

What Will My Account Really Be Worth? An Experiment on Exponential Growth Bias and Retirement Saving

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Overview

Question: Is saving behavior affected by projections of how changes in contributions will impact retirement income?

Method: Field experiment with $\approx 17,000$ employees at Univ. of MN

Findings:

- Individuals sent income projections and general retirement plan materials increased their level of saving
- Employees sent income projections were significantly more likely to:
 - engage in retirement planning,
 - be certain about expected retirement income, and
 - report greater satisfaction with their financial condition.
- Effect moderated by high rates of time preference, liquidity constraints, and procrastination.
- Effect sensitive to framing

Motivation: Policy

Percent with pensions of different types among Americans with pensions (Buessing & Soto 2006)

	1980	2003	Change
Only Defined Benefit (DB)	60	10	-83%
Only Defined Contribution (DC)	17	62	+265%
Both	23	28	+22%

DC plans require individuals to

- make accumulation/decumulation decisions and bear risk
- navigate mapping from contribution rate to target retirement income

Lifetime Income Disclosure Act (S. 2832): would require DC plans to project lifetime income supported by current retirement savings

Motivation

Evidence for bounded rationality in savings

- Financial literacy is not widespread (Lusardi & Mitchell 2007)
- Powerful effect of defaults (Madrian & Shea 2001, Beshears et al. 2006, Mitchell et al. 2009, Goda & Manchester 2010)
- Saving decisions affected by behavioral factors (Duflo & Saez 2003; Thaler & Benartzi 2004; Choi et al. 2004; Beshears et al. 2006; Choi et al. 2006; Bernheim et al. 2011)
- Exponential growth bias (Wagenaar & Sagaria 1975; Einstein & Hoch 2007; Stango & Zinman 2009; Song 2012)

Contributions of this study

- First study measuring impact of projections on savings behavior
- Investigate influence of projection assumptions
- Follow-up survey provides deeper insights

Overview of Talk

- Simple model of optimal saving
- Experimental design
- Results
 - effects on saving behavior
 - effects on saving process and attitudes
 - heterogeneity: for what kinds of people are effects larger
 - how do incidental aspects of projections matter
- Compare study sample to national sample (FINRA)
- Conclusions

Optimal Saving Problem

Worker's Saving Decision: Given

- A_1 initial wealth
- Y_1 working income, and
- (degenerate) beliefs about:
 - k years until retirement
 - R gross investment return
 - p annuity price

Choose:

- C_1 how much to consume while working (period 1)
- A_2 how much to save for retirement (period 2)

Modeling Accumulation and Decumulation Bias

We introduce bias in individuals' understanding of how savings map to retirement income

- **Accumulation bias (θ):** assets A grow according to $f(R, k, A; \theta) = R^{k\theta} A$ (Stango & Zinman 2010)
 - Unbiased $\Leftrightarrow \theta = 1$; under-estimate exponential returns if $\theta < 1$
 - Literature suggests $\theta < 1$
- **Decumulation bias ($g(\theta)$):** proportional bias in annuity price for individual with accumulation bias θ ; $g(\theta) = p_\theta/p$
 - Unbiased $\Leftrightarrow g(\theta) = 1$; under-estimate rate of annuitization if $g(\theta) < 1$
 - $g(1) = 1$ and $g'(\theta) > 0$

Optimal Saving Problem with Accumulation and Decumulation Bias

Individuals choose A_2 to maximize

$$U(C_1) + \beta^k U(C_2)$$

subject to:

$$\begin{aligned} A_2 + C_1 &= Y_1 + A_1 \\ C_2 &= g(\theta)pR^{k\theta} A_2 \end{aligned}$$

The first-order condition for optimal saving is

$$A_2^* : U'(C_1^*) = g(\theta)pU'(C_2^*)[\beta R^\theta]^k$$

Comparative Statics

$$\text{Define } \epsilon(\theta) \equiv -\frac{U'(C_2^*)}{U''(C_2^*)g(\theta)pR^{k\theta}A_2^*} = -\frac{U'(C_2^*)}{U''(C_2^*)(C_2^*)}.$$

Proposition 1: Given $U'' < 0$, $\beta > 0$, and $R > 1$,

$$\text{sign} [\epsilon(\theta) - 1] = \text{sign} \left[\frac{\partial A_2^*}{\partial \theta} \right]$$

Then ϵ = Elasticity of Intertemporal Substitution (EIS) which governs how savings responds to beliefs about returns.

Implications: Assuming our intervention reduced the amount of bias in θ and $\theta < 1$ pre-intervention, observing an increase (decrease) in saving implies $\epsilon > 1$ ($\epsilon < 1$).

