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

Stefano DellaVigna

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Outline

1. Investment Goods: Work Effort
2. Leisure Goods: Credit Card Borrowing
3. Leisure Goods: Consumption and Savings
4. Leisure Goods: Commitment and Savings
5. Leisure Goods: Drinking
6. Methodology: Commitment Field Experiments
7. Laboratory Experiments on Present Bias
8. Methodology: Errors in Applying Present-Biased Preferences
9. (Additional Applications of Present Bias)

1 Investment Goods: Work Effort

- Kaur, Kremer, and Mullainathan, "Self-Control at Work" *JPE* 2015
- Setting: workers in India who are paid a piece rate w in a weekly paycheck
- Since effort at work is immediate and benefits delayed, effort at work is an investment good
- $\left(\beta, \hat{\beta}, \delta\right)$ model, with $\delta = 1$
- Consider effort at work e, which costs $-c\left(e\right)$, with $c' > 0$, $c'' > 0$
- Assume for special case $c\left(e\right) = \gamma e^2/2$
- Two states:

- high output y_H with probability e –> pay w_H
- low output y_L with probability $1 - e$ –> pay w_L
- Notice: this is only local approximation, for $e \in [0, 1]$

- Pay at $t = 2$

- If working at $t = 1$, maximize

$$\max_{e_1} \beta \left[e_1 w_H + (1 - e_1) w_L \right] - c(e_1)$$

  - f.o.c.

$$\beta \left[w_H - w_L \right] - c'(e_1^*) = 0$$

  - Effort e_1^* increases in $w_H - w_L$ and in β

- Special case:

$$e_1^* = \frac{\beta\left[w_H - w_L\right]}{\gamma}$$

- If working at $t = 2$ (same period as paydate), optimal effort e_2^* solves

$$\max_{e_2}\left[e_2 w_H + (1 - e_2)\, w_L\right] - c\left(e_2\right)$$

and thus (for the special case)

$$e_2^* = \frac{w_H - w_L}{\gamma}$$

- **Prediction 1.** Effort is higher near payday for $\beta < 1$ (independent of $\hat{\beta}$)

- From $t = 0$ perspective, (perceived) utility V_0 from working at $t = 1$ is

$$V_0 = e_1^* w_H + (1 - e_1^*)\, w_L - c\left(e_1^*\right)$$

- Effect of altering w_L on $t = 0$ (expected) welfare V_0 is

$$\begin{aligned}\frac{dV_0}{dw_L} &= (1 - e_1^*) + \frac{de_1^*}{dw_L}\left[[w_H - w_L] - c'(e_1^*)\right] = \\ &= (1 - e_1^*) + \frac{de_1^*}{dw_L}\left[\left(1 - \hat{\beta}\right)[w_H - w_L]\right]\end{aligned}$$

- First term is direct effect on pay: lowering w_L lowers pay and thus welfare
- The second term is the effect on incentive, which is zero for $\beta = \hat{\beta} = 1$, by the envelope theorem – but envelope theorem does not apply for $\hat{\beta} < 1$. Indeed, second term is negative
- Notice that it is $\hat{\beta}$ which matters, since this is the value function from the $t = 0$ perspective

- Special case for $\hat{\beta} = \beta$:

$$\frac{dV_0}{dw_L} = 1 - \frac{\beta\left[w_H - w_L\right]}{\gamma} - \frac{\beta\left(1-\beta\right)\left[w_H - w_L\right]}{\gamma}$$

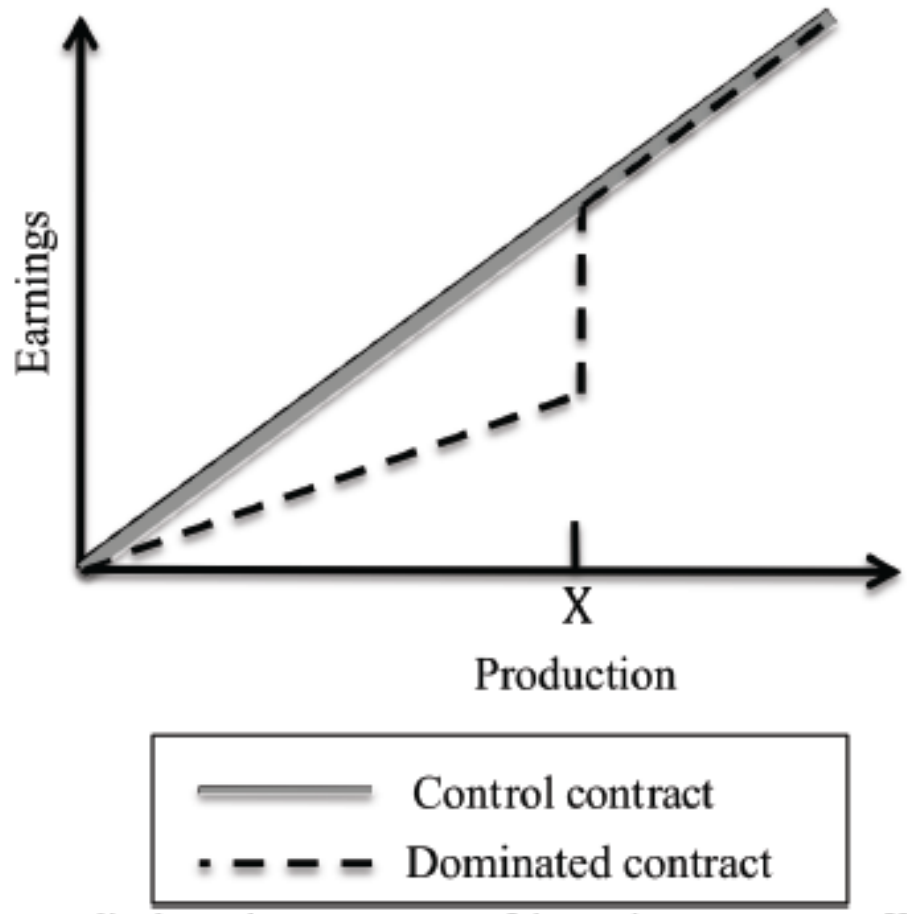
- Second term becomes large as β goes below 1 and is highest at $\beta = 1/2$
- If large enough, individual wants commitment device, prefers w_L low

- **Prediction 2.** Individual with $\beta < 1$ may prefer commitment device (low w_L)

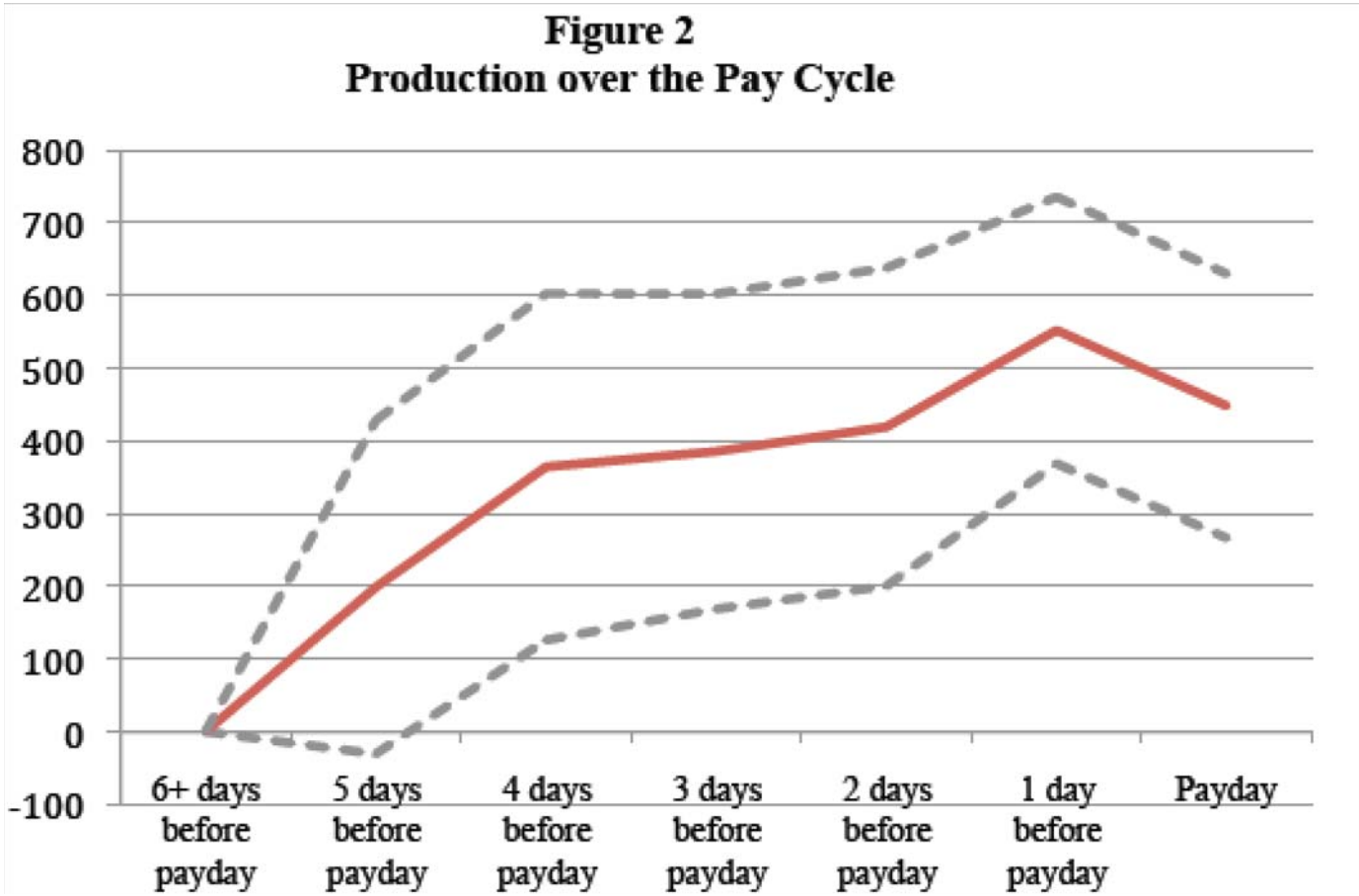
- **Prediction 3.** If there are both types with $\beta = 1$ and $\beta < 1$, demand for commitment should be associated with a payday cycle

