Time-Inconsistency and Savings

Experimental Evidence from Low-Income Tax Filers

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Outline

Motivation

- Evidence suggests that some undersave
  - transaction costs, regulatory barriers, social demands, trust in institutions, financial literacy, & **behavioral biases**
- Behavioral Bias: Present Bias Preferences
  - Demand for commitment devices (Shlomo and Thaler, 2004; Ashraf et al., 2006)
  - Correlated with lower retirement savings (Goda et al., 2016)
  - Low-income households: insights into time preferences may inform the design of policies aimed at improving financial decisionmaking

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- We design a field experiment that:
  1. Tests for time inconsistency, i.e. a "$\beta - \delta$" model of present-biased preferences
  2. Evaluates the design of saving incentive programs for low-income tax filers

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  2. Evaluates the design of saving incentive programs for low-income tax filers
- Challenges to implementation: sample attrition and ceiling effects

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- Basic Idea:
  - Offer a matched savings account to low-income tax filers
- Measure preferences over timing of payments:
  - Incentives in February vs. incentives in October
- Vary timing of decision:
  - Decision made in December vs. decision made in February

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- Measure preferences over timing of payments:
  - Incentives in February vs. incentives in October
- Vary timing of decision:
  - Decision made in December vs. decision made in February
- Test for time-consistency
  - Standard prediction: similar tradeoff
  - Present-bias: more "patient" in December

Preview of Results

Preliminary Results (First Year Data)

- Point estimates are suggestive of present-bias among low-income tax filers
  - Immediate incentive 2-3 times as effective as a delayed one
  - $\delta \approx 1$, $\beta = 0.34 - 0.45$ (8 month time period), Annualized discount rate of $79\% - 164\%$
  - Issues with sample attrition
- Manipulating the timing of savings incentives may improve cost-effectiveness of pro-saving policies
- Effect of savings programs on welfare ambiguous

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Incorporating Year 2 Data (partially)

- Immediate incentive still 2 times as effective as a delayed one
- $\beta \approx 0.5$, Annualized discount rate of 80%
- Mitigate sample attrition, but introduce ceiling effects

Background: Empirical Time Preference Studies

- One strand of studies estimates time preferences from observational data (Hausman 1979, Laibson, Repetto and Tobacman 1998, DellaVigna and Paserman 2005, Fang and Silverman 2009)
- Another set of laboratory experiments measure individuals' preferences over transfers (real or hypothetical) (Thaler 1981, Andreoni and Sprenger 2010, Halevy 2014) or tasks (Augenbleck et al. 2015)
- A third set of studies relies on field experiments (Ashraf, Karlan and Yin 2006, Meier and Sprenger 2010, Kaur et al. 2010, Giné et al. 2011, Eckel, et al. 2014)

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  - While some field experiments demonstrate a demand for commitment, we offer a hybrid approach that utilizes "commitment" but also seeks to quantify time preferences
  - Our study focuses on low-income households in the US, which complements evidence drawn from developing countries
  - We use a relatively "natural" decision context

Background: Income Tax Refunds and Savings

- Income tax refunds are the norm among US tax filers, especially lower-income households (mean $\approx \$3,000$)
- Of particular interest is the financial response to this relatively large income flow
  - Households may off-load debt at this time
  - Some tax filers report a demand for refund-based savings vehicles (Tufano 2008)
  - Nonprofits also push for households to store some of their tax refunds in a (illiquid) savings accounts such as the SaveUSA account

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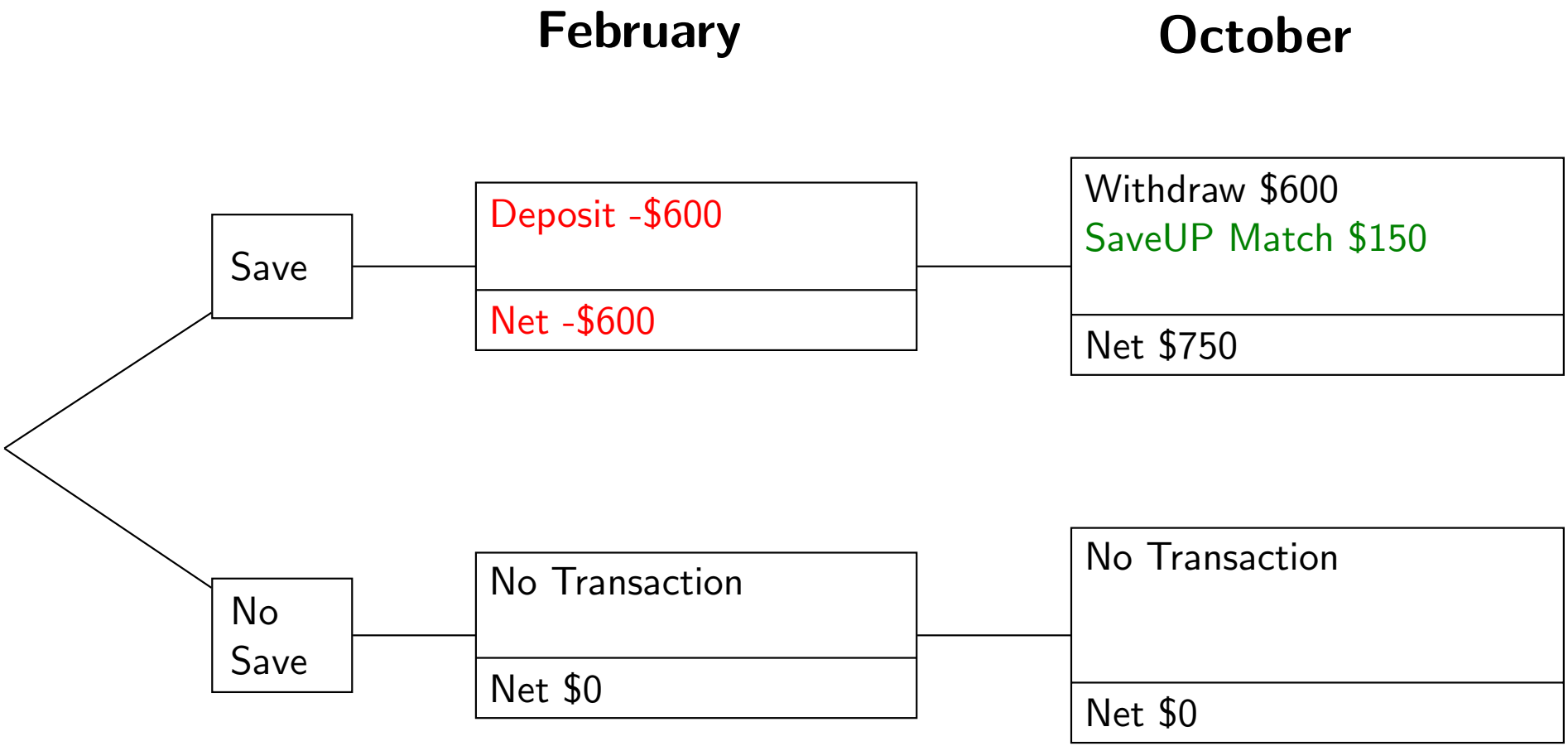
  - Nonprofits also push for households to store some of their tax refunds in a (illiquid) savings accounts such as the SaveUSA account
- We use decisionmaking in the third context to test theories of time preference
- Bernheim, Ray and Yeltekin (2013) explore the welfare impacts of savings promotion interventions in the presence of time-inconsistency and credit constraints

Outline

Thought Experiment: No Commitment Option (NC)