Experimental Context

Setting: University of Minnesota, October 2010 - May 2011

Measure contributions to a *Voluntary Retirement Plan* (VRP):

- Two choices (Optional Retirement Plan, 457 Plan)
- \$16,500 maximum annual tax-deferred contribution
- Range of investment options

Most employees also participate in mandatory retirement plans:

- DB pension for civil service and non-faculty bargaining unit employees
- DC plan for faculty, academic professionals and administrators

Nearly all employees also participate in Social Security.

Design of Treatments (T2)

Treatment Group:	Control	Planning	Balance	Income
General information on saving for retirement and signing up for VRP		✓	✓	✓
Customized information regarding conversion of hypothetical additional contributions to <i>additional account balance</i> at retirement			✓	✓
Customized information regarding conversion of hypothetical additional contributions to <i>additional annual income</i> in retirement				✓

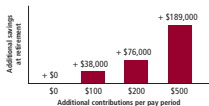
▶ List of Materials

Estimated Retirement Income Statement for

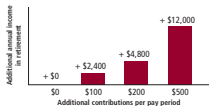
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If I begin making additional contributions now...

...how much additional savings at retirement can I expect to have?



...how much additional annual income in retirement can I expect to receive from these additional savings?



Assumptions. The true values of these future outcomes are uncertain and all projections depend on assumptions. The above projections assume:

- You begin additional contributions this year and continue them until retirement at age 67.
- Your assets earn a 5% rate of return annually.
- You are married and use your account balance at age 67 to purchase a joint survivor annuity which pays a fixed amount as long as either you or your spouse is alive.

Online calculator. You will soon receive an email giving you access to our online calculator. Here, you can personalize the projections further by changing assumptions regarding your:

- Marital status
- Expected retirement age
- Average annual rate of investment return
- Other sources of retirement income

The online calculator will also allow you to input an expected rate of inflation to reflect the above figures in today's dollars.

I am not currently enrolled in a Voluntary Retirement Plan. How do I participate?

- Step 1:** Drop the enclosed Information and Enrollment Kit Request Card in Campus mail (for Twin Cities) or U.S. Mail (for Crookston, Duluth, Morris, or Rochester). In a few weeks you will receive the relevant information and enrollment forms.
- Step 2:** Choose the Optional Retirement Plan or the Section 457 Plan. More information about the differences between the two plans is provided in this brochure.
- Step 3:** Choose your per-pay-period savings rate and complete the Salary Reduction Agreement (ORP) or Retirement Savings Agreement (457 Plan).
- Step 4:** Select an investment company and complete the account enrollment form for the company or companies you select.
- Step 5:** Return the completed forms to:
University of Minnesota
Employee Benefits
100 Donhowe
319 15th Avenue SE
Minneapolis, MN 55455-0103

I already participate in a Voluntary Retirement Plan. How do I change my contribution rate?

- Step 1:** Fill out the enclosed 1-page Salary Reduction Agreement (ORP) or Retirement Savings Agreement (457 Plan) with your new rate or amount.
- Step 2:** Return the form to:
University of Minnesota
Employee Benefits
100 Donhowe
319 15th Avenue SE
Minneapolis, MN 55455-0103

If you want additional information on the investment companies or investment options, please select 'Yes' on the enclosed Information and Enrollment Kit Request Card and drop in Inter-campus mail (for Twin Cities Campus) or U.S. Mail (Crookston, Duluth, Morris, or Rochester).



Preparing for a lifetime is worth a few minutes of your time!

Got questions? Get answers.
Talk to the Employee Benefits Service Center at (612) 624-9090, option 2.

For more information...

To learn more about Retirement Savings Plans at the University of Minnesota, you can:

Call the Employee Benefits Service Center at (612) 624-9090 and select Option 2.

Visit www1.umn.edu/ohr/benefits/retiresave/index.html.

Attend a Voluntary Retirement Program workshop where you will learn about the two plans and your investment options. Call the Employee Benefits Service Center at (612) 624-9090 and select Option 1 for dates and registration.

Retirement Income Online Customization Tool

Fill in your characteristics and assumptions below.
 Then hit the Calculate button at the bottom of the page.

If I begin making additional contributions now...

Current Age:

Expected Retirement Age:

Gender:

Marital Status:

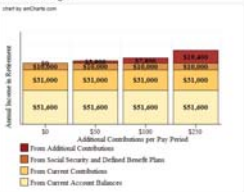
Average Investment Return: %
[\(Historical Rates of Return\)](#)

Adjust Future Values for Inflation: %
[\(No\)](#)

...how much **savings at retirement** can I expect to have?



...how much **annual income in retirement** can I expect to receive from these savings?