- Field experiment in India
  - Randomization of pay date (Tu, Th, Sa) to test proposition 1 unconfounded with day-of-week effects
  - Randomization of availability of commitment device: get paid $w/2$ instead of w if miss production target
  - Randomization of whether choice is made evening before, or morning of

Figure 1
Incentive Contracts



- **Prediction 1.** Evidence of pay cycle in effort



- **Prediction 2.** Quite significant take-up of commitment contract

Figure 3
Take-up of Dominated Contracts: Distribution of Worker Means

Table 4
Treatment Effects of Contract Assignment on Worker Production

	Dependent variable: Production				*Dependent variable: Attendance*			
Observations	All obs	All obs	Control & Choice	Control & Choice	All obs	All obs	Control & Choice	Control & Choice
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Assignment to choice	111		120		0.007		0.007	
	(59)*		(59)**		(0.009)		(0.009)	
Assignment to evening choice		150		156		0.01		0.014
		(69)**		(69)**		(0.01)		(0.010)
Assignment to morning choice		73		84		-0.00		0.001
		(69)		(69)		(0.01)		(0.010)
Assignment to low target	3	3			-0.002	-0.00		
	(90)	(90)			(0.013)	(0.01)		
Assignment to medium target	213	213			-0.006	-0.01		
	(91)**	(91)**			(0.013)	(0.01)		
Assignment to high target	335	334			-0.005	-0.01		
	(150)**	(150)**			(0.019)	(0.02)		
Worker fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Seat fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Date fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lag production controls	Yes	Yes	Yes	Yes	No	No	No	No
Observations	8423	8423	6310	6310	8423	8423	6310	6310
R2	0.59	0.59	0.60	0.60	0.15	0.15	0.11	0.11
Dependent variable mean	5337	5337	5311	5311	0.88	0.88	0.88	0.88
Proportion choosing a positive target (conditional on attendance)	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Proportion choosing a positive target (target=0 when absent)	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28

- **Prediction 3.** Correlation between payday effect and take-up of commitment, as well as with productivity effect

Table 5
Heterogeneity in Take-up of Dominated Contracts: Correlation with Payday Impact

Dependent variable	*Target level chosen*	*Positive target indicator*
	(1)	(2)
High payday production impact	353	0.138
	(129)***	(0.044)***
Seat fixed effects	Yes	Yes
Date fixed effects	Yes	Yes
Lag production controls	Yes	Yes
Observations	4098	4098
R2	0.22	0.20
Dependent variable mean	759	0.28

Table 6

Heterogeneity in Contract Treatment Effects: Correlation with Payday Impact

Dependent variable	*Production*	*Production*	*Production*	*Attendance*	*Attendance*	*Attendance*
	(1)	(2)	(3)	(4)	(5)	(6)
Assignment to choice	118	-69	-146	0.007	-0.016	-0.028
	(60)*	(74)	(84)*	(0.009)	(0.010)	(0.011)**
Assignment to choice *		482	735		0.058	0.091
High payday production impact		(126)***	(144)***		(0.019)***	(0.022)***
Assignment to choice *			401			0.064
Payday			(179)**			(0.024)***
Assignment to choice * Payday *			-1314			-0.178
High payday production impact			(288)***			(0.041)***
Assignment to a target	153	-35	-48	-0.003	-0.019	-0.024
	(71)**	(86)	(96)	(0.010)	(0.012)*	(0.013)*
Assignment to a target *		483	673		0.042	0.066
High payday production impact		(148)***	(168)***		(0.022)*	(0.025)***
Assignment to a target *			68			0.026
Payday			(219)			(0.029)
Assignment to target * Payday *			-972			-0.120
High payday production impact			(348)***			(0.049)***
Payday			-183			-0.009
			(153)			(0.021)
High payday impact *			1178			0.164
Payday			(234)***			(0.032)***
Worker fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Seat fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Date fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Lag production controls	Yes	Yes	Yes	No	No	No
Observations	8240	8240	8240	8240	8240	8240
R2	0.60	0.59	0.59	0.11	0.11	0.11
Dependent variable mean	5355	5355	5355	0.875	0.875	0.875

- Evidence very consistent with model of self-control problems and (at least partial) sophistication
- Discount factor is not $\beta - \delta$, but smoother decay (true hyperbolic)
- Significant demand of commitment device – different than some of other settings, see later
- Correlation with underlying measure of self-control
- Great evidence in important setting

2 Leisure Goods: Credit Card Borrowing

- Ausubel, “Adverse Selection in Credit Card Market"
- Joint-venture company-researcher
- Field Experiment: 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)

- Part of the randomization – Incredible sample sizes. How much would this cost to run? Millions

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

- Another set of experiments:

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

- Setting:
  - Individual has initial credit card (r_0^0, r_1^0, T_s^0). Balances: b_0 pre-teaser, b_1 post-teaser
  - Credit card offers: (r_0', r_1', T_s')
- Decision to take-up new credit card:
  - switching cost $k > 0$
  - approx. saving in pre-teaser rates (T_s years): $T_s \left(r_0' - r_0^0\right) b_0$
  - approx. saving in post-teaser rates ($21/12 - T_s$ years): $(21/12 - T_s)\,(r_1^{'} - r_1) b_1$
- Net benefit of switching:

$$NB' = -k + T_s \left(r_0^{'} - r_0^0\right) b_0 + (21/12 - T_s) \left(r_1^{'} - r_1^0\right) b_1$$

- Switch if $NB + \varepsilon > 0$

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

$$R = R(NB), \; R' > 0$$

- Compare take-up rate of card i, R^i, to take-up rate of Standard Card St, R^{St}
  - Standard Card (6.9% followed by 16%) (Card C above)

- Assume R (approximately) linear in a neighborhood of NB^{St}, that is,

$$R\left(NB^i\right) = R\left(NB^{St}\right) + R'_{NB}\left(NB^i - NB^{St}\right)$$

- Compare cards Pre and St that differ only in interest rate r_0 (pre-teaser)
- Assume $b_0^{Pre} = b_0^{St} = b_0$ (Pre-teaser balance) $\approx \$2,000$
- Difference in attractiveness:

$$R\left(NB^{Pre}\right) - R\left(NB^{St}\right) = R'_{NB} T_s \left(r_0^{Pre} - r_0^{St}\right) b_0$$

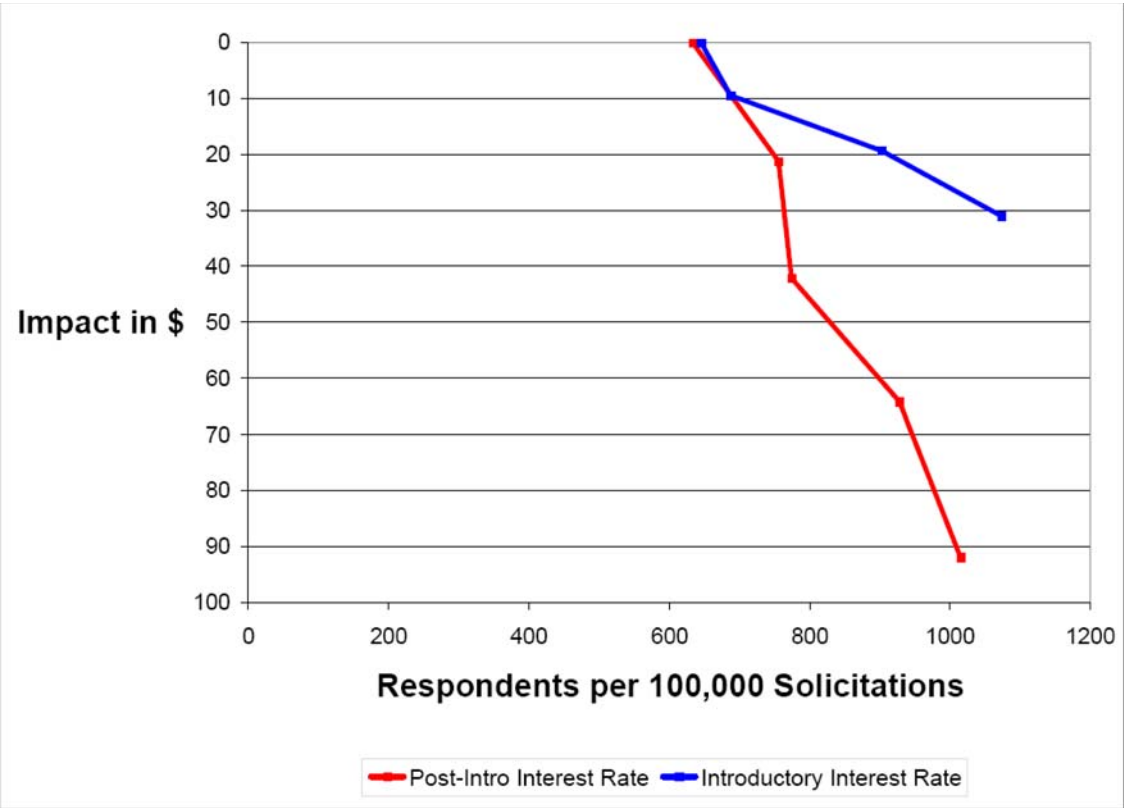
  - Pre-Teaser Offer (Card A): (4.9% followed by 16%)
    - $NB^{Pre} - NB^{St} \approx 6/12 * 2\% * \$2,000 = \$20$
    - $R\left(NB^{Pre}\right) - R\left(NB^{St}\right) =$ 386 out of 100,000

- Compare cards $Post$ and St that differ only in interest rate r_1 (post-teaser)
- Assume $b_1^{Post} = b_1^{St} = b_1$ (Post-teaser balance) $\approx \$1,000$
- Difference in attractiveness:

$$R(NB^{Post}) - R(NB^{St}) = R'_{NB}\,(21/12 - T_s)\left(r_1^{Post} - r_1^{St}\right) b_1$$

  - Post-Teaser Offer (Card B in Exp. III): (6.9% followed by 14%)
    - $NB^{Post} - NB^{St} \approx 15/12 * 2\% * \$1000 = \$25$
    - $R(NB^{Post}) - R(NB^{St}) =$ 154 out of 100,000
- Puzzle:
  - $NB^{Post} - NB^{St} > NB^{Pre} - NB^{St}$
  - But $R(NB^{Pre}) - R(NB^{St}) >> R(NB^{Post}) - R(NB^{St})$

- Plot NB and $R(NB)$ for different offers
- Compare offers varying in r_0 (flat line) and in r_1 (steep line)



- People underrespond to post-teaser interest rate.
- Most likely explanation: Present Bias + Naivete'
  - Naives overestimate switching to another card (procrastination)
  - –> Underestimate post-teaser borrowing: $\hat{b}_1 < b_1$ and $\hat{b}_0 = b_0$
- Compare cards:

$$NB^{Pre} - NB^{St} = T_s \left(r_0^{Pre} - r_0^{St} \right) b_0$$

and

$$\widehat{NB}^{Post} - \widehat{NB}^{St} = (21/12 - T_s) \left(r_1^{Post} - r_1^{St} \right) \hat{b}_1$$

- Calibration: $\hat{b}_1 \approx (1/3)\, b_1$ –> Underestimation of borrowing by a factor of 3

3 Leisure Goods: Consumption and Savings

- Laibson (1997) to Laibson, Repetto, and Tobacman (2007)
- Leisure Good: Temptation to overconsume at present
- Stylized facts:
  - Low liquid wealth accumulation
  - Extensive credit card borrowing (SCF, Fed, Gross and Souleles 2000)
  - Consumption-income excess comovement (Hall and Mishkin, 1982)
  - Substantial illiquid wealth (housing+401(k)s)

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).

