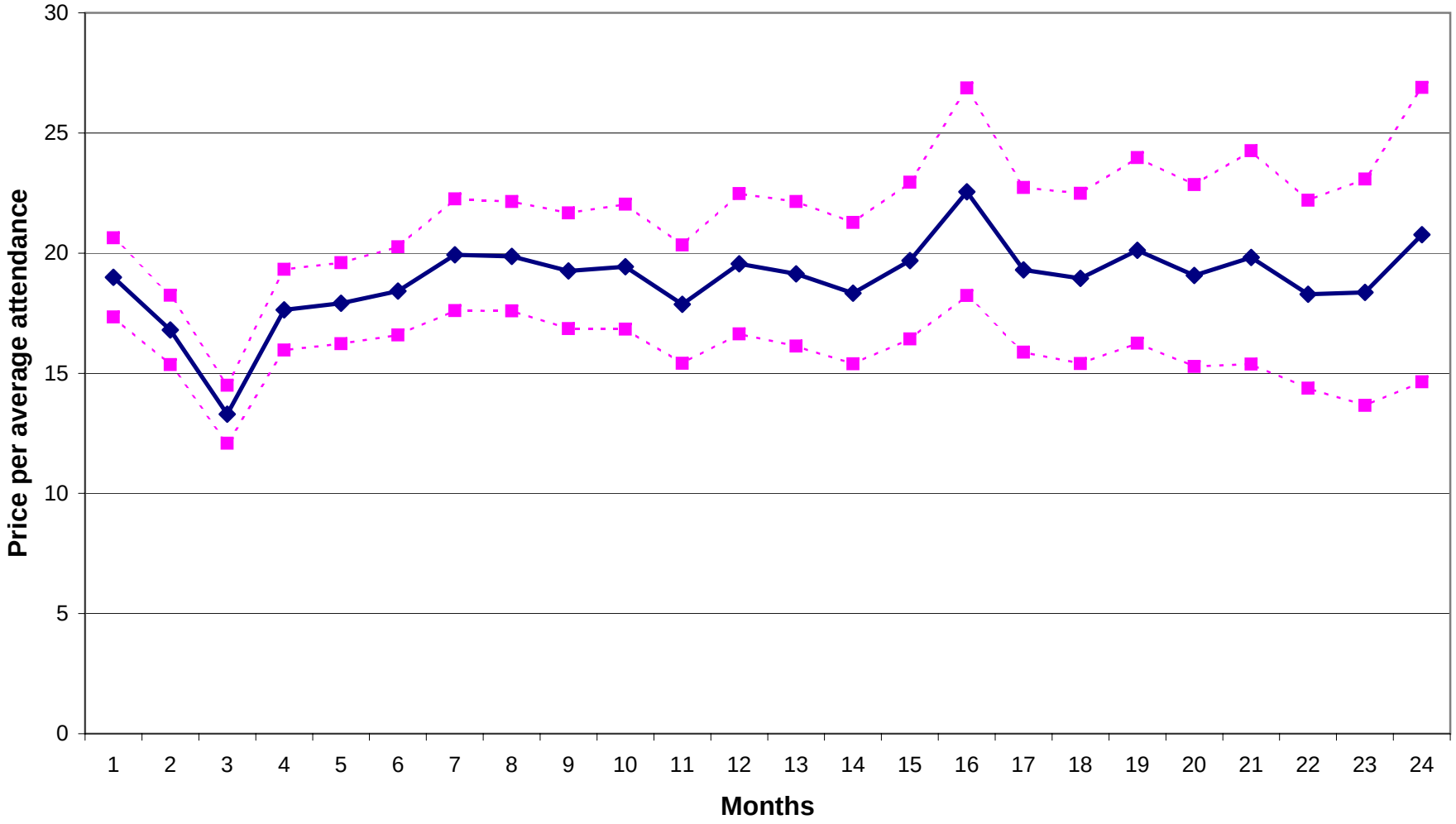


Table 1: Stylized Facts and Explanations

	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			

3 Credit card industry

- Ausubel, “Adverse Selection in Credit Card Market"
- Joint-venture company-researcher
- Randomized mailing of two million solicitations!
- Follow borrowing behavior for 21 months
- Variation of:
  - pre-teaser interest rate r_0: 4.9% to 7.9%
  - post-teaser interest rate r_1: Standard - 4% to Standard $+4\%$
  - Duration of teaser period T_s (measured in years)