Current Contributions per Pay Period

U of M Voluntary Retirement Plans:

Other retirement savings accounts:

Current Account Balances

U of M Voluntary Retirement Plans:

Other retirement savings accounts:

Estimated Annual Income at Retirement Age from Other Sources

Annual Defined Benefit Income:

Annual Social Security Income:

[Social Security estimation calculator](#)

Assumptions. The true values of these future outcomes are uncertain and all projections depend on assumptions. The above projections assume:

- You begin additional contributions this year and continue them until you retire at age 65.
- Your assets earn a 5% rate of return annually.
- Your projections have not been adjusted for future inflation. This is equivalent to assuming future inflation is 0% per year.
- You are married and use your account balance at age 65 to purchase a joint survivor annuity which pays a fixed amount as long as either you or your spouse is alive.

Randomization Procedure

Treatment Groups: We randomize assignment to four experimental groups at the department level

- Minimize contamination because treatment delivered via department-based mail
- Matched-quad randomization to ensure balancing on observable characteristics related to changes in VRP contributions (average participation rate, average age, average salary, department size)

Assumptions: We randomly assign assumptions used in projections at individual level

- Investment return: 3%, 5% or 7%
- Retirement age: 65 or 67
- Contribution increment: {\$50, \$100, \$250} or {\$100, \$200, \$500}

Timeline

Phase	Date	Action
1	October 2010	Pull baseline savings data
2	November 2010	Perform randomization
3	January 2011	Disseminate printed materials
4	March 2011	Disseminate online tool
5	April 2011	Pull final savings data
6	May 2011	Field follow-up survey

Experimental Sample

Sample consists of 16,881 employees who were:

- Eligible to contribute to a Voluntary Retirement Plan
- Present in both October 2010 and May 2011
- Less than age 65 at time of intervention

Sample attrition

- 765 employees left the firm between October and May
- No evidence of differential attrition across treatment groups

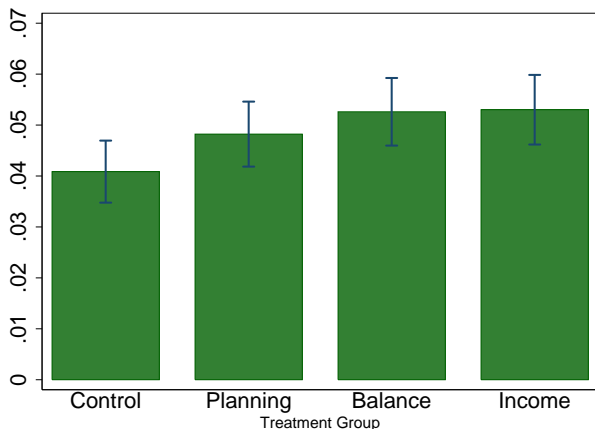
Summary statistics: administrative data

Variable	Mean	SD	Min.	Max.
1(VRP Participant, pre)	0.241	0.428	0	1
1(VRP Participant, post)	0.249	0.432	0	1
VRP Contr. Rate, pre	3.189	8.933	0	100
VRP Contr. Rate, post	3.334	9.157	0	100
VRP Contr. Amount, pre	2323.9	6407.7	0	38500
VRP Contr. Amount, post	2450.1	6589.2	0	38500
1(Female)	0.557	0.497	0	1
Age	44.9	11.16	19	64
Tenure	12.3	9.39	0.30	46.64
Salary, pre	58,387	32527	481	686,587
Salary, post	59,227	33349	481	686,587
1(Faculty Ret. Plan)	0.412	0.492	0	1
1(Twin Cities campus)	0.810	0.393	0	1

Observations: 16,881

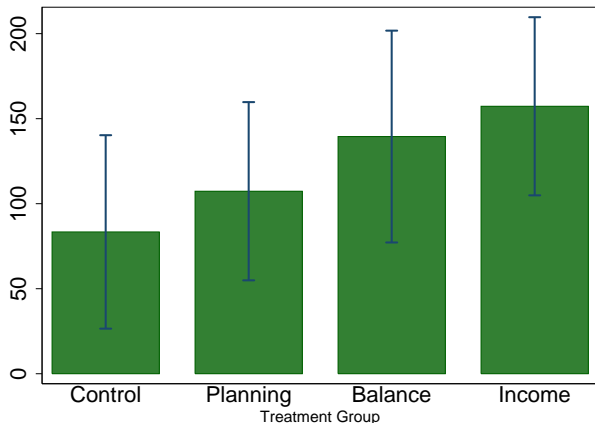
Group means on first measure of saving behavior change