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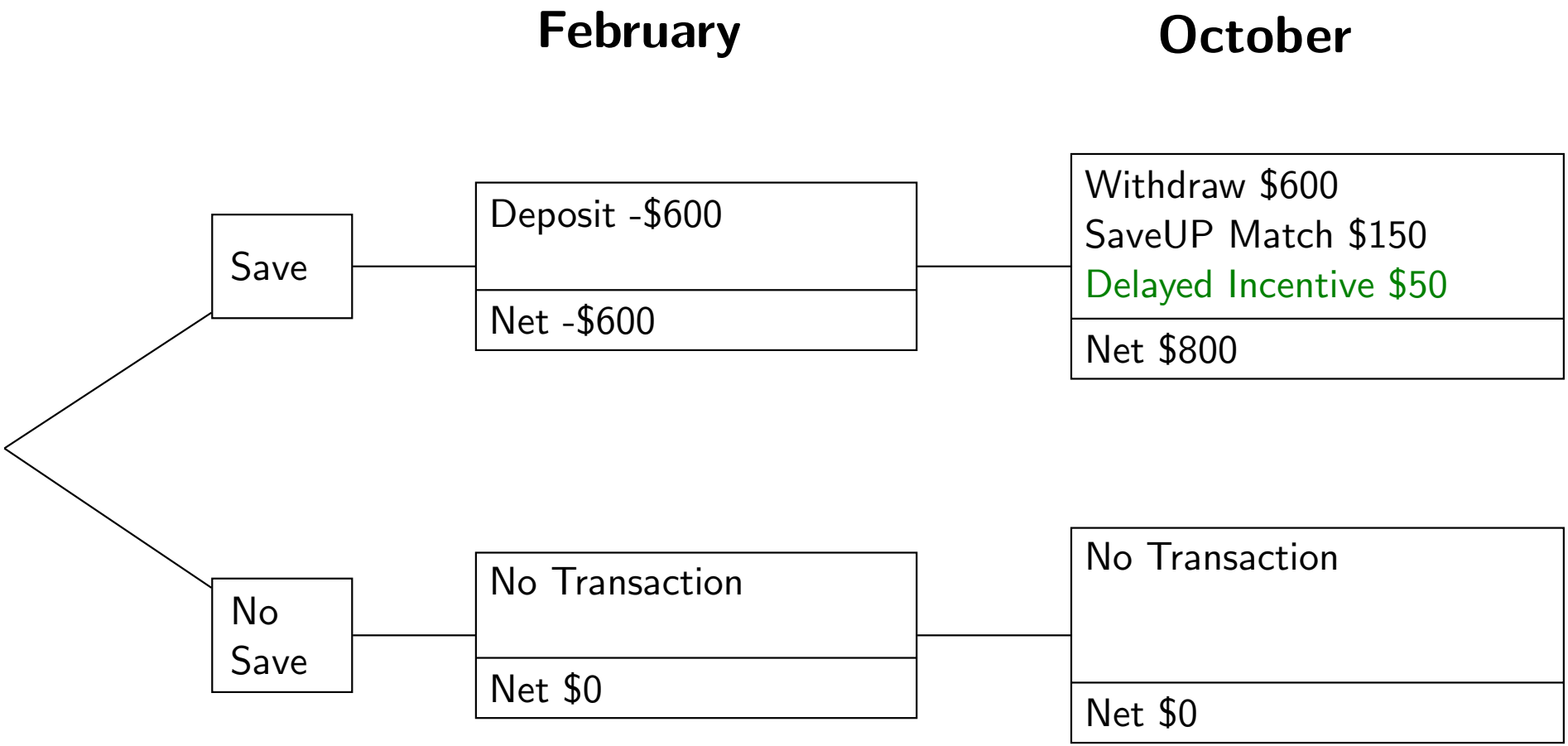

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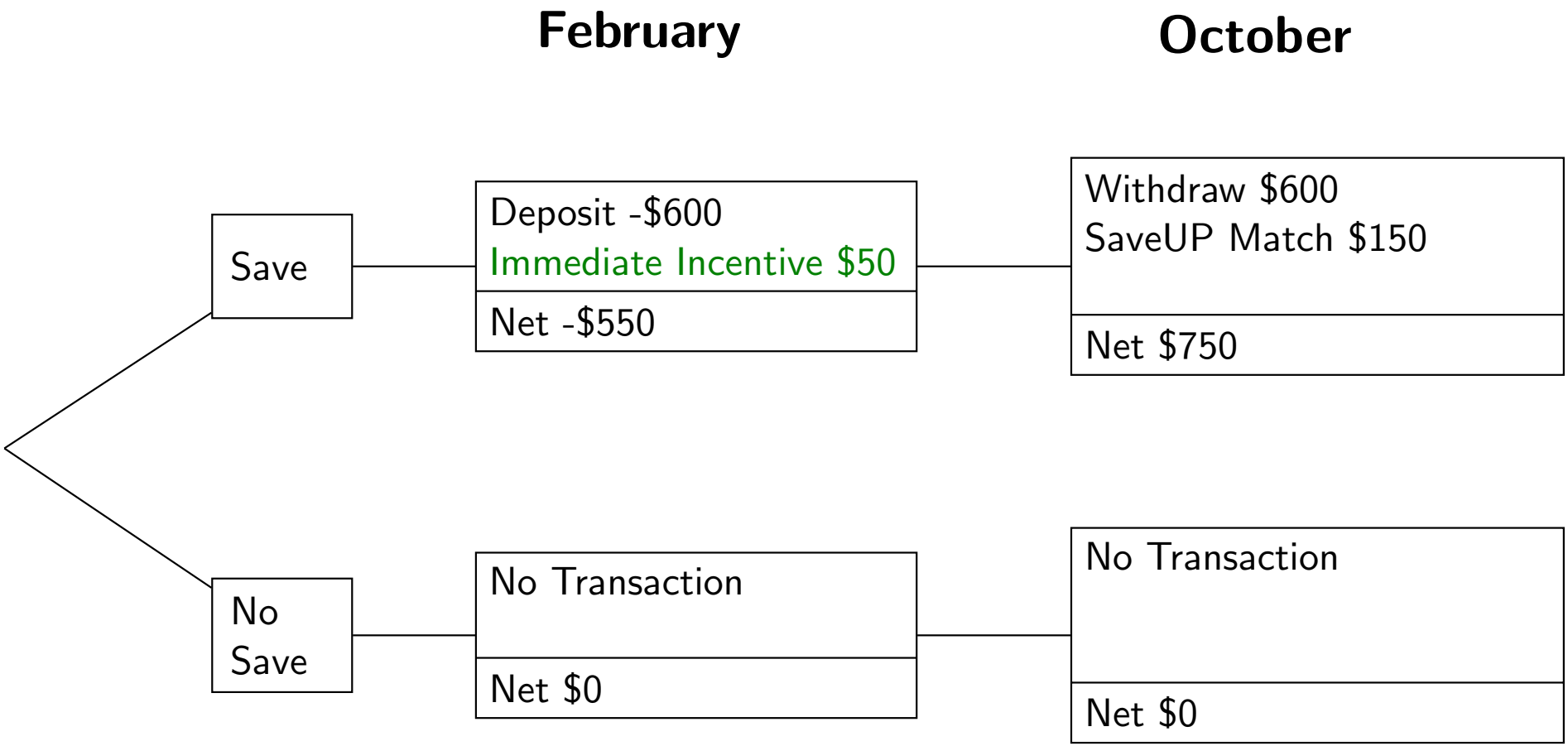

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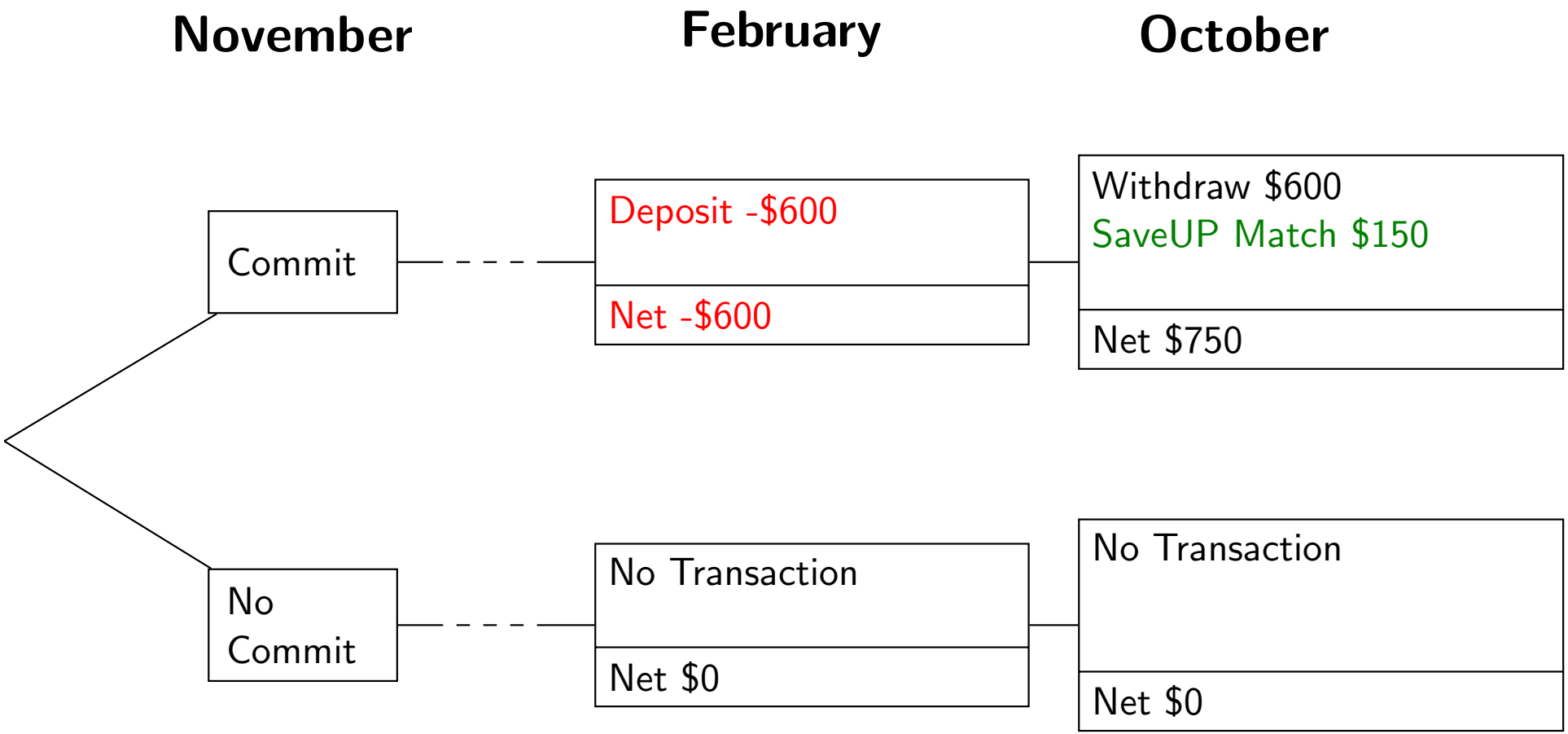