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
MKT EXP I	E: 6.9% Intro Rate 9 months	100,000	0.992%	81.15%	$6,279
MKT EXP I	F: 7.9% Intro Rate 12 months	100,000	0.944%	82.31%	$6,296
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 II	D: 6.9% Intro Rate 12 months	72,432	0.936%	77.73%	$5,368
MKT EXP II	E: 7.9% Intro Rate 6 months	379,448	0.456%	65.82%	$4,540
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%	76.87%	$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

- Credit card offers: (r_0, r_1, T_s)
- Balances: b_0 pre-teaser, b_1 post-teaser
- Individual has initial credit card (r_0^0, r_1^0, T_s^0)
- Decision to take-up new credit card:
  - switching cost $k > 0$
  - approx. saving in pre-teaser interest rates (T_s years): $b_0 = T_s \left(r_0^0 - r_0\right) b_0$
  - approx. saving in post-teaser interest rates ($2 - T_s$ years): $b_1 = (2 - T_s) \left(r_1^0 - r_1\right) b_1$
- Net benefit of switching:

$$NB = -k + T_s \left(r_0^0 - r_0\right) b_0 + (2 - T_s) \left(r_1^0 - r_1\right) b_1$$

- Compare cards A and B that differ only in interest rates r_0^A and r_0^B
- Assume $b_0^A = b_0^B = b_0$
- Difference in attractiveness:

$$NB^B - NB^A = T_s \left(r_0^A - r_0^B \right) b_0$$

- Compare cards A and C that differ only in interest rates r_1^A and r_1^C
- Assume $b_1^A = b_1^C = b_1$
- Difference in attractiveness:

$$NB^C - NB^A = (2 - T_s) \left(r_1^A - r_1^C \right) b_1$$

- Compute $NB^C - NB^A$ and $NB^B - NB^A$ using $\hat{b}_0$, $\hat{b}_1$, r_0, r_1

- Switch if $NB + \varepsilon > 0$

- Take-up rate R is function of attractiveness NB:

$$R = R\left(NB\right),\ R' > 0$$

- Assume R (approximately) linear in a neighbourhood of NB^A, that is,

$$R\left(NB\right) = R\left(NB^A\right) - \alpha\left(NB - NB^A\right),$$

with $\alpha = \partial R / \partial NB$

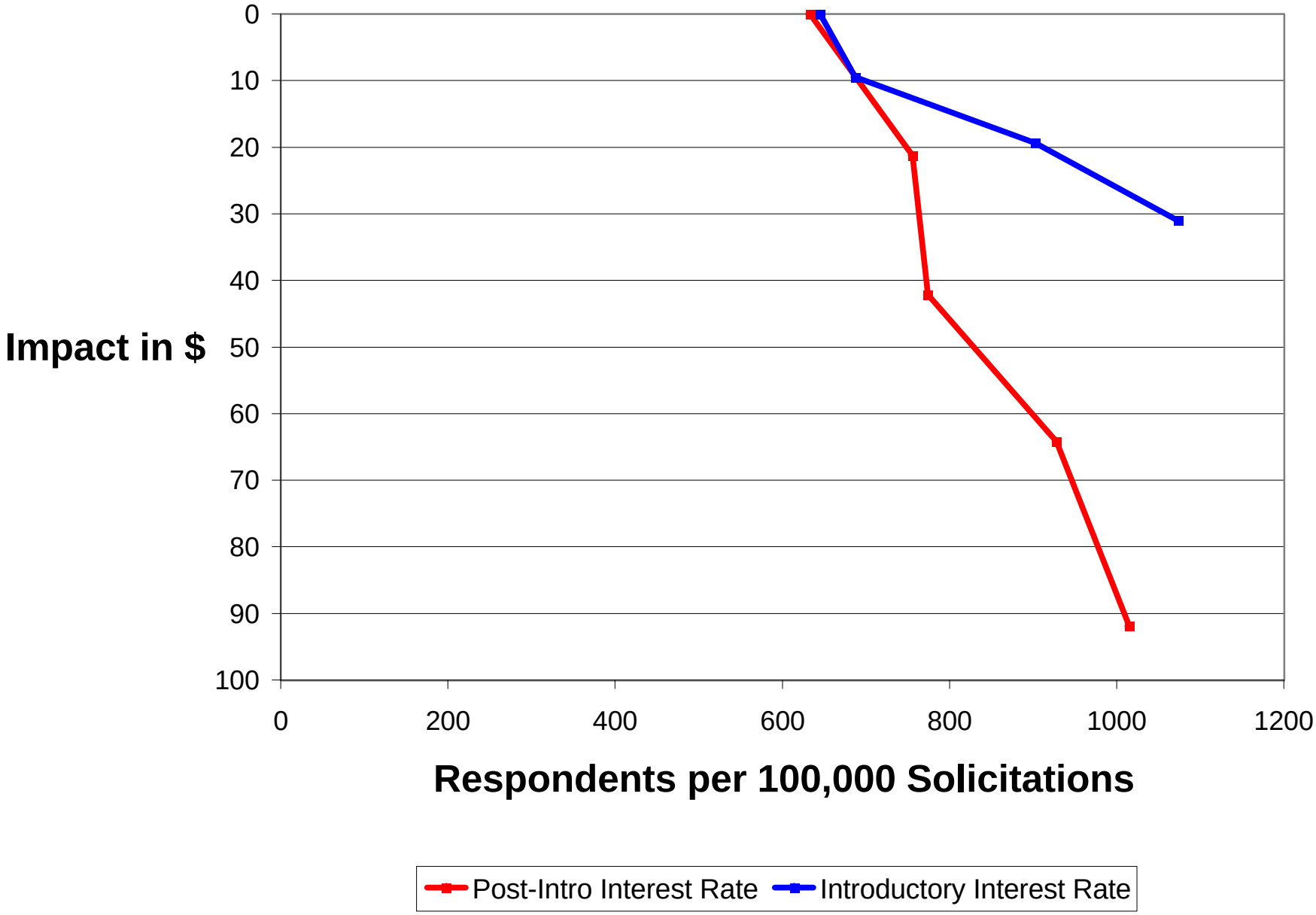
- Plot NB and R for different offers

- Slope of line should be the same for changes in pre-teaser and post-teaser interest rate

- Figure 1. Compare credit card offers varying in r_0 (flat line) and in r_1 (steep line)

- Very different slope!