- Reduced-form evidence here not sufficient
- Life-cycle consumption model (Gourinchas and Parker, 2004)
- Assume realistic features:
  - borrowing constraints
  - illiquid assets
  - bequests...

- Two steps of estimation: of MSM (Method of Simulated Moments)
  1. Estimate ('calibrate') auxiliary parameters
     - Interest rate
     - Mortality
     - Income shocks
  2. Estimate main parameters (β, δ) using Method of Simulated Moments
     - * Simulate model (cannot solve analytically)
     * Choose parameters $(\hat{\beta}, \hat{\delta})$ that minimize distance of simulated moments to estimated moments
     * Take into account uncertainty in estimates of 1st stage
- (David Laibson's Slides follow)

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)	(2)	(3)	(4)	(5)	(6)	(7)
	Benchmark	$\gamma = 3.38\%$	$\gamma = 6.59\%$	$r^{CC} = 10\%$	$r^{CC} = 13\%$	$\rho = 1$	$\rho = 3$
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

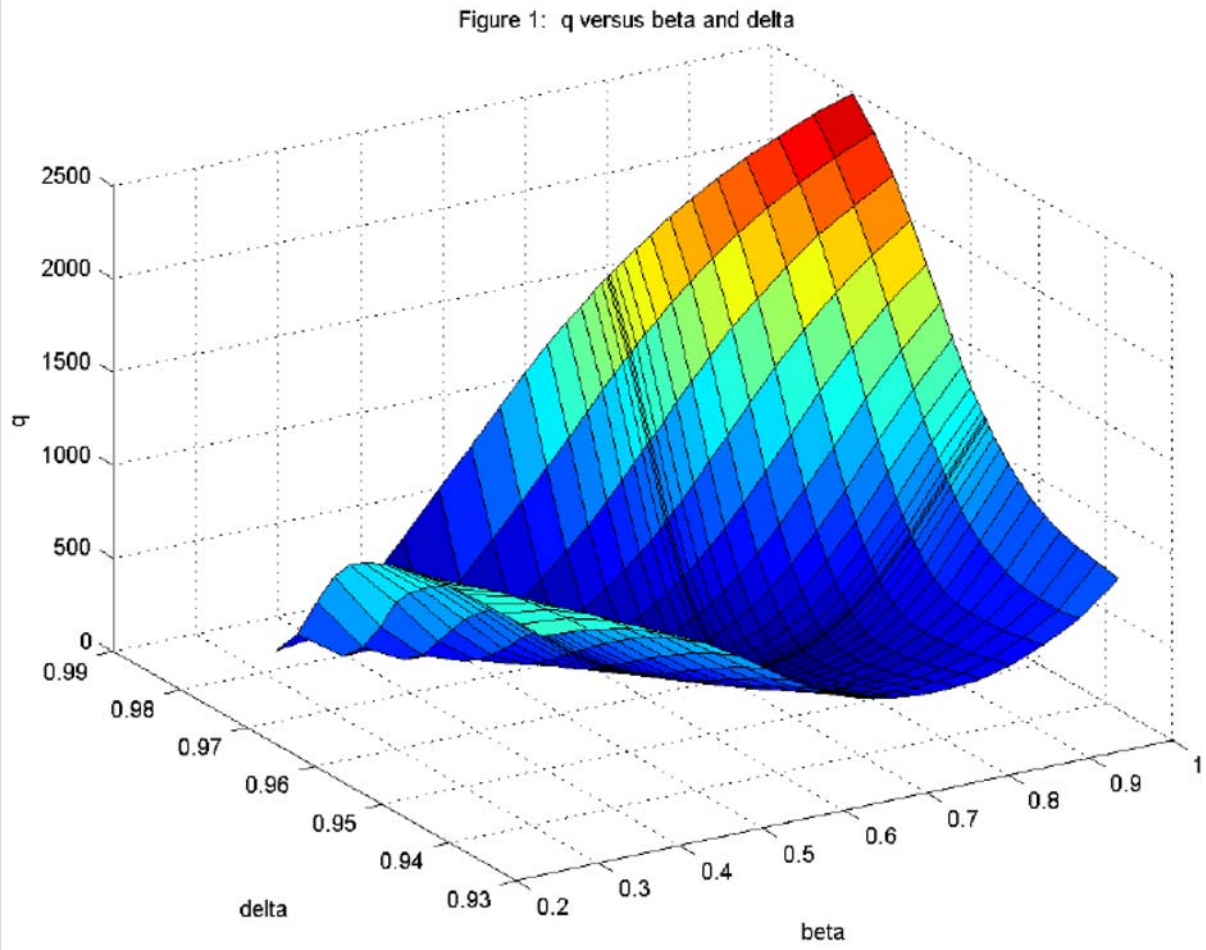


Figure 1: This figure plots the MSM objective function with respect to beta and delta under the paper's benchmark assumptions. The objective, q, equals a weighted sum of squared deviations of the empirical moments from the moments predicted by the model. Lower values of q represent a better fit of the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

4 Leisure Goods: Commitment and Savings

- Ashraf, Karlan, and Yin (2005), *QJE*
  - Different Methodology: Commitment Device 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)

- **Result 1. Take-up of commitment device** (in SEED Treatment):
  - Out of 842 treated people, 202 take up SEED –> Take up of 24%
  - 167 also got lock-up box (did not observe savings there)
- **Result 2. Effect of Availability of Commitment on Total Savings** (including funds in non-committed account)
  - Compare SEED to Marketing (Include all 842 people, Intent-to-Treat)
  - *Share of people with increased Balances*: 5.6 percentage (33.3 percent in SEED and 27.7 in Marketing)
  - *Share of people with increased Balances by at least 20 percent*: 6.4 percentage points
  - *Total Balances*: 287 Pesos after 6 months (not significant)
- 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.

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

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).

- **Result 3. Who takes up the Commitment device?**

- Correlate survey response with commitment take-up (see also Fehr-Goette paper)

- 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)

5 Leisure Goods: Drinking

- **Schilbach (2015):** Consider population with high levels of drinking while working
- Offer incentives to not drink during work hours
- Examine impact on
  - Drinking during work hours
  - Drinking after work hours
  - Earnings
  - Savings with (and without) savings commitment
- [Frank's slides follow]

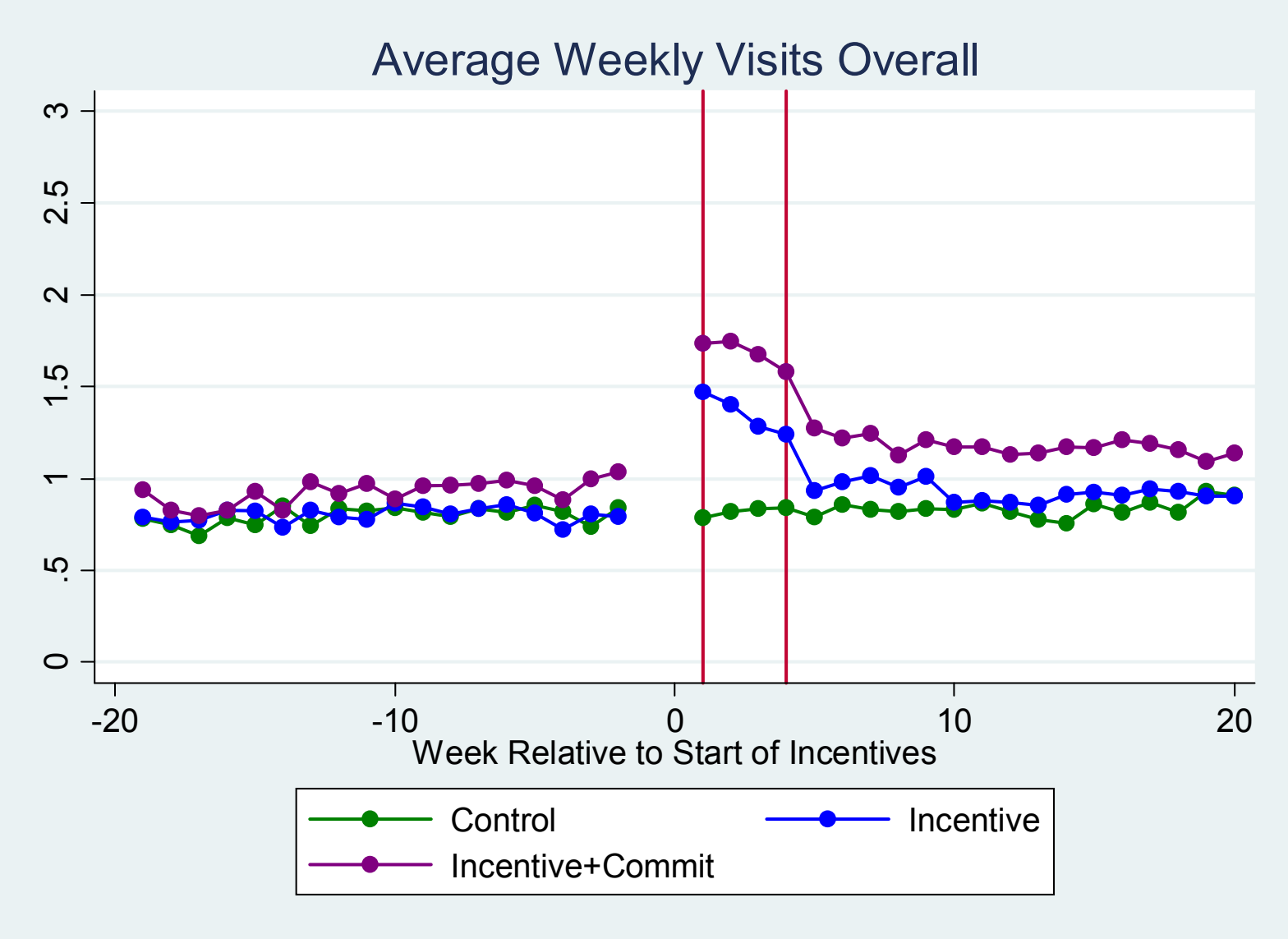
- Unique feature 1: Effect of commitment device on drinking on another patience-related activity: savings
  - How do we interpret the effect?
    - Effect on withdrawing – mechanical given drunkenness
    - Effect on deposits – sophistication?
  - Would be great to know if sobriety incentives increases or lowers demand for savings commitment device (not in design)
- Unique feature 2: Exceptional demand for commitment device by for drinking
  - 1/3 population even when very expensive
  - Other existing studies – Demand typically goes to near zero