Outcome: $1(\Delta\text{Contribution})$, indicator that there was any change in the election between periods



Group means on second measure of saving behavior change

Outcome: Δ Contributions, period-2 annualized \$ contribution minus period-1 annualized \$ contribution



Regression analysis

We evaluate the effect of treatments by estimating

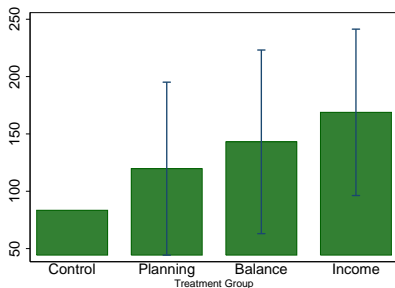
$$S_i = \alpha + T_i\delta + X_i\beta + \eta_q + \epsilon_{i,d} \quad (1)$$

- S_i is one of saving outcomes
- T_i is a vector of treatment group indicators
- X_i is a vector of demographic controls, including quadratics in age and tenure, log salary, percent change in salary, and indicators for gender, faculty, and campus location
- η_q are randomization-quad fixed effects
- $\epsilon_{i,d}$ is clustered at the department-level (d)

Effect of interventions on saving behavior (T3)

Outcome:	1(Δ Contrib.)			Δ Contribs.		
	(1)	(2)	(3)	(4)	(5)	(6)
1(Planning)	0.007 (0.005)	0.009** (0.004)	0.008* (0.004)	23.926 (43.326)	35.979 (37.695)	36.322 (38.473)
1(Balance)	0.012** (0.005)	0.014*** (0.004)	0.014*** (0.004)	56.074 (44.032)	57.482 (40.768)	59.703 (40.850)
1(Income)	0.012** (0.005)	0.013*** (0.004)	0.012*** (0.004)	73.890* (43.465)	89.363** (36.988)	85.424** (37.017)
Quad FEs	No	Yes	Yes	No	Yes	Yes
Controls	No	No	Yes	No	No	Yes
Adj. R ²	0.000	0.013	0.022	0.000	-0.002	0.000
Control Mean	0.0409	0.0409	0.0409	83.4000	83.4000	83.4000
Departments	1,385	1,385	1,385	1,385	1,385	1,385
Individuals	16,881	16,881	16,881	16,881	16,881	16,881

Regression-Adjusted Effects on Δ Contributions



- *Income* group had greater increase in contributions than *control* group (+\$85/year overall, \approx +\$1,150/year among changers)
- Point estimates suggest each component of materials gave rise to income group treatment effect

Implications from Model

Assume

- Control group individuals have negative exponential growth bias ($\theta_C < 1$)
- The intervention reduced bias ($\theta_C < \theta_T \leq 1$)
- Δ Total Savings has same sign as Δ Contributions

Then our results suggest that $EIS > 1$, i.e. substitution effect dominates income effect.

Past evidence estimating EIS:

- Many estimates range between zero and one (e.g., Attanasio and Weber (1993); Scholz, Seshadri and Khitatrakun (2006); Engelhardt and Kumar (2009); for review, see Attanasio and Weber (2010))
- In the realm of retirement savings, studies have found that individual contributions respond positively to returns to saving (e.g., Choi, Laibson and Madrian (2006); Engelhardt and Kumar (2007); Duflo, Gale, Liebman, Orszag and Saez (2006))

Follow-up Survey Analysis

Advantages: Facilitates richer look

- Treatment effects on saving process and attitude outcomes
- Heterogeneity in the treatment effect with respect to
 - Standard-model factors
 - Time-inconsistent preferences
 - Limited cognition
- Insight into channels by which projection assumptions matter

Disadvantage: Non-random subsample

- 22% response rate ($N = 3,688$)
- Survey respondents more likely to be *female, faculty, & participants* relative to full sample
- Treatment effect *larger* among survey respondents

Effect of Interventions on Process and Attitudes

Respondents rate agreement with statements on 7-point scale:

- *"It is difficult to find information that will help me decide how much to save for retirement."*
- *"I am better informed about retirement planning than I was 6 months ago."*
- *"In the last 6 months, have you tried to figure out how much you need to save for retirement?" (Yes/No)*
- *"I understand how savings today could affect my retirement income."*
- *"How certain are you about the amount of annual retirement income you expect your household to have?"*
- *"Overall, thinking of your assets, debts and savings, how satisfied are you with your current personal financial condition?"*

Effect of Interventions on Process and Attitudes (T4)