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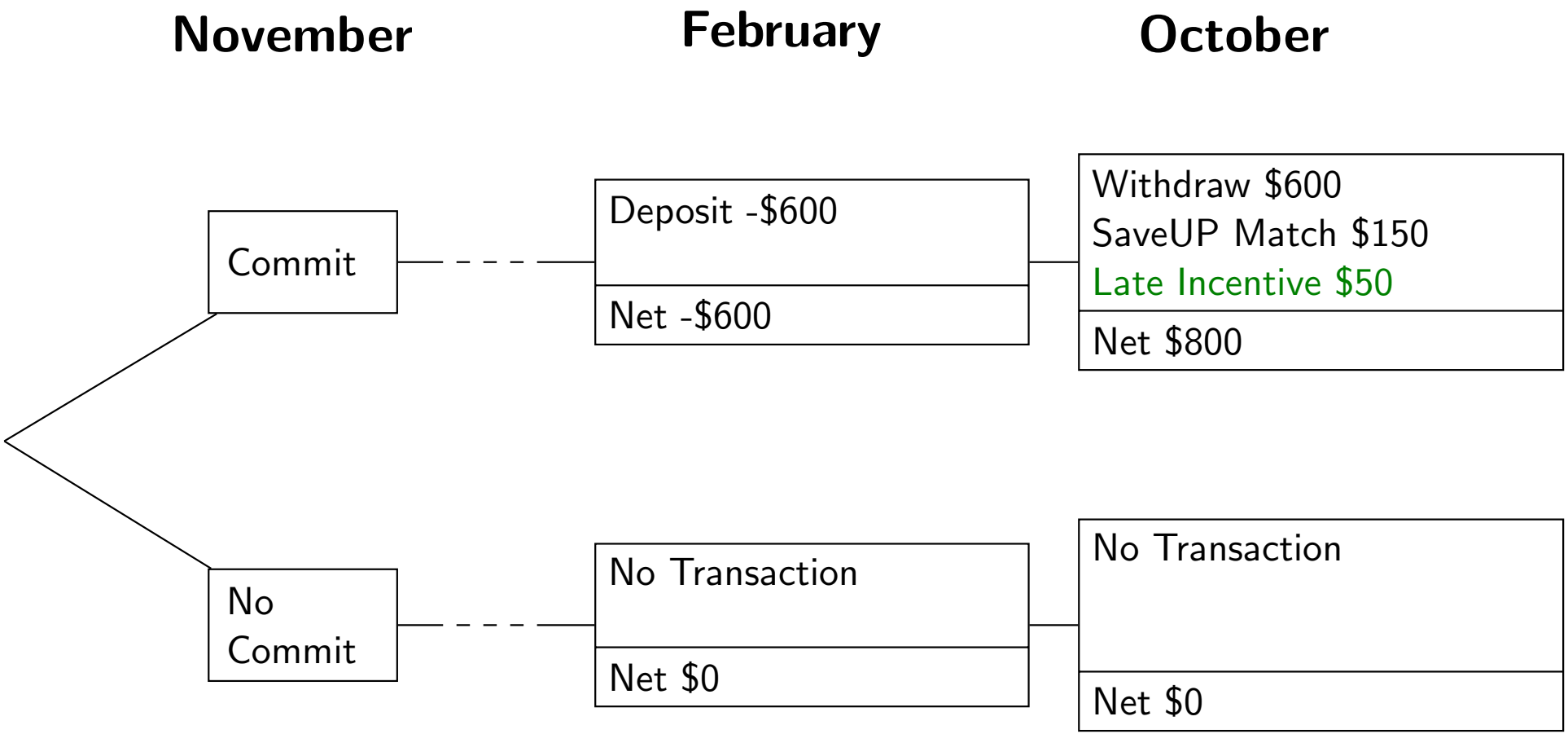

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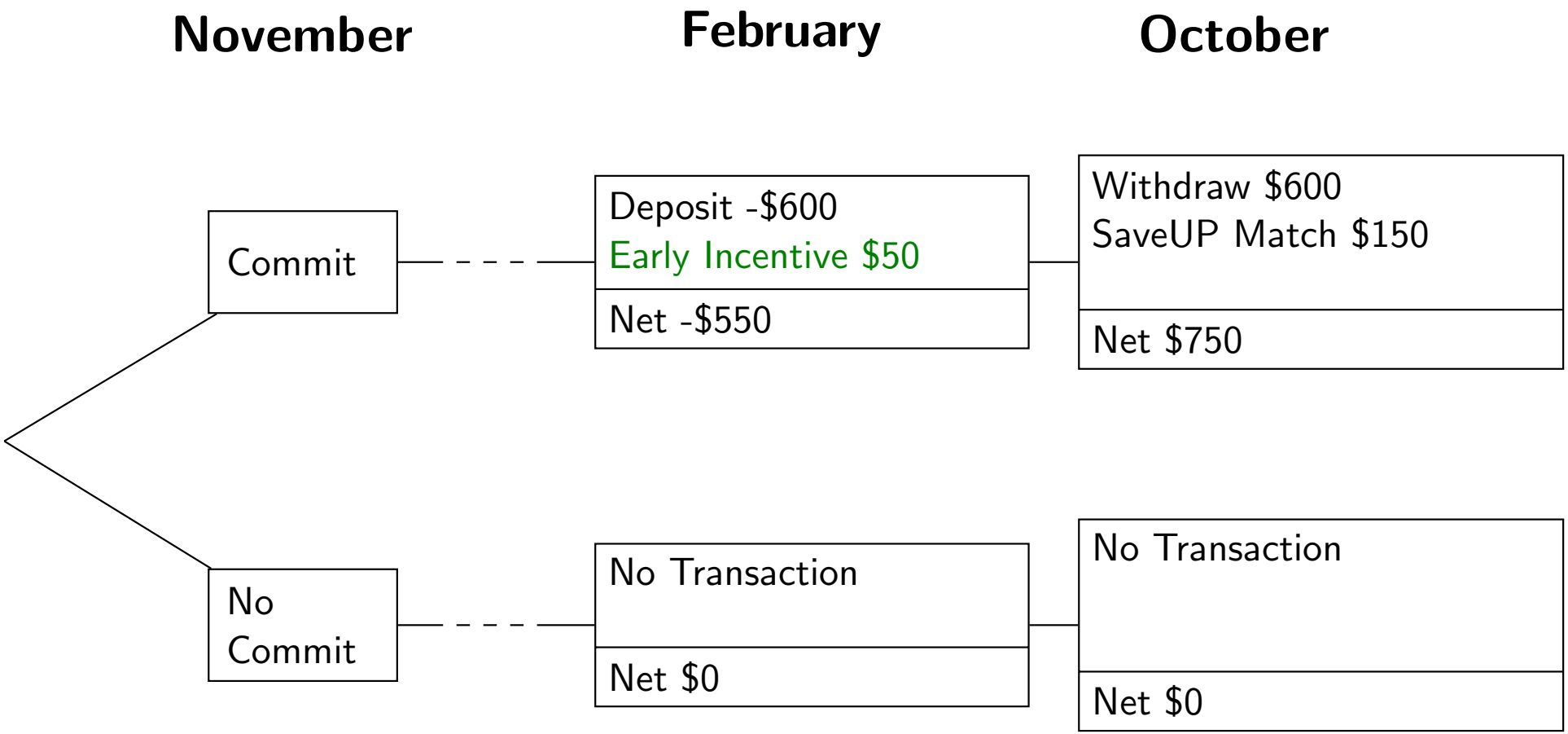

Model Overview

1. Our main test consists of measuring the relative effect of the "immediate" and "delayed" incentives and comparing that to the relative effect of the "early" and "late" incentives
2. We cannot implement a binding commitment and instead use a "soft commitment"
    - Our test is not based on demand for commitment nor reversal of the initial commitment decision
3. Our test does not rely on different levels of savings between the commitment option and the no-commitment option groups
4. Start with simple case of certainty and move on to a case of uncertainty

Preferences

- Individuals maximize "$\beta - \delta$" preferences (e.g. Laibson 1997, O'Donoghue and Rabin 1999):

$$U_t = u_t + \beta \sum_{\tau=t+1}^{T} \delta^{\tau-t} \cdot u_\tau$$

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- Individuals hold beliefs, $\hat{\beta}$ about future values of β

$$U_{t+k} = u_{t+k} + \hat{\beta} \sum_{\tau=t+k+1}^{T} \delta^{\tau-t} \cdot u_\tau$$