6 Methodology: Commitment Field Experiments

- Growing literature on field experiments offering commitment devices
- Recipe for typical device:
  - Random assignment into Treatment (T) and Control (C)
  - Group T: Offered commitment option (action that imposes constraints)
  - Group C: No option
  - Observe take-up of commitment in T
  - Observe outcome (e.g., saving, smoking, eating) in C and T

- Three sets of results:
  1. **Take-up.** What share in T uses commitment device?
     - Standard agent would not choose additional constraints –> Smoking gun for time inconsistency
     - Time inconsistency can be from present bias+ sophistication
     - OR from hot/cold states or intra-family bargaining
  2. **Effect on outcome.** Compare outcomes in T and C
     - Notice: Compare *everybody* in T to *everybody* in C
     - Cannot focus on those that took up the commitment in T, since do not know who they compare to in C
     - Treatment on Treated: rescale by dividing by take-up (assumption of no effect on non-takers)
  3. **Who Takes Up?** Document who in T takes up commitment
     - Correlation with measured time preferences, previous behavior, etc.
     - This is not causal evidence, but still interesting

- **Representative studies: Investment Goods**
- *Homework Completion* (Ariely-Wertenbroch *PS*)
  - Deadlines are penalties for delivering homework late
  - Result 1. Very large take-up rate (65 percent)
  - Result 2. Large effect on quality of homework and delay (in exp. 2)
- *Health-club attendance* (Royer, Stehr, and Sydnor, *AEJ Applied* 2014)
  - First pay a treatment group to go to the gym
  - Then offer half of this treated group commitment device to keep going
  - Commitment device is deposit money into an account. money forfeited if do not attend at least once every 14 days for 4 months
  - Result 1: Low demand for commitment: 13% take-up, with average sum of $63
  - Result 2: Some effect on attendance


Average Weekly Visits Overall
0
.5
1
1.5
2
2.5
3
-20
-10
0
10
20
Week Relative to Start of Incentives
Control
Incentive
Incentive+Commit

- **Representative studies: Leisure Goods**
- *Consumption/Savings* (Ashraf-Karlan-Yin)
  - Result 1. Commitment device take-up 24%
  - Result 2. Significant effect on overall savings
- *Consumption/Savings* (Beshears, Choi, Laibson, Madrian, Mekong, 2011)
  - RAND panel respondents, 495 subjects, given $50, $100, or $500
  - Choice between
    - Liquid account (r=22% yearly)
    - Commitment account (set a goal) with r of 21%, 22%, or 23%
    - Penalty for early withdrawal
    - (Notice: only group with r=21% is a commitment device design)
    - Can choose share into each account

– Result 1. Commitment device take-up quite high – up to 56%

	21%	22%	23%
10% penalty	0.28	0.39	0.58
20% penalty		0.45	0.61
No withdrawal		0.56	0.60

- *Retirement Savings* (SMRT plan, Thaler and Benartzi, 2007 – last lecture)
  - Result 1. Take-up rate 80% when offered in person
  - Result 2. Huge effects on 401(k) contribution rates

- *Online gaming* (Chow, 2010 and Acland and Chow, 2010)
  - Offer online interface that one can use to limit play of online games
  - Result 1. Take-up rate relatively high initially, but declines to 5-10%
  - Result 2. Suggestive effects on time spent playing

- *Smoking* (Gine, Karlan, and Zinman, 2010)
  - Offer urine test for smoking in 6 months
  - Can deposit money into account – forfeited if fail test at month 6

- Result 1. Low take-up: 11% of 781 offered product
- Result 1. Conditional on take-up, average deposit of 57 pesos (4 weeks worth of cigarettes)
- Result 2: At 6 months, increase of 4-5 percentage point in chance of making urine test
- Result 2: At 12 months, similar increase at surprise test

TABLE 5—IMPACT OF CARES ON PASSING URINE TEST ONE YEAR LATER
(*OLS, intent-to-treat estimates*)

Assumption:	Everyone that did not take the test continues smoking		Drop if did not take the test		Everyone that was found but refused to take the test still smokes	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. With baseline covariates						
CARES treatment	0.035**	0.035*	0.057**	0.055*	0.054**	0.054**
	(0.018)	(0.018)	(0.028)	(0.028)	(0.027)	(0.027)

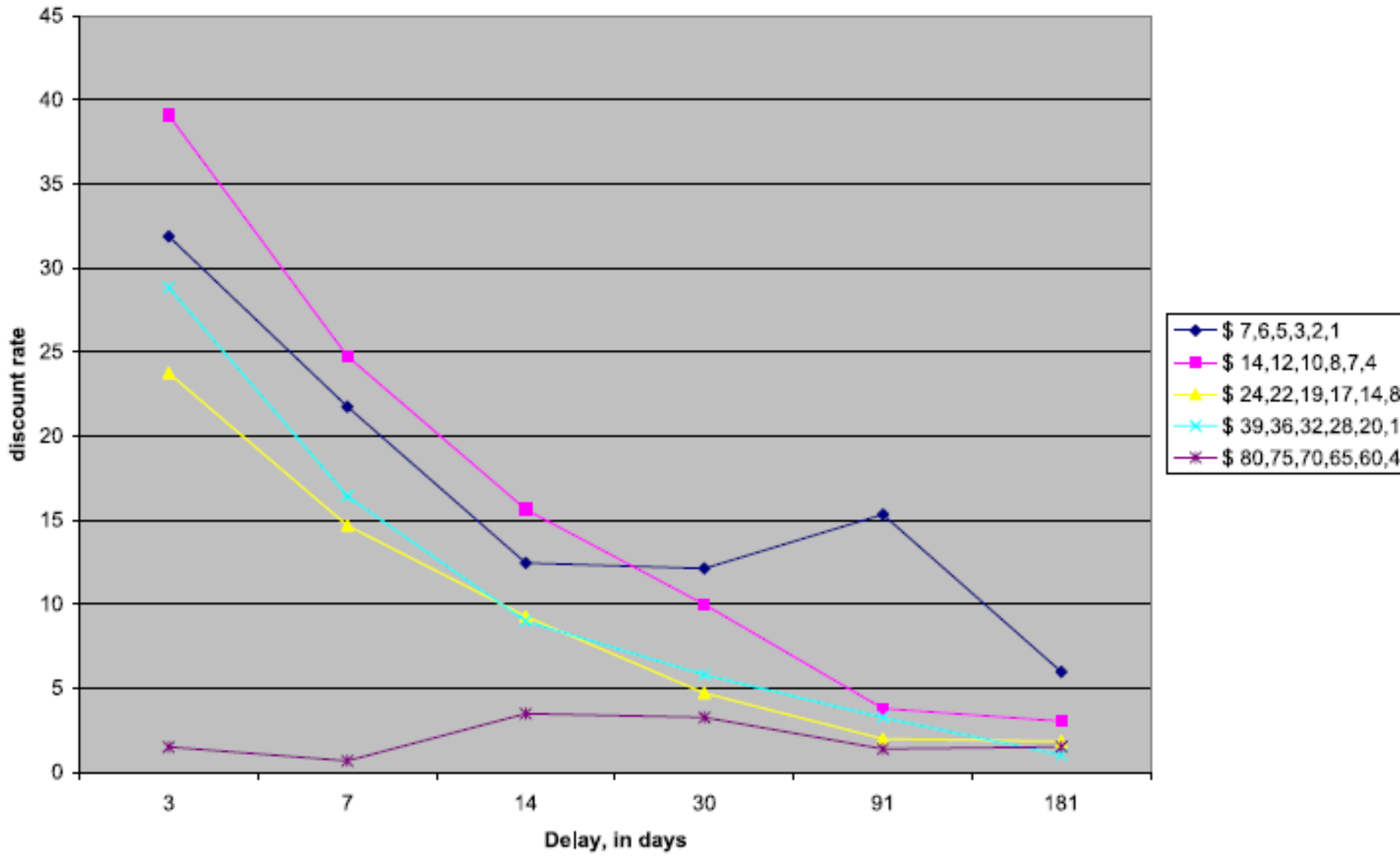
- Why often low-take up? At least 3 possibilities:
  - Self-control not prevalent
  - Self-control prevalent, but naivete' is strong
  - Demand for commitment outweighed by costs of commitment in terms of loss of flexibility
- Important to examine design to separate explanations

- Alternative design of the commitment device field experiments: *2*2 Design* (Chow, 2010)
  - Offer *everyone* the commitment device
  - Then randomly assign whether commitment device is actually offered
  - Therefore groups are 2 (wanted comm./did not) * (got comm./did not)
- Advantage of this design
  - More power on demand for commitment since everybody (not just 1/2 of subjects) is asked
  - Can estimate effect of commitment both on the subjects that demand it, and the ones who do not (but who may end up using it)
  - See also Chassang, Padro-i-Miguel, Snowberg, (AER 2012)