Outcome:	Diff. to find info	Better informed	1(Figured ret. savings)	Undrstnd sav-inc	Ret. incme certainty	FncI. satisf.
1(Planning)	-0.061 (0.044)	0.067 (0.042)	0.022 (0.021)	-0.002 (0.046)	-0.000 (0.040)	-0.001 (0.040)
1(Balance)	-0.052 (0.048)	0.084** (0.041)	0.018 (0.023)	-0.019 (0.046)	0.009 (0.042)	-0.021 (0.039)
1(Income)	-0.123** (0.048)	0.201*** (0.045)	0.051** (0.021)	0.060 (0.052)	0.102** (0.040)	0.078* (0.040)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R ²	0.026	0.029	0.101	0.016	0.211	0.116
Control Mean	0.0460	-0.0588	0.4356	0.0037	-0.0261	-0.0093
Departments	984	993	994	991	965	992
Individuals	3,573	3,641	3,624	3,651	3,406	3,649

For what kinds of people is treatment effect larger?

Theory suggests 3 classes of factors

- Standard model: time discounting and liquidity constraints
- Time inconsistencies: procrastination and follow-through
- Limited cognition: difficulty gathering and processing information; financial literacy

Test for heterogeneity in treatment effects:

- Measure each factor and convert to z-score
- Interact z-score with treatment indicators and predict behavior
- Coefficients on interaction is how 1 SD difference in factor changes effect of intervention.

Measures of heterogeneity factors

- Standard model
 - *“Nowadays, a person has to live pretty much for today and let tomorrow take care of itself.”*
 - *“In a typical month, how difficult is it for you to cover your expenses and pay all your bills?”*
- Time-inconsistent preferences
 - *“When I make a plan to do something, I am good at following through.”*
 - *“I tend to put off thinking about how much money I need to save for retirement.”*
- Limited cognition
 - *“I find most retirement planning information easy to use.”*
 - *“I find it overwhelming to think about how much I need to save for retirement.”*
 - Financial literacy: a composite of responses to survey items, self-assessment, and “quiz.”

Heterogeneity Effects on Δ Contributions (T5)

DV: Δ Contribution Amount

Z-Moderator	Standard model factors	
	High discount rate "Live for today"	Liquidity constr. "Diff. paying bills"
1(Planning)	172.013 (108.767)	146.577 (107.192)
1(Balance)	183.451 (129.409)	173.288 (128.781)
1(Income)	401.579*** (116.170)	401.085*** (117.583)
Z-Score	2.394 (51.336)	-26.171 (53.890)
Z-Score X 1(Planning)	-35.523 (79.224)	-43.309 (75.277)
Z-Score X 1(Balance)	-2.977 (84.743)	-180.700** (83.514)
Z-Score X 1(Income)	-207.885*** (78.986)	-197.623** (93.474)
Control Mean	108.71	118.66
Departments	992	986
Individuals	3,663	3,604

Heterogeneity Effects on Δ Contributions (T5)

DV: Δ Contribution Amount

Z-Moderator	Time Inconsistency	
	"Follows through"	"Puts off planning"
1(Planning)	158.047 (108.731)	158.972 (108.019)
1(Balance)	157.524 (128.283)	151.808 (128.161)
1(Income)	383.300*** (113.821)	386.044*** (114.392)
Z-Score	-137.920* (76.033)	4.925 (72.924)
Z-Score X 1(Planning)	159.423* (94.861)	33.134 (100.055)
Z-Score X 1(Balance)	108.396 (118.079)	111.631 (116.930)
Z-Score X 1(Income)	320.155*** (114.142)	-233.232** (117.454)
Control Mean	120.28	120.53
Departments	995	992
Individuals	3,675	3,668

Heterogeneity Effects on Δ Contributions (T5)

DV: Δ Contribution Amount

Z-Moderator	Limited Cognition		Fin. Literacy
	"Info easy to use"	"Overwhelming to plan"	
1(Planning)	135.272 (111.412)	142.515 (108.752)	115.836 (103.845)
1(Balance)	132.553 (136.818)	135.518 (128.686)	160.858 (128.438)
1(Income)	397.911*** (120.961)	374.424*** (116.508)	386.580*** (114.769)
Z-Score	-18.209 (72.609)	-32.877 (89.855)	2.904 (22.197)
Z-Score X 1(Planning)	32.419 (104.544)	86.585 (124.129)	15.819 (30.587)
Z-Score X 1(Balance)	125.195 (128.355)	27.426 (136.601)	0.988 (32.733)
Z-Score X 1(Income)	151.770 (120.100)	17.821 (128.115)	45.078 (38.427)
Control Mean	125.85	135.02	121.53
Departments	979	989	991
Individuals	3,512	3,648	3,619

Effects of projection assumptions

Is there evidence that assumptions affected saving behavior? If so, could happen through 3 channels,