Preferences

- In Period t, utility in period $t+k$ and $t+k+j$ are discounted by a factor of δ^j
- In Period t, it is believed that when period $t+k$ arrives, the discount factor will be $\hat{\beta}\delta^j$
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Everyone is either:

1. time consistent (TC) $\beta = \hat{\beta} = 1$
2. time-inconsistent (PB) and naive $\beta < \hat{\beta} = 1$
3. time-inconsistent (PB) and sophisticated $\beta = \hat{\beta} < 1$

Additional Assumptions

- We model the discrete choice of saving as an "investment good" (DellaVigna and Malmendier 2004)
  - Individuals incur some cost of saving, c, in Period 2 (e.g. February)
  - The benefit of saving, b, is realized in Period 3 (e.g. October)

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$$\begin{aligned} \text{TC:} \quad & -c + \delta b \\ \text{PB:} \quad & -c + \beta\delta b \end{aligned}$$

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- Individuals face borrowing constraints (no arbitrage)

Notation and Timing

- Agents make soft-commitment decision in Period 1 (e.g. November) prior to tax-filing season:

$$a_1 \in \{0, 1\}$$

  Agents make final savings decision in Period 2 (e.g. February):

$$a_2 \in \{0, 1\}$$

- Reward for honoring prior soft-commitment is realized in Period 3 (e.g. October):

$$p(a_1, a_2) = p \cdot \mathbf{1}\{a_1 = a_2\}$$

Certainty Case

- $(c, b) \sim G(\cdot)$, unobservable to the researcher
- Individuals know in Period 1 what (c, b) will be

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TC:	$\mathbb{E}[a_1 \mid C]$	$=$	$\mathbb{E}[a_2 \mid C]$	$=$	$\mathbb{E}[a_2 \mid NC]$
Sophisticated:	$\mathbb{E}[a_1 \mid C]$	$=$	$\mathbb{E}[a_2 \mid C]$	$\geq$	$\mathbb{E}[a_2 \mid NC]$
Naive:	$\mathbb{E}[a_1 \mid C]$	$\geq$	$\mathbb{E}[a_2 \mid C]$	$\geq$	$\mathbb{E}[a_2 \mid NC]$

▸ Proof

Uncertainty Case

- In Period 1, Agent n only knows that $(c, b) \sim G_n(\cdot)$
- (c, b) revealed to Agent in Period 2
- Utility is now quasilinear
- Savings decision in Period 2 remains the same
- Soft-Commitment decision in Period 1 is now different

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$$V_{a_1=1} = \iint_{-c+\hat{\beta}\delta b \geq -\hat{\beta}\delta p} \left[-c + \delta\left(b + p\right)\right] \mathrm{dG}_n\left(c, b\right)$$

$$V_{a_1=0} = \iint_{-c+\hat{\beta}\delta b \geq \hat{\beta}\delta p} \left[-c + \delta b\right] \mathrm{dG}_n\left(c, b\right) + \iint_{-c+\hat{\beta}\delta b < \hat{\beta}\delta p} \left[\delta p\right] \mathrm{dG}_n\left(c, b\right)$$

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- $a_1 = 1$ if $V_{a_1=1} \geq V_{a_1=0}$

No Commitment Option (NC)

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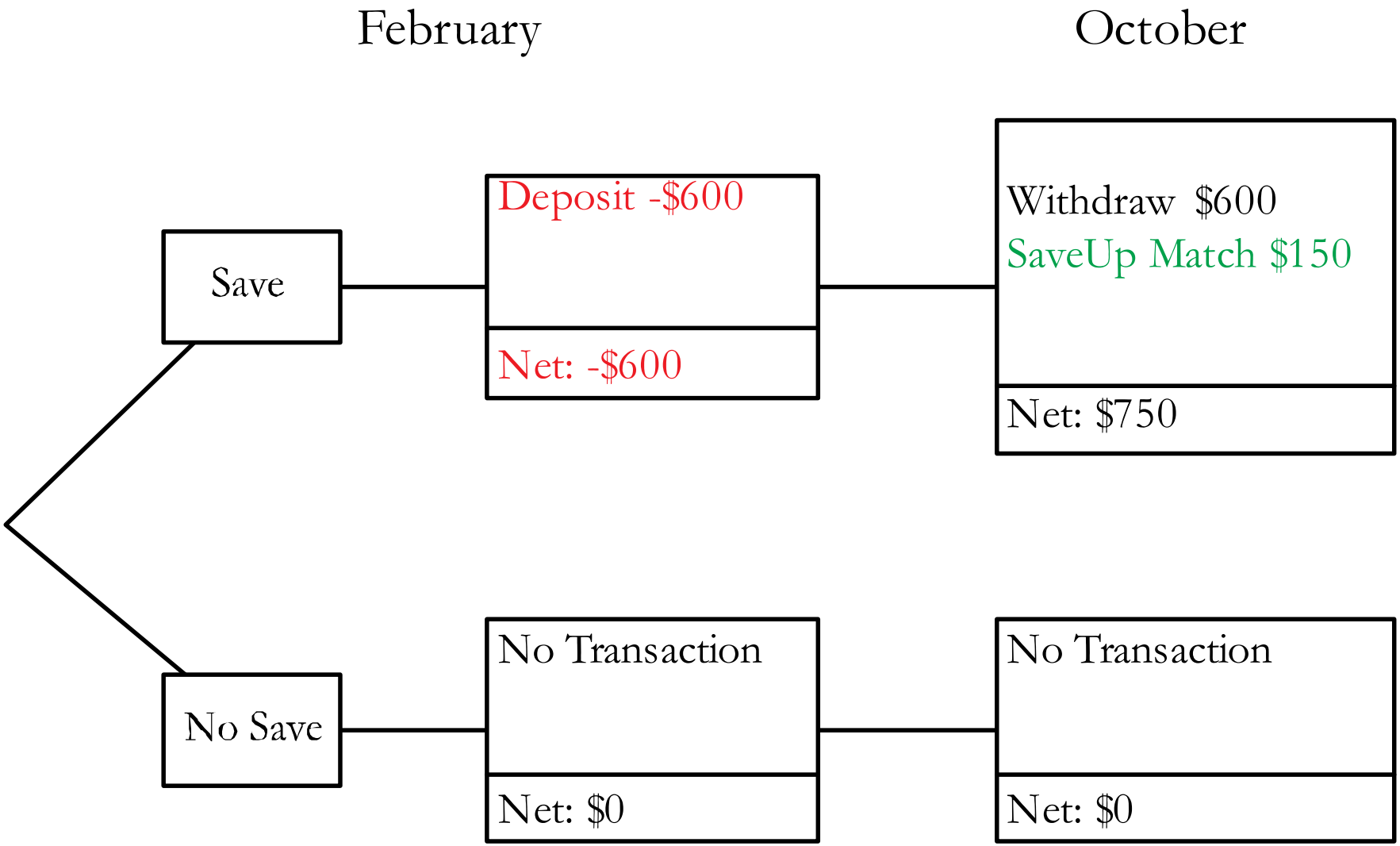
$$\Longrightarrow \frac{\partial \mathbb{E}\left[a_2 \middle| NC\right] / \partial d}{\partial \mathbb{E}\left[a_2 \middle| NC\right] / \partial i} = \beta\delta$$

Full Experiment: No Commitment Option (NC)