7 Laboratory Experiments on Present Bias

- Experiments on time preferences (Ainslie, 1956; Thaler, 1981; Benhabib, Bisin, and Schotter, 2009; Andreoni and Sprenger, 2012)
- Typical design (Thaler *EL* 1981):
  - What is X today that makes indifferent to \$10 in one week?
  - What is Y in one week that makes indifferent to \$10 in two weeks?
- Assuming (locally) linear utility:
  - $X = \beta\delta 10$ and $Y = \delta 10$
  - Hence, $Y/10$ is estimate of weekly δ
  - X/Y is estimate of (weekly) β

- Alternative design: Benhabib, Bisin, and Schotter (BBS, *GEB* 2009):
  - What is X today that makes indifferent to \$10 in one week? –> Implied weekly discount factor $\beta\delta$
  - What is Y today that makes indifferent to \$10 in T weeks? –> Implied weekly discount factor $\left(\beta\delta^T\right)^{1/T} = \beta^{1/T}\delta$
- For $\beta < 1$, implied weekly discount factor should be increasing in T
- BBS (2009):
  - 27 undergraduate students making multiple choices
  - Support for a hyperbolic discount function
  - Next figure: data from a representative subject: weekly discount rate implied by choice, as function of delay


45
40
35
30
25
20
15
10
5
0
discount rate
3
7
14
30
91
181
Delay, in days
$ 7,6,5,3,2,1
$ 14,12,10,8,7,4
$ 24,22,19,17,14,8
$ 39,36,32,28,20,1
$ 80,75,70,65,60,4

- Potential problems in such designs:

- *Problem 1 (Credibility)*
  - BSS: '*If money today were to be paid subjects were handed a check. If future money were to be paid subjects were asked to supply their mailing address and were told that on the day promised a check would arrive at their campus mailboxes with the promised amount.*'
  - Suppose subjects believe *future* payments occur only with probability q, while immediate payments are sure
  - Implied discount factor is $q\delta^T$
  - –> β captures subjective probability q that future payments will be paid (compared to present payments)

- *Problem 2 (Money versus Consumption)*
  - Discounting applies to consumption, not income (Mulligan, 1999):

$$U_0 = u(c_0) + \beta\delta Eu(c_1) + \beta\delta^2 Eu(c_2)$$

  - Assume that individual plans to consume the $\$X$ paid today or the \$10 paid in one week one week later–> Then the choice is between
    * $\beta\delta u(X)$
    * $\beta\delta u(10)$
  - Hence, present bias β does not play a role
  - It does play a role *with credit constraints* –> Consume immediately

- *Problem 3 (Concave Utility)*
  - Choice equates

$$u(10) = \beta\delta u(X)$$

  - $\beta\delta = u(10)/u(X)$ –> Need to estimate the concavity of the utility function to extract discount function
  - Problem likely less serious for small payments

- *Problem 4 (Uncertain future marginal utility of money)*
  - Marginal utility of money certain for present, uncertain in future:

$$u(10) = \beta\delta E u(X)$$

  - –> Marginal utility of money can differ in the future, depending on future shocks

- Recent improved experimental design: Andreoni and Sprenger (AS, *AER* 2012)

- To deal with *Problem 1 (Credibility)*, emphasize credibility
  - All sooner and later payments, including those for $t = 0$, were placed in subjects' campus mailboxes.
  - Subjects were asked to address the envelopes to themselves at their campus mailbox, thus minimizing clerical errors
  - Subjects were given the business card of Professor James Andreoni and told to call or e-mail him if a payment did not arrive

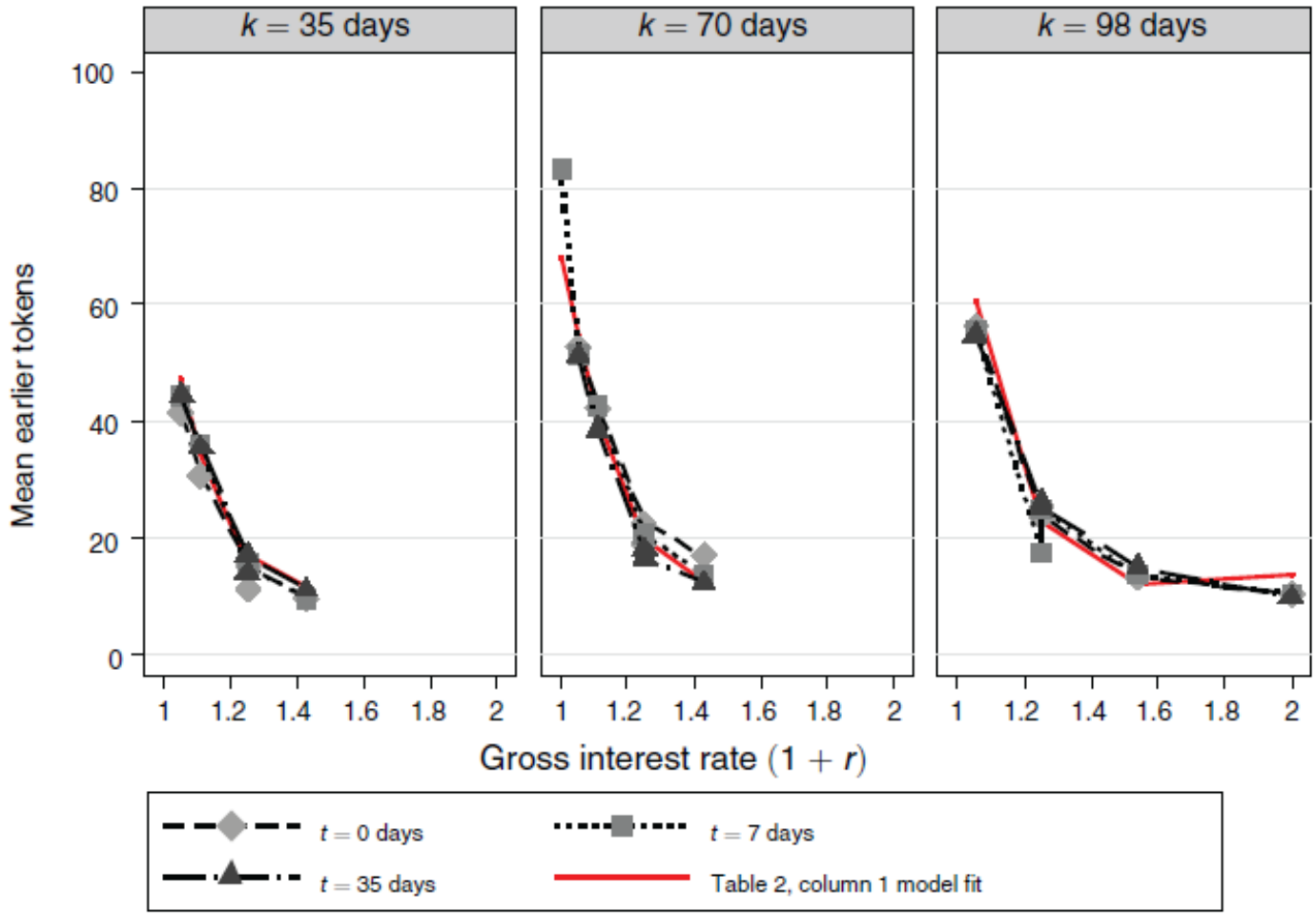
- Potential drawback: Payment today take places at end of day
  - Other experiments: post-dated checks

- To deal with *Problem 3 (Concave Utility)*, design to estimate concavity:
  - Subject allocate share of money to earlier versus later choice
  - -> That is, interior solutions, not just corner solutions
  - Vary interest rate between earlier and later choice to back out concavity
- Example of choice screenshot

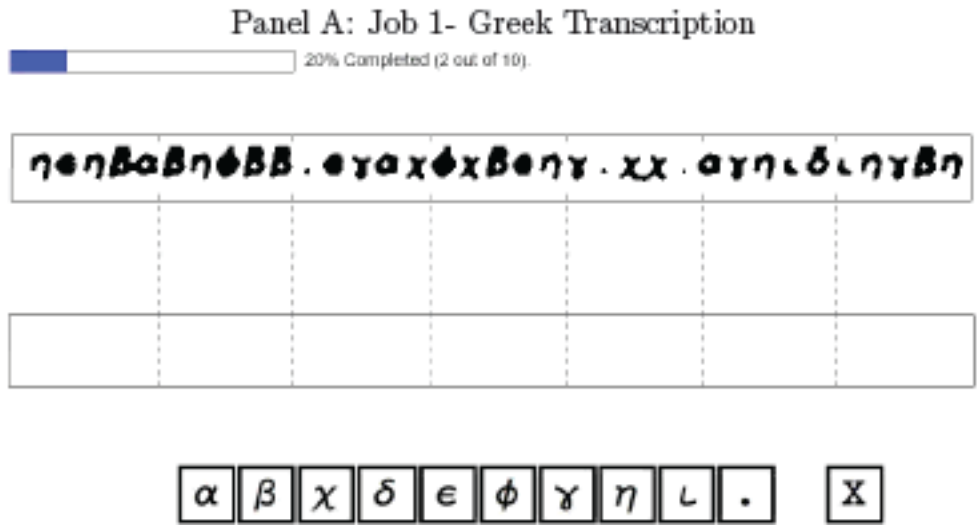
January 21, February 25 | January 21, April 1 | January 21, April 29 | January 28, March 4 | January 28, April 8

	Divide Tokens between January 28 (1 week(s) from today), and April 8 (10 week(s) later)					January 28	April 8
1	Allocate 100 tokens:	83	tokens at $0.20 on January 28, and	17	tokens at $0.20 on April 8	$16.60	$3.40
2	Allocate 100 tokens:	51	tokens at $0.19 on January 28, and	49	tokens at $0.20 on April 8	$9.69	$9.80
3	Allocate 100 tokens:	43	tokens at $0.18 on January 28, and	57	tokens at $0.20 on April 8	$7.74	$11.40
4	Allocate 100 tokens:	21	tokens at $0.16 on January 28, and	79	tokens at $0.20 on April 8	$3.36	$15.80
5	Allocate 100 tokens:	14	tokens at $0.14 on January 28, and	86	tokens at $0.20 on April 8	$1.96	$17.20