- Figure 2. Vary length of teaser period. Similar findings.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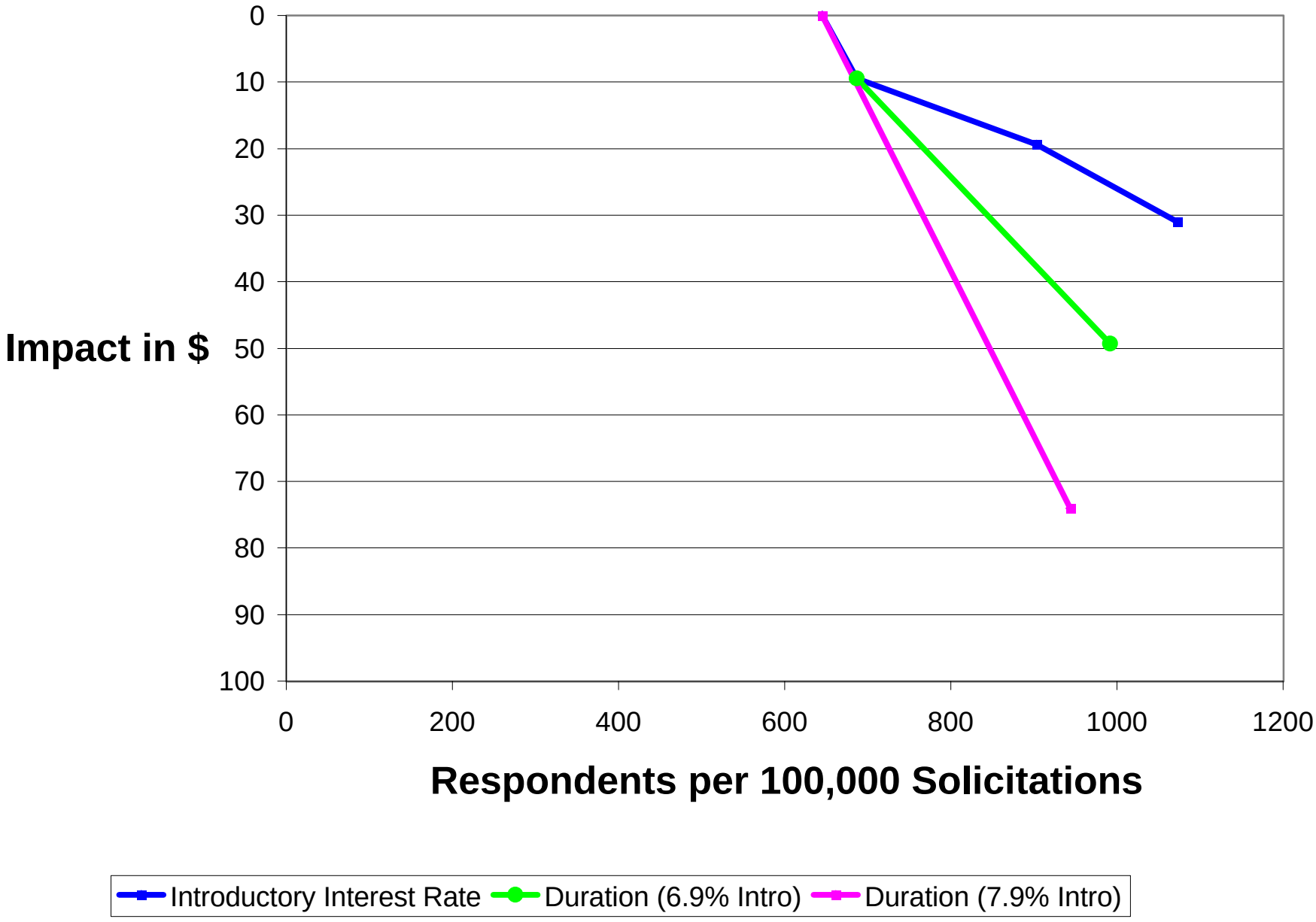
Respondents per 100,000 Solicitations
Post-Intro Interest Rate
Introductory Interest Rate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Respondents per 100,000 Solicitations
Introductory Interest Rate
Duration (6.9% Intro)
Duration (7.9% Intro)

- **Figure 1. Variation in r_0 and r_1**

- People underrespond to post-teaser interest rate.

- Why?
  - truncation at 21 months?
  - (very) high impatience?
  - sophistication?
  - most plausible: naiveté

- Naive time-inconsistent preferences

- Naives overestimate switching to another card (procrastination)

- Naives underestimate post-teaser borrowing: $b_1 > \hat{b}_1$ and $b_0 = \hat{b}_0$

- Compare cards:

$$NB^B - NB^A = T_s \left(r_0^A - r_0^B \right) b_0$$

and

$$NB^C - NB^A = (2 - T_s) \left(r_1^A - r_1^C \right) \hat{b}_1$$

- Underestimate impact of post-teaser interest rates

- Calibration: $\hat{b}_1 \approx (1/3)\, b_1$

- **Figure 2. Variation in T_s**

- Naive agent overestimates probability of switching to another teaser offerfs

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: $A > C > B$