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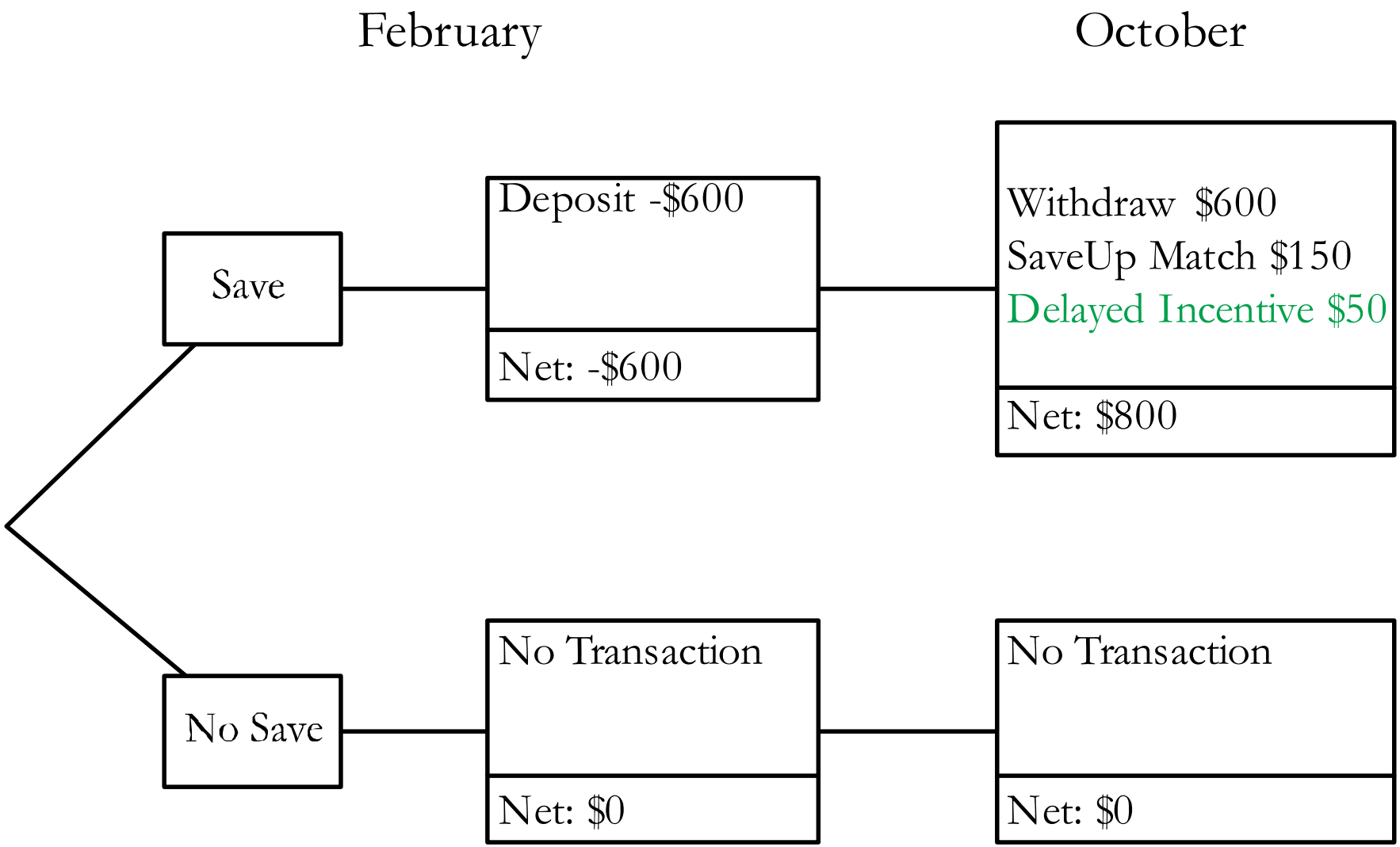

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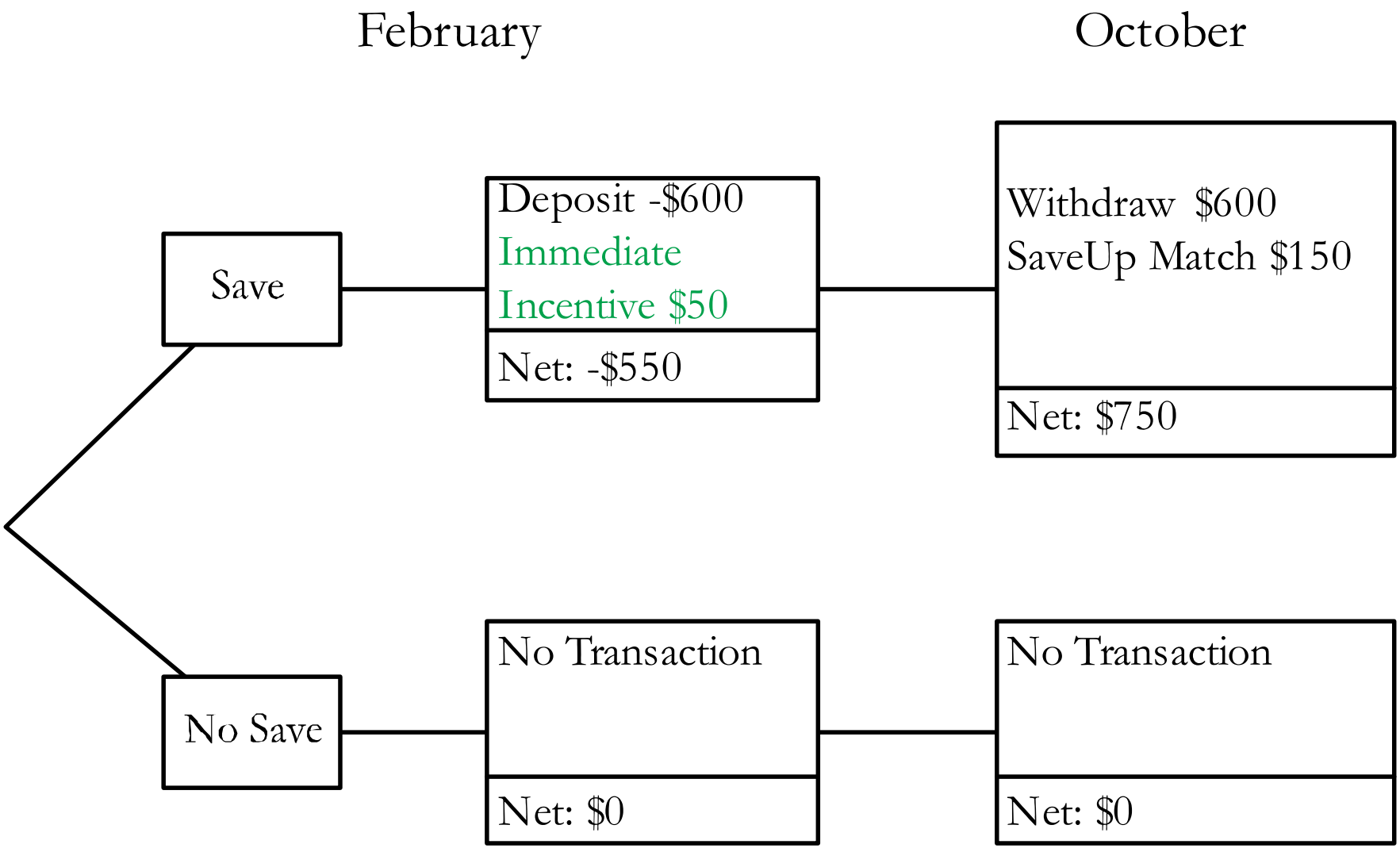

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$$\Longrightarrow \frac{\partial \mathbb{E}\left[a_1 \middle| C\right] / \partial l}{\partial \mathbb{E}\left[a_1 \middle| C\right] / \partial e} = \delta$$

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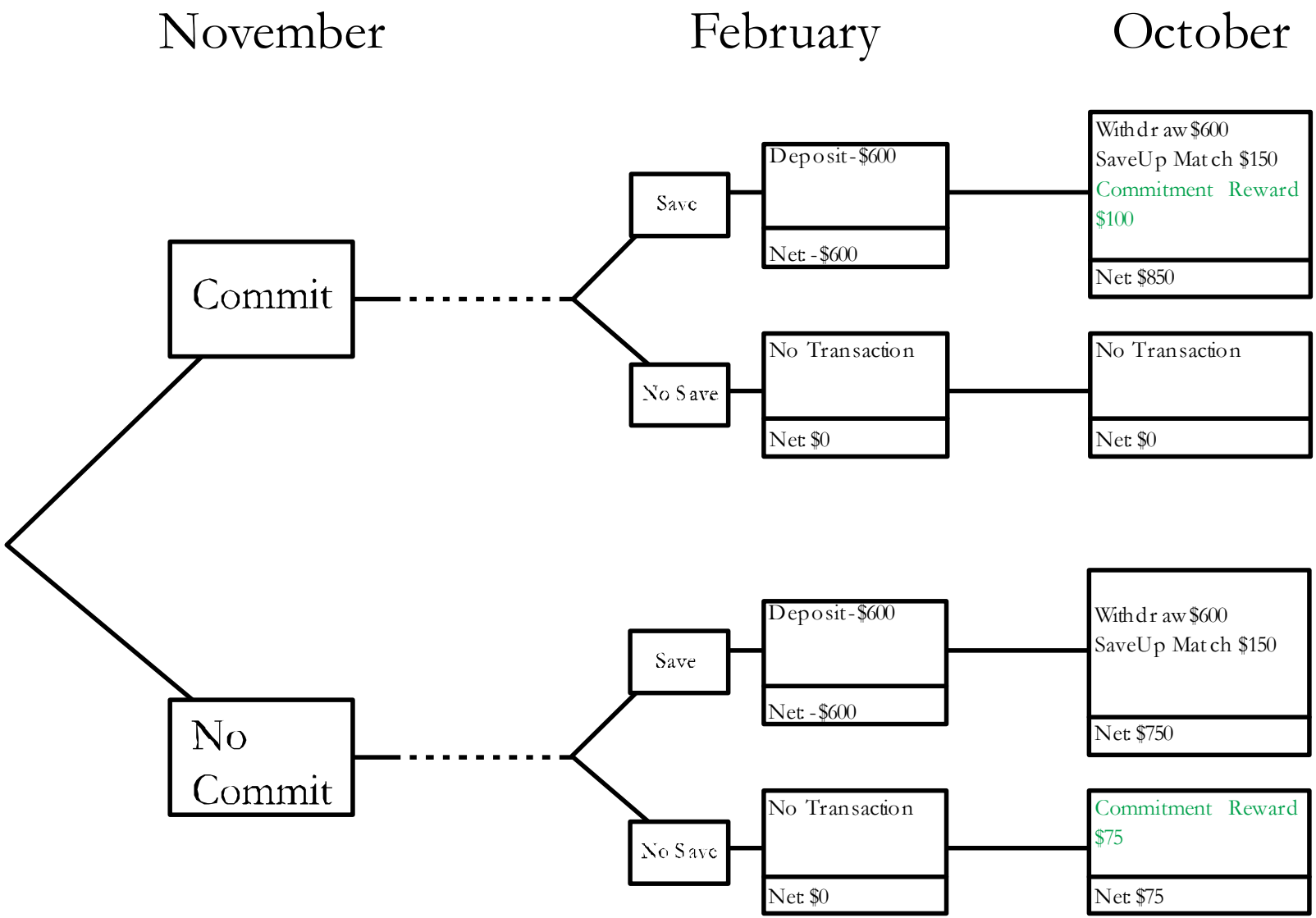