- Main result: No evidence of present bias



- What about *Problem 2 (Money vs. Consumption)*?
  - One solution: Do experiments with goods to be consumed right away:
    - Low- and High-brow movies (Read and Loewenstein, 1995)
    - Squirts of juice for thirsty subjects (McClure et al., 2005)
  - Problem: Harder to invoke linearity of utility when using goods as opposed to money
- Augenblick, Niederle, and Sprenger (*QJE* 2015): Address problem by having subjects intertemporally allocate effort
  - 102 subjects have to complete boring task

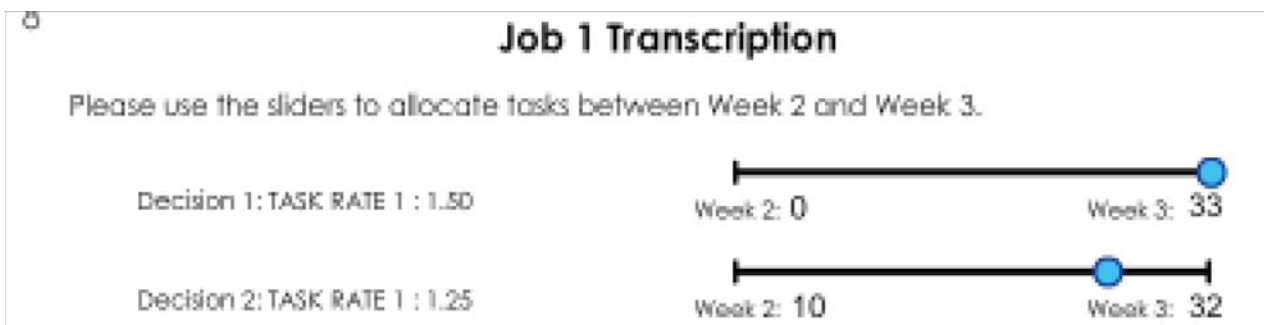


- – Experiment over multiple weeks, complete online
  - – Pay largely at the end to reduce attrition
  - – Week 1: Choice allocation of job between weeks 2 and 3
  - – Week 2: Choose again allocation of job between weeks 2 and 3
  - – –> Do subjects revise the choice?
  - – As in AS, choice of interior solution, and varied ‘interest rate’ between periods

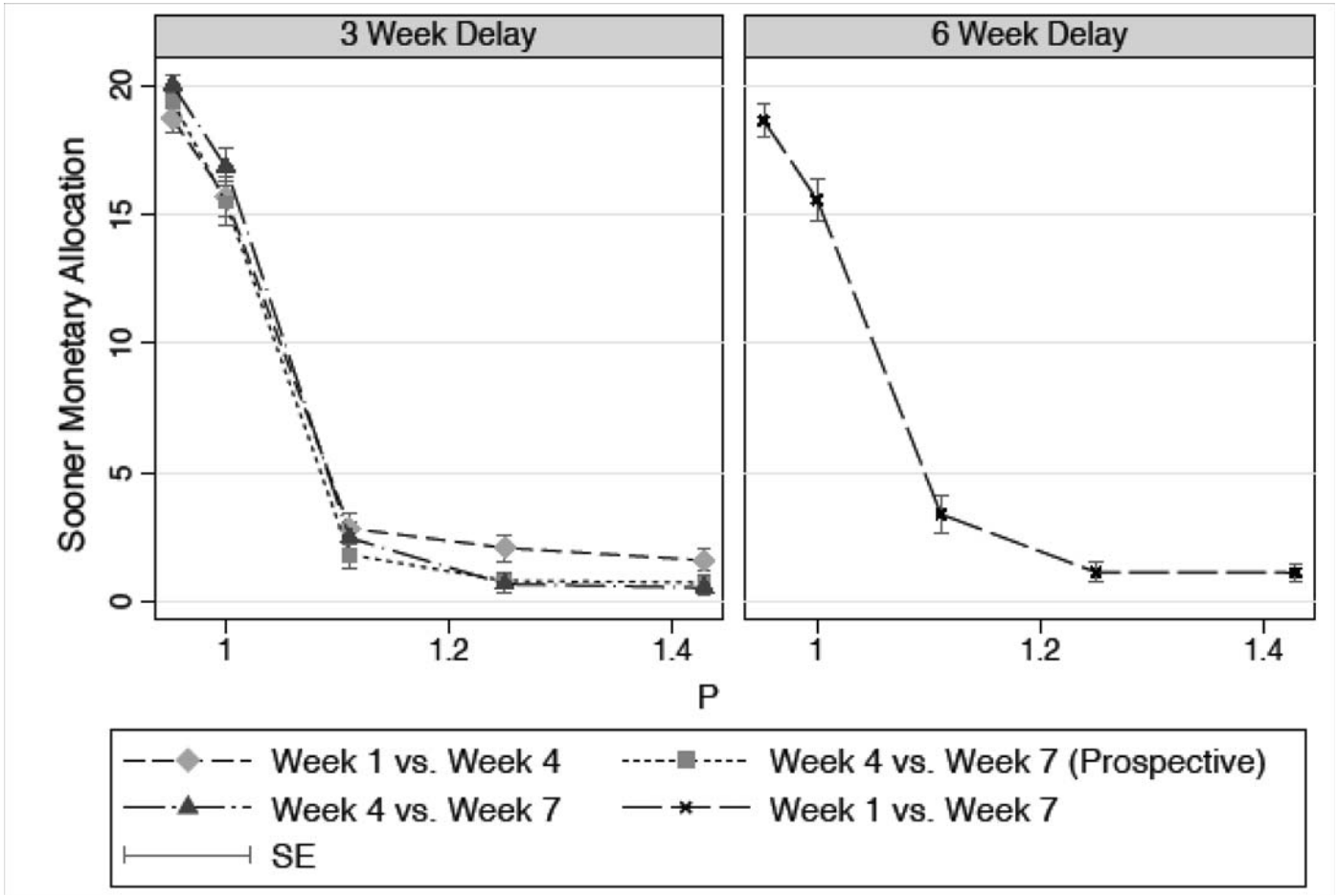
– Also do monetary discounting

Table 1: Summary of Longitudinal Experiment

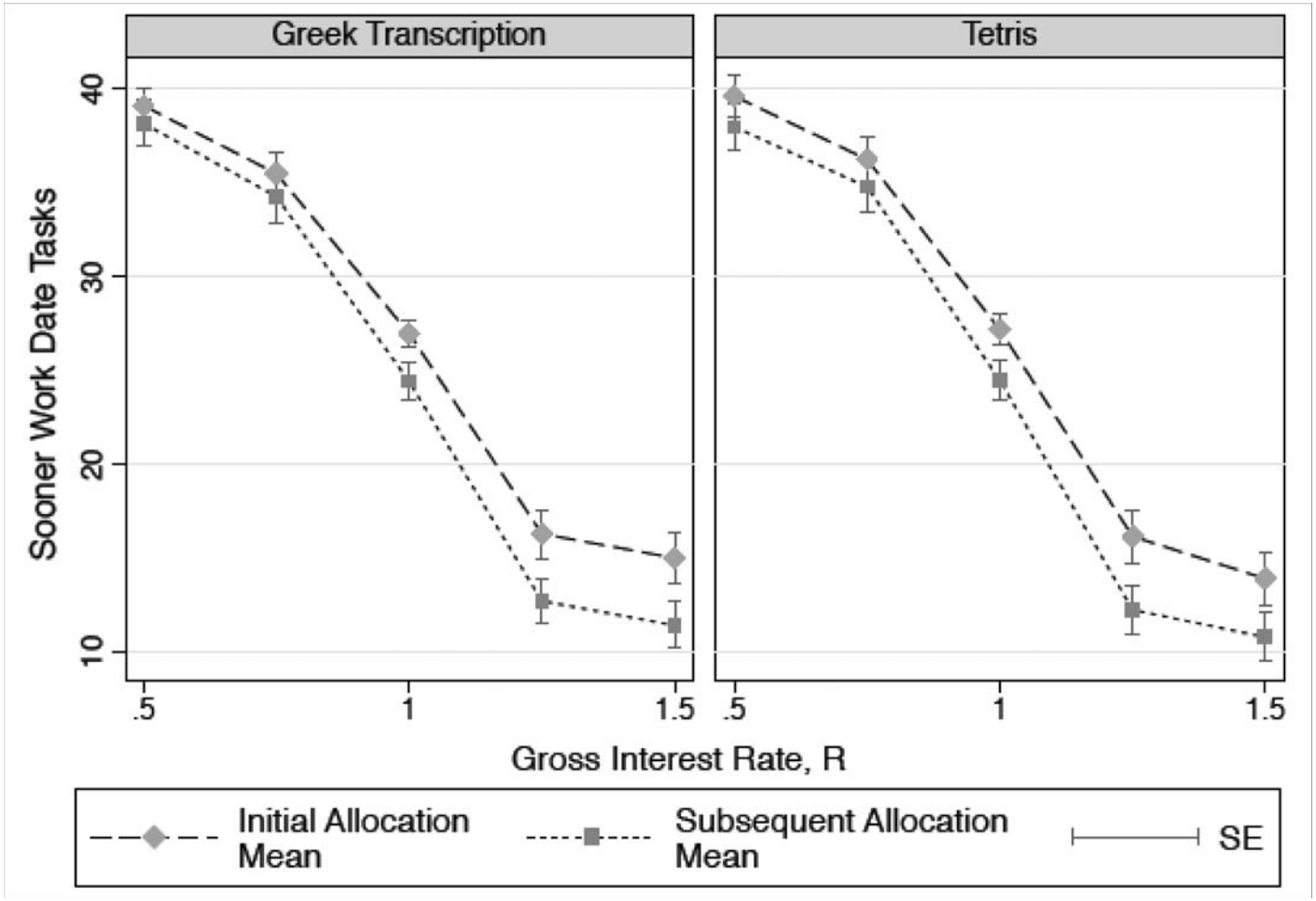
	10 Effort Allocations	Minimum Work	Allocation-That-Counts Chosen	Complete Work	Commitment Choice	Receive Payment
Week 1 (In Lab):	x	x				
Week 2 (Online):	x	x	x	x		
Week 3 (Online):		x		x		
Week 4 (In Lab):	x	x			x	
Week 5 (Online):	x	x	x	x		
Week 6 (Online):		x		x		
Week 7 (In Lab):						x