- Beliefs: Assumptions may affect beliefs regarding future investment returns, one's retirement age
- Anchoring: Contribution increments used in projection may become focal
- Framing: Larger projections may induce larger response

By randomizing set of assumptions used, we are able to investigate whether treatment effect varied by assumptions

- Restrict attention to balance and income groups
- Examine effect of assumptions on saving outcomes

Relative Projection Magnitude (RPM)

RPM age-normalizes assumptions' effects and varies continuously:

- For older employees, changes in retirement age have large effect
- For younger employees, changes in rate of return have large effect

RPM \equiv

$$\frac{\text{projection printed on brochure}}{\text{projection assuming 3\% return, retire at 65, small contrib. increments}} \quad (2)$$

Effects of projection assumptions on Δ Contribution Amount

DV: Δ Contributions

1(Income)	23.976 (32.765)	24.504 (32.729)	25.188 (32.711)	25.906 (32.843)
1(Inv Ret = 5%)	19.135 (53.581)			
1(Inv Ret = 7%)	-27.962 (53.756)			
1(Ret Age = 67)		73.612* (43.478)		
1(High Axes)			103.881** (44.217)	
ln(RPM)				95.017** (48.376)
Balance Mean	139.47	139.47	139.47	139.47
Departments	681	681	681	681
Individuals	8,484	8,484	8,484	8,484

Channels for assumptions to affect behavior

Given evidence that saving response affected by assumptions used in projections, possible channels:

- Shift beliefs about retirement age and returns
- Anchoring effects
- Framing effects

To assess beliefs channel, examine survey data on:

- age at which they expect to claim retirement benefits,
- average annual real rate of return they expect to earn between now and retirement

Effects of treatments/assumptions on beliefs

Outcome:	Exp. Ret Age	Exp. Return	Exp. Ret Age	Exp. Return
1(Planning)	0.383** (0.162)	0.131 (0.119)		
1(Balance)	0.281 (0.184)	0.095 (0.122)		
1(Income)	-0.086 (0.174)	0.104 (0.119)	-0.336 (0.208)	0.131 (0.134)
Inv Return(%)			-0.033 (0.061)	0.038 (0.040)
1(Ret Age=67)			0.216 (0.209)	0.091 (0.141)
1(Higher axes)			0.141 (0.213)	0.024 (0.135)
Control Mean	65.63	5.29		
Balance Mean			66.00	5.37
Departments	940	847	455	394
Individuals	3,188	2,440	1,537	1,151

Study Survey Sample compared to FINRA Samples

Compare to U.S. population and subsample who are age 18-65, employed, and with employer-provided pensions. Our respondents have:

- higher performance on financial literacy quiz and lower self-assessed financial knowledge (\Rightarrow more accurate),
- more highly educated, whiter, married, less liquidity constrained,
- higher levels of satisfaction with their financial situation.

Source: Sample:	Study		US		FINRA	
	Survey Resp.	Only			18-65 w/empl. pnsn.	
	Mean	SD	Mean	SD	Mean	SD
Fin. satisfaction	5.5	2.7	4.5	2.8	4.9	2.6
Good at day-to-day	5.8	1.4	5.6	1.6	5.7	1.6
Pretty good at math	5.5	1.5	5.6	1.7	5.8	1.6
Keep up with econ. news	4.4	1.7	4.8	1.8	5.0	1.7
Fin. knowledge (self-assess)	4.3	1.5	4.9	1.3	5.1	1.2
Quiz items correct, of 5	4.0	1.0	2.9	1.3	3.2	1.2
Willing to take risks	5.4	2.2	4.3	2.6	5.1	2.5

Source: (Sub-)Sample:	All	Study Survey Resp. Only	US	FINRA Age 18-65 w/ empl. pension
Size/ <i>Subsample</i> %	16,881	21.9%	28,146	28.7%
1(female)	0.56	0.63	0.487	0.545
1(white)		0.90	0.685	0.679
1(married)		0.73	0.534	0.641
Age Indicators				
18-24 years	0.021	0.014	0.135	0.056
25-34 years	0.203	0.172	0.171	0.223
35-44 years	0.246	0.205	0.183	0.278
45-54 years	0.279	0.289	0.196	0.275
55-64 years	0.249	0.320	0.163	0.167
Education Indicators				
Less than HS		0.000	0.035	0.009
HS Grad		0.017	0.293	0.193
Some College		0.118	0.419	0.398
College Grad.		0.346	0.159	0.251
Post-Grad degree		0.520	0.094	0.149
Liquidity - ease paying monthly bills				
Very difficult		0.060	0.185	0.112
Somewhat difficult		0.282	0.444	0.435
Not at all difficult		0.657	0.372	0.453

Conclusions

Summary of Findings

- All treatment groups increased saving relative to control group; largest increase among income group (+\$85/year, +\$1,150/year among changers).
- Under some conditions, results suggest $EIS > 1$
- Evidence that intervention affected saving process
- More optimistic projections raise saving, via framing

Effects of policy initiative on welfare?