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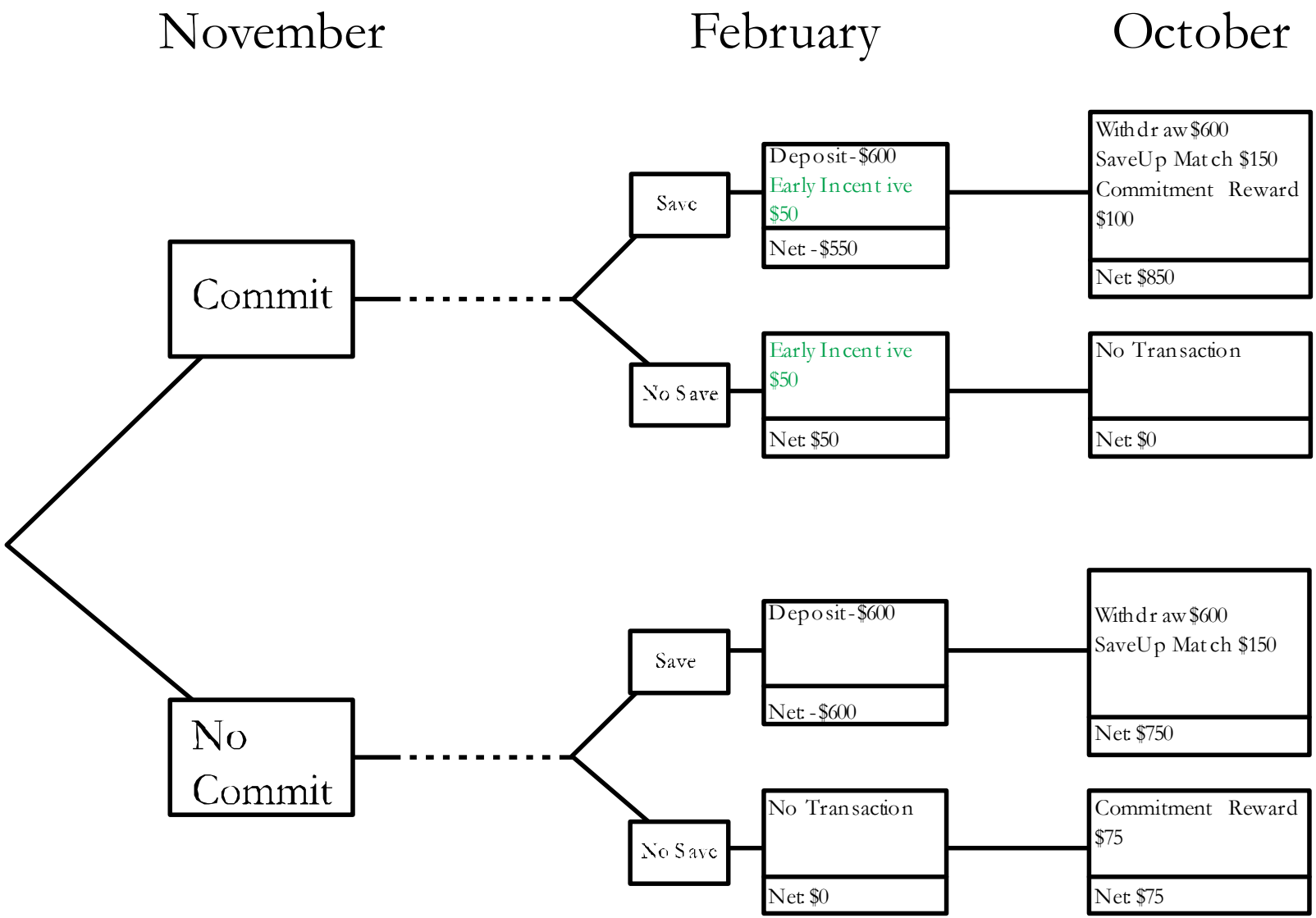

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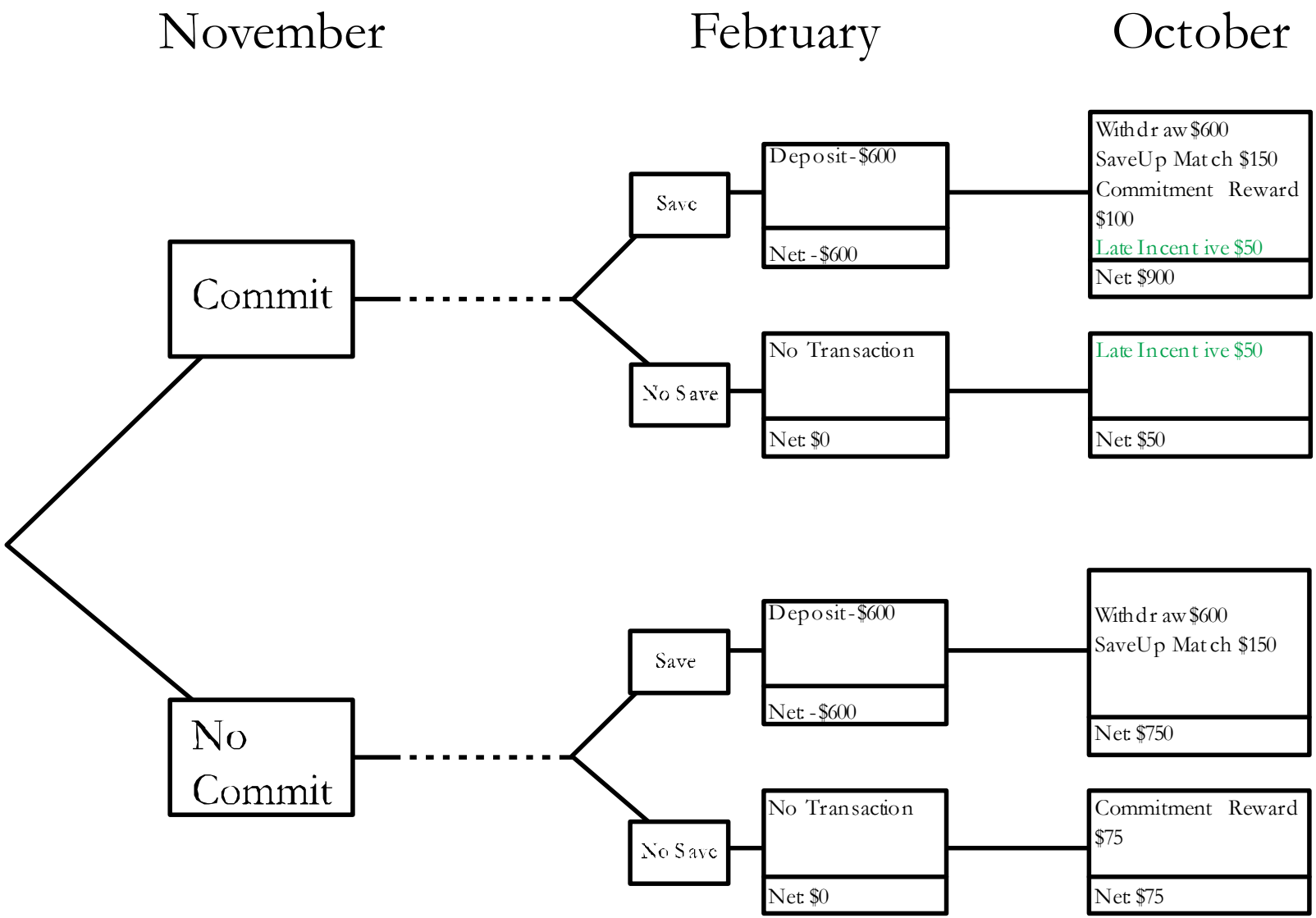

Outline

SaveUP Study

- Partnered with a non-profit tax preparation and financial coaching organization in NYC
  - Clients have previously been offered savings options during the tax season in the form of the SaveNYC account
- We offer a similar savings accounts: SaveUp and SaveUpFront
  - Savings decisions are combined with survey and tax return data to test for time consistency
- Magnitude of incentives are less generous than SaveNYC:
  - 50% match rate on deposit amount above \$300 but below \$1,000
  - $(p, i, d, e, l) = (\$75 - \$100, \$50, \$50, \$50, \$50)$