- Result 1: On monetary discounting no evidence of present-bias



- Result 2: Clear evidence on effort allocation



- Result 3: Estimate of present-bias given that can back out shape of cost of effort function $c(e)$

	Monetary Discounting		Effort Discounting		
	(1) All Delay Lengths	(2) Three Week Delay Lengths	(3) Job 1 Greek	(4) Job 2 Tetris	(5) Combined
Present Bias Parameter: β	0.974	0.988	0.900	0.877	0.888
	(0.009)	(0.009)	(0.037)	(0.036)	(0.033)
Daily Discount Factor: δ	0.998	0.997	0.999	1.001	1.000
	(0.000)	(0.000)	(0.004)	(0.004)	(0.004)
Monetary Curvature Parameter: α	0.975	0.976			
	(0.006)	(0.005)			
Cost of Effort Parameter: γ			1.624	1.557	1.589
			(0.114)	(0.099)	(0.104)
# Observations	1500	1125	800	800	1600
# Clusters	75	75	80	80	80
Job Effects					Yes

- **Dean and Sautmann (2014):** Provide direct evidence on *Problem 2 (Money vs. Consumption)*
  - Elicit time preferences with standard money now versus money in the future questions

Table 1: A Price List Experiment

Set A		Set B	
today	in 1 week	in 1 week	in 2 weeks
a_0	a_1	b_1	b_2
CFA 50	CFA 300	CFA 50	CFA 300
CFA 100	CFA 300	CFA 100	CFA 300
CFA 150	CFA 300	CFA 150	CFA 300
CFA 200	CFA 300	CFA 200	CFA 300
CFA 250	CFA 300	CFA 250	CFA 300
CFA 300	CFA 300	CFA 300	CFA 300
CFA 350	CFA 300	CFA 350	CFA 300
CFA 400	CFA 300	CFA 400	CFA 300

- – Observe shocks to ability to borrow and marginal utility of income
  - – Do those affect the choices in price list?
  - – If so, clearly we are not capturing δ, but rather r or u'
  - – Estimate MRS from questions above, relate to adverse income shock

Table 5: Consumption shocks and MRS_t.

	MRS (A) OLS	MRS (A) OLS	MRS (A) OLS	MRS (A) OLS	MRS (A) IV	MRS (A) IV
Adv. event (0/1)	0.284 *	0.263 *				
	(0.124)	(0.124)				
Adv. event expense			0.256 +	0.237 +	1.707 *	1.579 *
			(0.147)	(0.141)	(0.695)	(0.797)
Constant	4.588 **	4.678 **	4.665 **	4.755 **	4.579 **	4.663 **
	(0.041)	(0.074)	(0.009)	(0.059)	(0.101)	(0.130)
Ind FE	yes	yes	yes	yes	yes	yes
Time FE		yes		yes		yes
Observations	2547	2547	2543	2543	2543	2543

Standard errors clustered at the individual level (OLS) or bootstrapped (IV, ML) (in pa
*Significance levels + p<0.10, * p<0.05, ** p<0.01*

- – Related to savings shock

Table 7: Income, spending, and MRS_t.

	MRS (A) OLS	MRS (A) OLS	MRS (A) OLS	MRS (A) OLS	MRS (A) IV	MRS (A) IV	MRS (A) ML
Labor income			-0.185	-0.189	-0.153	-0.159	-0.324 *
			(0.142)	(0.143)	(0.163)	(0.142)	(0.135)
Nonlabor income "endogenous"			-0.330	-0.321	-0.268	-0.265	-0.281
			(0.251)	(0.258)	(0.261)	(0.270)	(0.351)
Nonlabor income "exogenous"	**-0.409 ****	**-0.409 ****	**-0.382 ****	**-0.384 ****	**-0.378 ***	**-0.380 ***	**-0.407 ****
	(0.142)	**(0.149)**	**(0.125)**	**(0.133)**	**(0.171)**	**(0.149)**	**(0.199)**
Other spending			0.268 *	0.245 +	0.192	0.177	0.236
			(0.128)	(0.131)	(0.141)	(0.132)	(0.135)
Adv. event expense	**0.252 +**	**0.233 +**	**0.251**	**0.222**	**1.683 +**	**1.562 ***	**0.357 +**
	(0.145)	**(0.139)**	**(0.182)**	**(0.183)**	**(0.761)**	**(0.769)**	**(0.250)**
Constant	4.69 **	4.782 **	4.56 **	4.67 **	4.527 **	4.622 **	2.737 **
	(0.011)	(0.059)	(0.093)	(0.125)	(0.144)	(0.145)	(0.145)
Ind FE	yes	yes	yes	yes	yes	yes	yes
Time FE		yes		yes		yes	
Observations	2540	2540	2390	2390	2390	2390	1437

Standard errors clustered at the individual level (OLS) or bootstrapped (IV, ML) (in parentheses).
*Significance levels + p<0.10, * p<0.05, ** p<0.01*

- **Carvalho, Meier, Wang (AER 2016):** Replicates both of the previous findings
  - Measures time preferences with money and real effort
  - 1,191 participants rendomized into
    - Surveyed before payday (financially constrained)
    - Surveyed after payday (not constrained)
  - Real effort task (clever):
    - Complete shorter survey within 5 days
    - Complete longer survey within 35 days
    - Multiple choices withvarying length of sooner survey

- Replicates Dean and Sautmann result on financial choices

Table 3: Intertemporal Choices about Monetary Rewards

	$ Amount of Sooner Reward	
	Coefficient	Standard Error
{Before Payday} * {Immediate Rewards}	10.6	3.83***
{Before Payday} * Interest Rate	2.7	3.24
{Before Payday} * Delay Time	-1.4	1.06
{Before Payday}	-6.3	9.80
{Immediate Rewards}	-5.3	2.75*
Experimental Interest Rate	-47.3	2.33***
Delay Time	-0.7	0.72
Constant	304.3	6.83***

Notes: This table reports results from an OLS regression where the dependent variable is the dollar amount of the sooner payment. "Immediate Rewards" is an indicator variable that is 1 if the mailing date of the sooner payment is today. "Delat Time" is the time interval between the sooner and later payments. The sample is restricted to the 1,060 subjects who made all 12 choices in the task with monetary rewards. $N = 12.720$.

- Replicates Augenblick et al. on real effort

Table 4: Intertemporal Choices about Real Effort

	Monthly Discount Rate
{Before Payday} * {Immediate Task}	-0.03
	[0.025]
{Before Payday}	0.02
	[0.027]
{Immediate Task}	0.09
(5-day deadline for short-sooner survey)	[0.018]***
Constant	0.31
	[0.019]***

Notes: This table reports estimates from an interval regression where the dependent variable is the interval measure of the individual discount rate (IDR). Two IDRs are estimated for each subject; one for each time frame. "Immediate Task" is an indicator variable for the "5 days (sooner) x 35 days (later)" time frame. Standard errors clustered at the individual level. The sample is restricted to the 1,025 subjects who made all 10 choices in the non-monetary intertemporal task. $N = 2{,}050$.

- Recent additional work using the real effort methodology
- **Augenblick and Rabin (2016)**:
  - Use real effort to elicit not only β, but also $\hat{\beta}$
  - Elict forecasts for future choice, as well as future choice
  - Key result: individuals are almost fully naive
- **Augenblick (2017):**
  - Estimate timing of β
  - Individual make effort decisions at varying distance from effort time
  - 1/3 of discounting in next 6 hours, further 1/3 in next 2 days
- **Fedyk (2016)**:
  - What beliefs do people have about others' self control?
  - People more realistic about others

8 Methodology: Errors in Applying Present-Biased Preferences

- Present-Bias model very successful
- Quick adoption at cost of incorrect applications
- Four common errors

- **Error 1. Procrastination with Sophistication**
  - 'Self-Control leads to Procrastination'
  - This is not accurate in two ways
  - *Issue 1.*
    - (β, δ) Sophisticates do not delay for long (see our calibration)
    - Need Self-control + Naiveté (overconfidence) to get long delay
  - *Issue 2.* (Definitional issue) We distinguished between:
    - Delay. Task is not undertaken immediately
    - Procrastination. Delay systematically beyond initial expectations
    - Sophisticates and exponentials do not procrastinate, they *delay*

- **Error 2. Naives with Yearly Decisions**
  - 'We obtain similar results for naives and sophisticates in our calibrations'
  - Example 1. Fang, Silverman (*IER*, 2009)
  - Single mothers applying for welfare. Three states:
    1. Work
    2. Welfare
    3. Home (without welfare)
  - Welfare dominates Home – So why so many mothers stay Home?

Choice at $t-1$	Choice at t		
	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

- – Model:
  - ∗ Immediate cost ϕ (stigma, transaction cost) to go into welfare
  - ∗ For ϕ high enough, can explain transition
  - ∗ Simulate Exponentials, Sophisticates, Naives

- However: Simulate decision at **yearly** horizon.
- BUT: At yearly horizon naives do not procrastinate:
  - Compare:
    - Switch now
    - Forego *one year* of benefits and switch next year
- Result:
  - Very low estimates of β
  - Very high estimates of switching cost ϕ
  - Naives are same as sophisticates

Parameters		(1) Time Consistent Estimate	(1) Time Consistent S.E.	(2) Present-Biased (sophisticated) Estimate	(2) Present-Biased (sophisticated) S.E.	(3) Present-Biased (Naive) Estimate	(3) Present-Biased (Naive) S.E.
Preference Parameters							
Discount Factors	β	1	n.a.	0.33802	0.06943	0.355	0.0983
	δ	0.41488	0.07693	0.87507	0.01603	0.868	0.02471
Net Stigma	$\phi^{(1)}$	7537.04	774.81	8126.19	834.011	8277.46	950.77
(by type)	$\phi^{(2)}$	10100.9	1064.83	10242.01	955.878	10350.20	1185.27
	$\phi^{(3)}$	13333.2	1640.18	12697.25	1426.40	12533.69	1685.92

- – Conjecture: If allowed daily or weekly decision, would get:
  - ∗ Naives fit much better than sophisticates
  - ∗ β much closer to 1
  - ∗ ϕ much smaller

- Example 2. Shui and Ausubel (2005) –> Estimate Ausubel (1999)
  - Cost k of switching from credit card to credit card
  - Again: Assumption that can switch only every quarter
  - Results of estimates (again):
    - Quite low β
    - Naives do not do better than sophisticates
    - Very high switching costs

Table 4: Estimated Parameters [a]

	Sophisticated Hyperbolic	Naive Hyperbolic	Exponential
β	0.7863 (0.00192)	0.8172 (0.003)	
δ	0.9999 (0.00201)	0.9999 (0.0017)	0.9999 (0.00272)
k	0.02927 \$293 (0.00127)	0.0326 \$326 (0.00139)	0.1722 \$1,722 (0.0155)

- **Error 3. Present-Bias over Money**
  - We discussed problem applied to experiments
  - Same problem applies to models
    - Notice: Transaction costs of switching k in above models are real effort, apply immediately
    - Effort cost c of attending gym also 'real' (not monetary)
    - Consumption-Savings models: Utility function of consumption c, not income I

- **Error 4. Getting the Intertemporal Payoff Wrong**
  - 'Costs are in the present, benefits are in the future'
  - (β, δ) models very sensitive to timing of payoffs
  - Sometimes, can easily turn investment good into leisure good
  - Need to have strong intuition on timing
  - Example: Paper on nuclear plants as leisure goods
    - Immediate benefits of energy
    - Delayed cost to environment
  - BUT: 'Immediate' benefits come after 10 years of construction costs!