- Some misunderstand mapping of contributions to retirement income.
- Projections can help them get on target for goals.
- Low cost, low benefit policy. Will not drive a savings revolution.
- Caution: projection assumptions matter.

Limitations

Experiment differs from proposed policy initiative

- One-time treatment vs. quarterly communication
- Delivered via work-based mail instead of home address
- Sent to both initial participants and non-participants

External Validity

- Sample has high rates of mandatory saving
- Above average education
- University employees may place greater value on benefits than private-sector employees

Appendix: Experimental Materials

	C	P	B	I
Printed Brochures				
General information on saving for retirement		✓	✓	✓
Customized estimated retirement balance			✓	✓
Customized estimated retirement income				✓
Steps to sign up/change contributions to VRP		✓	✓	✓
ORP/457 plan comparison chart		✓	✓	✓
Contribution Change Forms (participants only)		✓	✓	✓
Enrollment Kit Request Card		✓	✓	✓
Online Customization Tool				
Retirement balance with modified assumptions			✓	✓
Retirement income with modified assumptions				✓



Demographics by Treatment Group

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	1(Female)	Age	Tenure	ln(Salary)	% Δ Salary	1(Faculty	Participant	Cont. Amt.
1(Planning)	0.027 (0.021)	-0.021 (0.165)	-0.070 (0.255)	0.009 (0.013)	-0.004 (0.003)	-0.022 (0.023)	0.001 (0.005)	-70.676 (141.216)
1(Balance)	-0.015 (0.021)	0.041 (0.190)	0.069 (0.259)	-0.008 (0.014)	-0.005 (0.003)	-0.005 (0.022)	0.002 (0.005)	94.308 (139.693)
1(Income)	0.061*** (0.023)	0.134 (0.175)	-0.050 (0.275)	-0.001 (0.014)	-0.004 (0.003)	-0.019 (0.025)	0.002 (0.005)	-86.059 (145.598)
Adj. R ²	0.057	0.139	0.065	0.241	0.117	0.151	0.087	0.048
Control Mean	0.5388	44.9451	12.4280	10.8471	0.0190	0.4263	0.2419	2348.3678
Departments	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385
Individuals	16,881	16,881	16,881	16,881	16,881	16,881	16,881	16,881
F-Statistic	4.3253	0.3811	0.1322	0.4994	0.7772	0.4096	0.1123	0.7797
p-value	0.0048	0.7666	0.9409	0.6828	0.5067	0.7461	0.9530	0.5053

- Randomization procedure balanced employees on shaded observable characteristics
- Generally fail to reject hypothesis that there are significant differences in other observables across groups

Survey Response by Treatment Group and Incentives

	(1)	(2)	(3)
1(Planning)	-0.024** (0.010)		-0.021* (0.011)
1(Balance)	-0.039*** (0.010)		-0.042*** (0.011)
1(Income)	-0.028*** (0.010)		-0.030*** (0.011)
1(Incentive)		0.090*** (0.013)	0.083*** (0.029)
1(Incentive) X 1(Planning)			-0.032 (0.039)
1(Incentive) X 1(Balance)			0.006 (0.038)
1(Incentive) X 1(Income)			0.054 (0.039)
Controls	Yes	Yes	Yes
Adj. R ²	0.043	0.048	0.049
Control Mean	0.2402	0.2489	0.2489
Departments	1,385	1,046	1,046
Individuals	16,881	13,667	13,667