SaveUP Study

- SaveUp involves six treatment groups
- 3 groups are offered the SaveUp account which only involves a savings decision during the tax season
  - Baseline group, immediate and delayed incentives
- The other 3 are offered the SaveUpFront account, which includes a (non-binding) soft-commitment decision prior to tax season and final savings decision during tax season
  - Baseline group, early and late incentives
- In general, the savings account is a CD that with a maturity horizon of 8 months, and return varying depending on group and commitment decisions

SaveUP Study: Time Line

- December 2010 - January 2011:
  - Participants assigned to treatment groups and sent information in mail
  - Calls made to enroll participants in study and ask survey questions
  - Pre-commitment decisions collected from relevant groups
- February 2011 - April 2011:
  - Participants who show up at tax site make an actual savings decision
  - Commitment group members are reminded of prior commitment
  - Additional participants added to the study to increase sample size, and previously unreached participants are re-incorporated into the study

SaveUP Study: Time Line

- October 2011 - December 2011:
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- October 2012 - December 2012:
  - Savings matches are deposited into accounts

SaveUP Pilot Study: Sample Selection

- Initial pool of participants chosen from a subset of non-profit clients
  - Eligibility based on Prior Year refund $\geq$ \$300
  - Individuals randomly assigned to one of 6 treatment groups
- Additional participants were recruited during tax season, from additional client rolls and from walk-in tax clients
- Members of initial pool not reached during pre-tax season are re-incorporated if encountered later

Outline

Treatment Group Balance

Baseline Observables

	Commitment Groups			Non-Commitment Groups		
	Early	Late	Control	Immed.	Delayed	Control
Age	41.4	42.8	41.8	40.8	38.5*	40.8
Female	0.66	0.66	0.72	0.65	0.57	0.69
2009 AGI	$18,234	$18,681	$17,986	$17,459	$17,479	$15,813*
2009 Refund	$2,214	$2,222	$2,132	$1,990	$1,858	$2,157
Dependents	0.71	0.60	0.65	0.54	0.55	0.65
Married	0.09	0.11	0.14	0.12	0.14	0.10
$\leq$HS	0.54	0.48	0.51	0.53	0.54	0.52
College	0.04	0.04	0.04	0.04	0.04	0.05
Afr-Am	0.49	0.50	0.50	0.53	0.55	0.47
Asian	0.04	0.03	0.03	0.01	0.01	0.04
Hispanic	0.30	0.31	0.32	0.31	0.29	0.31
White	0.04	0.07	0.04	0.06	0.06	0.07
Banked	0.79	0.72	0.75	0.73	0.81	0.76
N	140	140	137	139	140	137

Key Challenge: Sample Attrition

Treatment Group Survival Rates

	Commitment Groups			Non-Commitment Groups		
	Early	Late	Control	Immed.	Delayed	Control
Phone Call	0.39	0.38	0.31	0.15***	0.23***	0.20***
Phone Consent	0.21	0.20	0.14	0.09***	0.013***	0.11***
On-site	0.08	0.13	0.09	0.04	0.08	0.10
Conditional on Phone Call						
Phone Consent	0.54	0.50	0.43	0.52	0.56	0.54
On Site	0.20	0.30	0.28	0.23	0.30	0.38
N	140	140	137	139	140	137

Key Challenge: Sample Attrition

- Sample attrition creates several challenges
  - Unconditional outcomes combine choices and attrition
  - Remaining sample is small $\rightarrow$ imprecise estimates
  - Selection potentially correlated with outcomes
- Will focus on estimates conditional on survival
- Will bound estimates to adjust for attrition
  - Attrition only appears to be mildly related to observables, between treatment groups

▸ Attrition Balance

Outcomes by Treatment Group

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	Commitment Groups			Non-Commitment Groups		
	Early	Late	Control	Immed.	Delayed	Control
Pre-Commit	0.14***	0.14***	0.05	-	-	-
Saving	0.09	0.06	0.06	0.04	0.004	0.04
Saving Amount	47.50	60.67	30.56	36.01	37.56	32.74
N	140	140	137	139	140	137

Outcomes Conditional on Phone Consent

Outcomes by Treatment Group						
	Commitment Groups			Non-Commitment Groups		
	Early	Late	Control	Immed.	Delayed	Control
Pre-Commit	0.69**	0.71**	0.37	-	-	-
Saving	0.24	0.36	0.26	0.17	0.17	0.13
Saving Amount	212.07	257.93	141.42	154.17	128.22	95.73
N	29	28	19	15	12	18

Outcomes Conditional on Site Appearance

Outcomes by Treatment Group

	Commitment Groups			Non-Commitment Groups		
	Early	Late	Control	Immed.	Delayed	Control
Pre-Commit	0.64*	0.56	0.31	-	-	-
Saving	0.73	0.67	0.62	1.00***	0.64	0.43
Saving Amount	604.55	471.89	322.08	834.33***	478.00	320.43
N	11	18	13	6	11	14

Simple Test Under No Uncertainty (Year 1)

	(1)	(2)	(3)
	$\mathbb{E}[a_1 \mid C]$	$\mathbb{E}[a_2 \mid C]$	$\mathbb{E}[a_2 \mid NC]$
Conditional on Participation	0.618	0.666	.612
	[0.056]	[0.073]	[0.088]
Balanced Sample	0.724	0.759	0.583
	[0.085]	[0.081]	[0.145]

Estimation Under Uncertainty

- Use linear probability models to estimate four reduced form parameters:

$$\left(\frac{\partial \mathbb{E}\left[a_1 \middle| C \right]}{\partial e}, \frac{\partial \mathbb{E}\left[a_1 \middle| C \right]}{\partial l}, \frac{\partial \mathbb{E}\left[a_2 \middle| NC \right]}{\partial i}, \frac{\partial \mathbb{E}\left[a_2 \middle| NC \right]}{\partial d} \right)$$

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- The first two are estimated from the treatment effect on soft-commitment decisions, using Groups 1 (Early Incentive e), 2 (Late Incentive l) and 3:

$$a_1 = \gamma_e T_1 + \gamma_l T_2 + \Gamma_2 \mathbf{X} + \varepsilon_2$$

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- Use linear probability models to estimate four reduced form parameters:

$$\left(\frac{\partial \mathbb{E}\left[a_1 \middle| C \right]}{\partial e}, \frac{\partial \mathbb{E}\left[a_1 \middle| C \right]}{\partial l}, \frac{\partial \mathbb{E}\left[a_2 \middle| NC \right]}{\partial i}, \frac{\partial \mathbb{E}\left[a_2 \middle| NC \right]}{\partial d} \right)$$

- The first two are estimated from the treatment effect on soft-commitment decisions, using Groups 1 (Early Incentive e), 2 (Late Incentive l) and 3:

$$a_1 = \gamma_e T_1 + \gamma_l T_2 + \Gamma_2 \mathbf{X} + \varepsilon_2$$

- And the second two are likewise estimated on saving among Group 4 (Immediate Incentive i) or Group 5 (Delayed Incentive d) relative to Group 6:

$$a_2 = \gamma_i T_4 + \gamma_d T_5 + \Gamma_1 \mathbf{X} + \varepsilon_1$$

Treatment Effects for Soft-Committment (C)

	(1)	(2)	(3)	(4)
	γ_e		γ_l	
Treatment Effect	0.321	0.306	0.346	0.352
	[0.143]**	[0.143]**	[0.143]**	[0.144]**
Mean Outcome	0.368	0.372	0.368	0.372
	[0.113]***	[0.110]***	[0.113]***	[0.110]***
Treatment Bounds				
Upper Bound	0.443	0.428	0.459	0.461
	[0.132]***	[0.130]***	[0.134]***	[0.133]***
Lower Bound	0.113	0.099	0.152	0.169
	[0.161]	[0.157]	[0.166]	[0.170]
N	76/417	76/417	76/417	76/417
Controls	No	Yes	No	Yes

Treatment Effects for Savings (NC)

	(1)	(2)	(3)	(4)
	γ_i		γ_d	
Treatment Effect	0.571	0.431	0.208	0.225
	[0.139]***	[0.178]**	[0.207]	[0.200]
Mean Outcome	0.429	0.450	0.429	0.450
	[0.139]***	[0.123]***	[0.139]***	[0.123]***
Treatment Bounds				
Upper Bound	1.353	1.173	0.380	0.410
	[0.713]*	[0.656]	[0.364]	[0.357]
Lower Bound	-0.015	-0.176	0.079	0.074
	[0.574]	[0.592]	[0.311]	[0.305]
N	31/416	31/416	31/416	31/416
Controls	No	Yes	No	Yes

Estimating Time Preferences

- Recall from the model:

$$\frac{\partial \mathbb{E}\left[a_1 \middle| C\right] / \partial I}{\partial \mathbb{E}\left[a_1 \middle| C\right] / \partial e} = \frac{\gamma_I}{\gamma_e} = \delta$$

and

$$\frac{\partial \mathbb{E}\left[a_2 \middle| NC\right] / \partial d}{\partial \mathbb{E}\left[a_2 \middle| NC\right] / \partial i} \Bigg/ \frac{\partial \mathbb{E}\left[a_1 \middle| C\right] / \partial I}{\partial \mathbb{E}\left[a_1 \middle| C\right] / \partial e} = \frac{\gamma_d}{\gamma_i} \Bigg/ \frac{\gamma_I}{\gamma_e} = \beta$$