9 Additional Applications of Present Bias

9.1 Fertilizer Adoption

- Duflo, Kremer, and Robinson (forthcoming): Invest in fertilizer
- Development: Why so little adoption of fertilizer and high-yield seeds?
- Literature examining role of learning, social learning
  - Effect of fertilizer in Western Kenya
  - Field Experiments: In appropriate proportions high returns
  - However, low adoption

Table 1: Returns to Fertilizer

	Top Dressing 1/4 Teaspoon			Top Dressing 1/2 Teaspoon			Top Dressing 1 teaspoon 1 Teaspoon		
	mean	median	obs	mean	median	obs	mean	median	obs
Panel A: Not Annualized									
25 Ksh per goro-goro	0.080	-0.327	116	0.189	0.156	202	-0.476	-0.494	85
40 Ksh per goro-goro	0.728	0.077	116	0.903	0.850	202	-0.161	-0.191	85
Panel B: Annualized									
25 Ksh per goro-goro	0.362	-0.794	116	1.002	0.786	202	-0.788	-0.805	85
40 Ksh per goro-goro	1.272	0.118	116	1.625	1.515	202	-0.190	-0.225	85

- Possible explanation of puzzle: Farmers would like to purchase fertilizer, but they run out of money by the time the new season comes
- Experiment (SAFI Program):
  - Manipulate timing of adoption
  - Farmers can pre-buy fertilizer at end of previous season (when 'rich')
  - Significant effect on adoption

Table 8: Adoption for Parents Sampled for School-Based SAFI and Subsidy

Season	*Long Rains 2004*	*Short Rains 2004*
Number of Seasons after School-Based Demonstration Plot	*1*	*2*
Number of Seasons after Starter Kit Program	-	*1*
Programs for which an effect would be expected in the given season (coefficients in **bold**)	*SAFI LR 2004* *Demo Plot*	*SAFI SR 04* *Subsidy* *Full Price Visit* *Starter Kit*
Panel A. Control for School	(1)	(2)
Starter Kit Farmer	0.085	**0.047**
	(0.045)*	**(0.049)**
Sampled to Participate in School Demonstration Plot	**-0.046**	0.018
	(0.064)	(0.071)
SAFI Long Rains 2004	**0.103**	-0.020
	(0.038)* **	(0.043)
SAFI Short Rains 2004	-0.037	**0.169**
	-0.047	**(0.053)*** **
Subsidy Short Rains 2004	-0.046	**0.142**
	(0.056)	**(0.063)** **
Full Price Visit Short Rains 2004	-0.089	**0.070**
	(0.056)	**(0.063)**
Observations	874	752

9.2 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?
- Facts suggestive of present-bias (O'Donoghue and Rabin, 2003; Gruber and Koszegi, 2003)

- Standard test of addiction: Does cigarette consumption at t respond to future prices at $t+1$?
  - Becker, Grossman, and Murphy, *AER* 1994: Future prices lower current consumption
  - BUT: Data problems (yearly data; sales data, not consumption data)

- Gruber and Koszegi, *QJE* 2001:
  - Response of consumption to present and future taxes at monthly level
    - Consumption data: Smoking for mothers in National Vital Statistics
    - Price data: Legislated tax increase at monthly horizon
  - Compare response to tax increases at $t+1$ and $t+2$ to estimate β and δ
  - BUT: limited power –> Cannot separate present bias vs. rational addition

- Levy (2009):
  - Revisit Gruber and Koszegi, *QJE* 2001 with novel test for present bias (and projection bias)
    1. Compare response to price increase at t and at $t + 1$
    2. Supplement with response to temporary (price of tobacco) vs. permanent (taxes) price increases
  - Some evidence of present bias, stronger evidence of projection bias

- Gruber and Mullainathan (2006): Use happiness data
  - (Predicted) smokers happier in states one year after smoking taxes are raised
  - Could also be rational response given yearly data

9.3 Obesity

- Overweght and obesity rates doubled over last two decades in US:
  - 1985: No US state has an obesity rate above 15%
  - 2007: only one state (Colorado) has obesity rate below 20%, most states are above 25%
- Problem increasingly common also internationally: UK, Mexico,...
- What explains the increase?
  - Cutler, Glaeser, and Shapiro (*JEP* 2003): Decrease in fixed cost of preparing food + self-control
  - Currie, DellaVigna, Moretti, and Pathania (*AEJ: Policy*, 2010): Fast-foods may have a role, but only partial

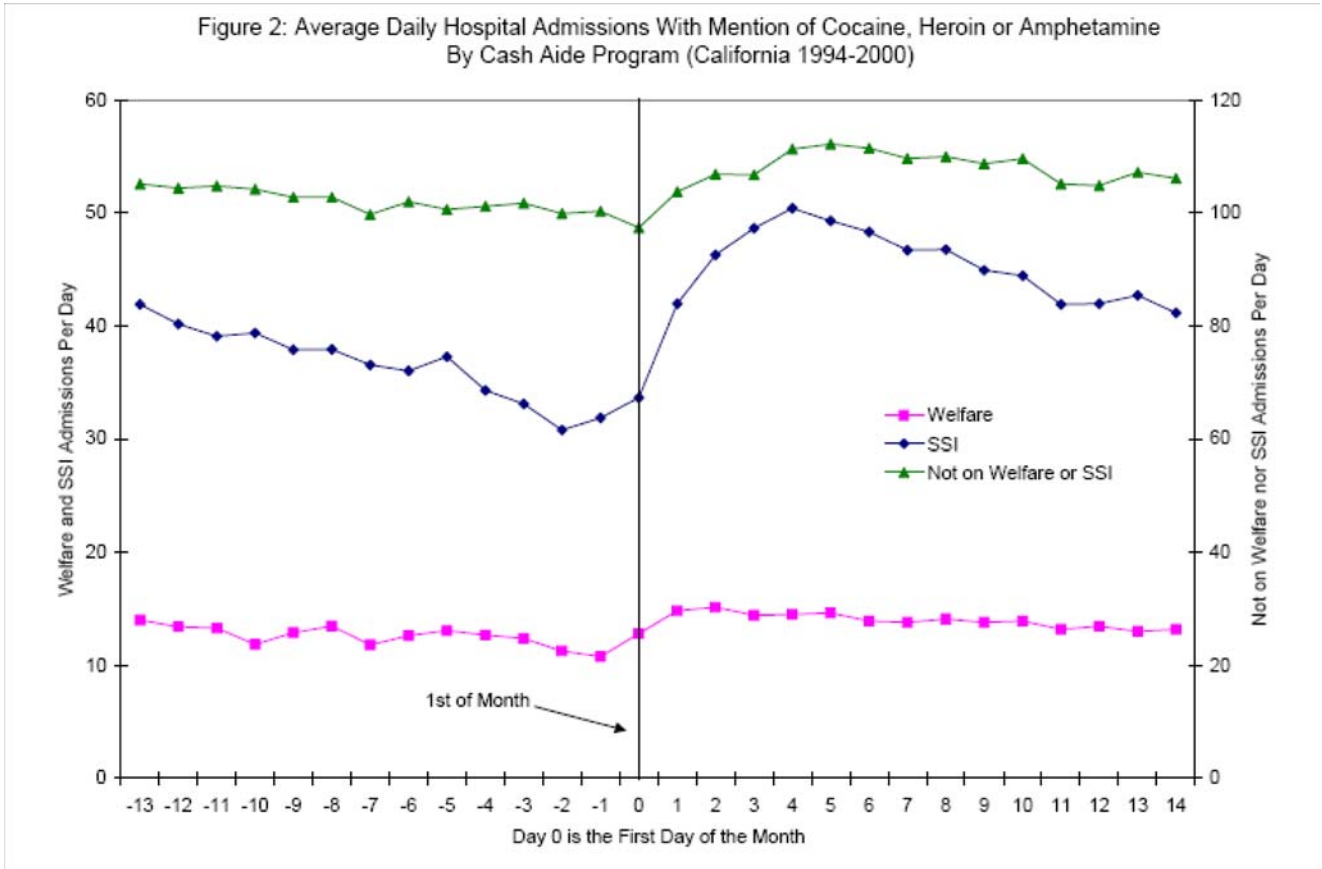
* Fitness Test for CA 9th graders: Obesity rate increase by 5 percent if f.f. $<.1$ miles of school
* Fitness Test for CA 9th graders: No effect at larger distances
* Weight gain of pregnant mothers: Small (but significant) effect of f.f. $<.5$ miles of residence
* Possible explanation: Self-control problems –> Temptation of near-by school
* Could also be transport costs

- Need for field experiments to separate hypotheses

9.4 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



9.5 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

9.6 Present Bias: Summary

- 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

10 Next Lecture

- Reference-Dependence Preferences
  - Introduction
  - Endowment Effect
  - Methodology: Effect of Experience
  - Insurance Choices