Estimates for Time Preference Parameters

	(1)	(2)	(3)	(4)
	δ		β	
Point Estimate	1.077	1.152	0.338	0.453
	[0.395]***	[0.428]**	[0.301]	[0.375]
Upper Bound	4.078	4.645	1.933	2.413
	[5.914]	[7.462]	[2.740]	[3.242]
Lower Bound	0.344	0.394	0.014	0.014
	[0.384]	[0.411]	[0.060]	[0.061]
N	76/417	76/417	134/833	134/833
Controls	No	Yes	No	Yes

Alternative Explanations

- A key assumption made was one of quasilinear utility
- The observed patterns might instead be due to curvature in utility, shocks to marginal utility and rising income profiles
- To address these concerns, we:
  - Use alternative estimation methods that allow for risk aversion
  - Survey participants on their expected income flows (Year 2)
  - Amend our discrete choice model to allow for risk aversion (Forthcoming)

Using Continuous Savings Decision

- We collect a continuous savings decision during tax season
- We can use the Convext Time Budget (CTB) method of Andreoni and Sprenger (2012)
- Requires variation in (r, k, t)
  - We can only estimate $M(\beta\delta, \gamma)$
  - Assume values for γ and income profile $\triangle w$, back out $\beta\delta$

Using Continuous Savings Decision

Estimate of $\beta\delta$ for different levels of Risk Aversion (Year 1)

	OLS			Tobit		
	$\triangle w = 0\%$	$= 10\%$	$= 25\%$	$\triangle w = 0\%$	$= 10\%$	$= 25\%$
$\gamma = 1$	0.430	0.451	0.489	0.361	0.378	0.405
	[0.055]	[0.060]	[0.069]	[0.057]	[0.062]	[0.071]
$\gamma = 2$	0.277	0.306	0.359	0.196	0.214	0.246
	[0.071]	[0.081]	[0.102]	[0.062]	[0.070]	[0.086]
$\gamma = 3$	0.178	0.207	0.263	0.106	0.121	0.150
	[0.068]	[0.082]	[0.112]	[0.051]	[0.060]	[0.078]
$\gamma = 4$	0.115	0.140	0.193	0.058	0.069	0.091
	[0.059]	[0.074]	[0.109]	[0.037]	[0.045]	[0.063]
N	20	20	20	46	46	46

Measuring Increasing Income Profiles (Year 2)

	(1)	(2)	(3)	(4)
	Full Sample	Commitment Group	Non-Commitment Group	Panel Only
Expected Growth (Nov.)	0.096 [0.046]**	0.134 [0.079]*	0.058 [0.047]	0.066 [0.043]
Expected Growth (Feb.)	0.124 [0.025]***	0.104 [0.027]***	0.174 [0.059]***	0.098 [0.036]***
Difference	0.028 [0.053]	-0.029 [0.083]	0.116 [0.075]	0.032 [0.056]
N	225	120	87	88

Outline

Key Challenge: Sample Attrition

Treatment Group Survival Rates

	Commitment Groups			Non-Commitment Groups		
	Early	Late	Control	Immed.	Delayed	Control
Phone Call	0.17	0.24	0.22	0.25	0.16	0.22
Phone Consent	0.15	0.22	0.17	0.20	0.14	0.17
On-site	0.16	0.20**	0.19*	0.12	0.13	0.12
Conditional on Phone Call						
Phone Consent	0.89	0.90	0.78	0.80	0.85	0.78
On-site	0.62**	0.63*	0.61*	0.41	0.50	0.43
N	166	166	165	166	166	165

Treatment Effects for Soft-Committment (C) (Year 2)

	(1)	(2)	(3)	(4)
	γ_e		γ_l	
Treatment Effect	−0.159	−0.088	−0.012	0.093
	[0.136]	[0.136]	[0.120]	[0.122]
Mean Outcome	0.679	0.616	0.679	0.616
	[0.090]***	[0.093]***	[0.090]***	[0.093]***
N	497	494	497	494
Controls	No	Yes	No	Yes

Treatment Effects for Savings (NC) (Year 2)

	(1)	(2)	(3)	(4)
	γ_i		γ_d	
Treatment Effect	0.050	0.046	0.029	0.012
	[0.160]	[0.177]	[0.158]	[0.179]
Mean Outcome	0.400	0.407	0.400	0.407
	[0.112]***	[0.125]***	[0.112]***	[0.125]***
N	497	494	497	494
Controls	No	Yes	No	Yes

Estimates for Time Preference Parameters (Years 1 & 2)

	(1)	(2)	(3)	(4)
	δ		β	
Point Estimate	1.077	1.152	0.496	0.479
	[0.395]***	[0.428]**	[0.645]	[0.645]
Upper Bound	4.078	4.645	11.712	12.554
	[5.914]	[7.462]	[73.428]	[88.536]
Lower Bound	0.344	0.394	0.039	0.030
	[0.384]	[0.411]	[0.129]	[0.118]
N	76/417	76/417	168/1,330	168/1,327
Controls	No	Yes	No	Yes

Outline

Summary of Results

- Design field experiment and methodology to test for time-inconsistency
- Pattern of pre-commitment and savings decision consistent with present-bias
  - Immediate incentive is 2 - 3 times as effective as the delayed incentive
  - Manipulating the timing of savings incentives may improve cost-effectiveness
  - Not sufficient for welfare gain (although see Bernheim, et al. 2013)
- Point estimates for $\beta < 1$, though not always statistically significantly different
- Point estimates for β and δ translate into an annual discount rate between $79\% - 164\%$
  - Previous estimates 49% (Laibson et al., 2007), 153% (DellaVigna and Paserman, 2005) and 238% (Fang and Silverman, 2009)
- Challenges to implementation: attrition and ceiling effects

Key Takeaways

- Significant barriers to saving
  - Take up is relatively low considering a 50% match rate
- Upfront costs to saving matter
  - Relaxing costs of opening the savings account were more effective than backloaded incentives
- Savings decisions in advance were higher
  - Leveraging long-run discount rates using advance decisions
  - However, attrition limits the effectiveness of longitudinal interventions

Savings Decision in Period 2

No Commitment Option

$a_2 = 1$ implies:

TC	PB
$\delta b \geq c$	$\beta\delta b \geq c$

▸ Deterministic Case

Savings Decision in Period 2

Commitment Option

$a_2 = 1$ implies:

	TC	PB
$a_1 = 0$	$\delta(b-p) \geq c$	$\beta\delta(b-p) \geq c$
$a_1 = 1$	$\delta(b+p) \geq c$	$\beta\delta(b+p) \geq c$

▸ Deterministic Case

Savings Decision in Period 1

Time Consistent Agent

	$a_{1,C}$	$a_{2,C}$	$a_{2,NC}$
$c \leq \delta b$	1	1	1
$c > \delta b$	0	0	0

▸ Deterministic Case

Savings Decision in Period 1

Time Inconsistent Agent - Sophisticated

	$a_{1,C}$	$a_{2,C}$	$a_{2,NC}$
$c \leq \beta\delta b$	1	1	1
$\beta\delta b < c \leq \beta\delta (b+p)$	1	1	0
$\beta\delta (b+p) < c \leq \delta b$	0	0	0
$\delta b < c$	0	0	0

Assumes: $\beta\delta b + p \leq \delta b$

▸ Deterministic Case

Savings Decision in Period 1

Time Inconsistent Agent - Naive

	$a_{1,C}$	$a_{2,C}$	$a_{2,NC}$
$c \leq \beta\delta b$	1	1	1
$\beta\delta b < c \leq \beta\delta (b+p)$	1	1	0
$\beta\delta (b+p) < c \leq \delta b$	1	0	0
$\delta b < c$	0	0	0

Assumes: $\beta\delta b + p \leq \delta b$

▸ Deterministic Case

Treatment Group Balance after Attrition

Baseline Observables for those Consenting

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Age	41.3	44.2	43.6	35.8	38.6	46.2
Female	0.69	0.63	0.89	0.82	0.47	0.73
2009 AGI	$22,089	$20,596	$24,471	$21,436	$20,191	$20,901
2009 Refund	$2,731	$2,784	$1,937	$3,472	$2,045	$3,351
Dependents	1.03	0.61	0.58	1.08	0.44**	1.00
Married	0.21	0.14*	0.05	0.00***	0.06	0.13
$\leq$HS	0.52	0.43	0.53	0.50	0.50	0.47
College	0.03	0.04	0.05	0.00	0.00	0.07
Afr-Am	0.59	0.71	0.63	0.50	0.72	0.60
Asian	0.03	0.04	0.00	0.00	0.00	0.00
Hispanic	0.17	0.11	0.21	0.33	0.17	0.20
White	0.07	0.11	0.05	0.00	0.11	0.13
Banked	0.90	0.82	0.68*	0.58**	0.89	0.87
N	29	28	19	12	18	15

▸ Attrition