Demographics by Treatment Group: Follow-up Survey Sample

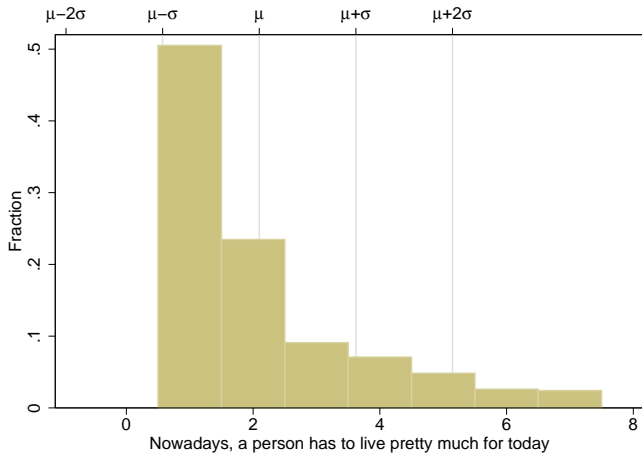
	1(Female) (1)	Age (2)	Tenure (3)	ln(Salary) (4)	% Δ Salary (5)	1(Faculty) (6)	Participant (7)	Cont. Amt. (8)
1(Planning)	-0.001 (0.027)	-0.060 (0.480)	-0.285 (0.461)	0.000 (0.017)	0.001 (0.003)	-0.058** (0.027)	0.007 (0.018)	-220.877 (309.109)
1(Balance)	0.007 (0.029)	0.096 (0.561)	-0.261 (0.498)	-0.011 (0.020)	0.004 (0.003)	-0.001 (0.028)	0.004 (0.018)	-48.095 (307.736)
1(Income)	0.037 (0.027)	1.096** (0.510)	0.174 (0.516)	0.029 (0.018)	0.004 (0.003)	-0.009 (0.030)	0.025 (0.018)	-139.883 (315.246)
Adj. R ²	0.038	0.137	0.059	0.189	-0.010	0.088	0.093	0.027
Control Mean	0.6219	46.5902	13.9888	10.9388	0.0129	0.4652	0.3402	3208.2060
Departments	996	996	996	996	996	996	996	996
Individuals	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688
F-Statistic	0.8783	2.6859	0.3950	1.6723	0.7318	2.0371	0.6906	0.1998
p-value	0.4518	0.0454	0.7566	0.1713	0.5331	0.1070	0.5579	0.8966

- Survey subsample relative to administrative sample: more female, more faculty, more likely to be participants
- However, not much evidence of extreme differences in observable characteristics across treatment groups

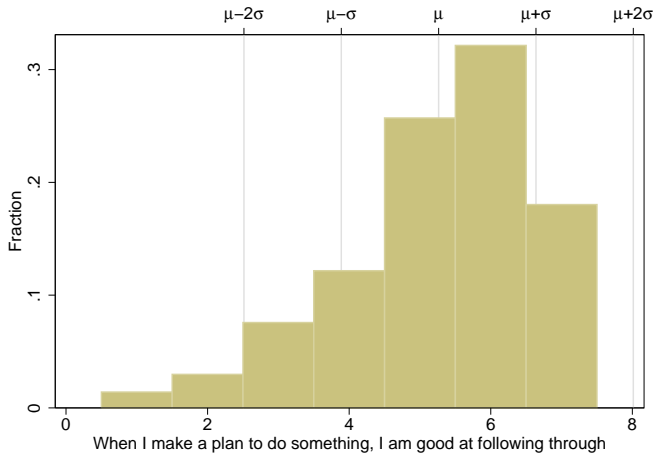
Saving Outcomes: Follow-Up Survey Subsample

	(1)	(2)	(3)	(4)
	1(Δ Part.)	1(Δ Cont.)	Δ Rate	Δ Amt
1(Planning)	0.010 (0.007)	0.032*** (0.012)	0.335* (0.181)	156.591 (108.575)
1(Balance)	0.017** (0.008)	0.051*** (0.013)	0.353* (0.185)	154.868 (128.151)
1(Income)	0.018** (0.007)	0.054*** (0.012)	0.511*** (0.167)	385.563*** (114.828)
Controls	Yes	Yes	Yes	Yes
Adj. R ²	-0.005	0.018	-0.024	-0.017
Control Mean	0.0195	0.0625	0.1282	119.7863
Departments	996	996	996	996
Individuals	3,688	3,688	3,688	3,688

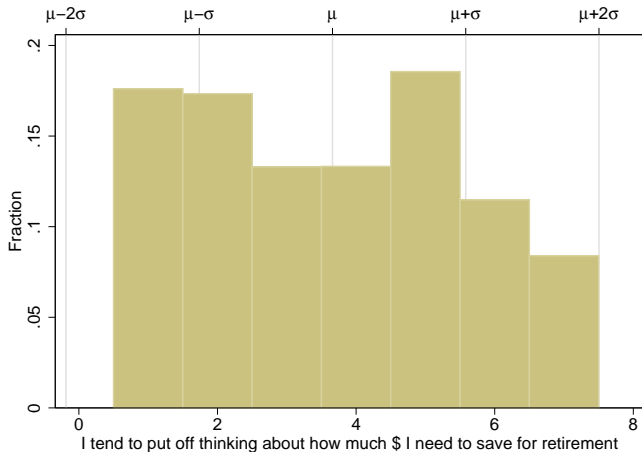
“Nowadays, a person has to live pretty much for today and let tomorrow take care of itself.”



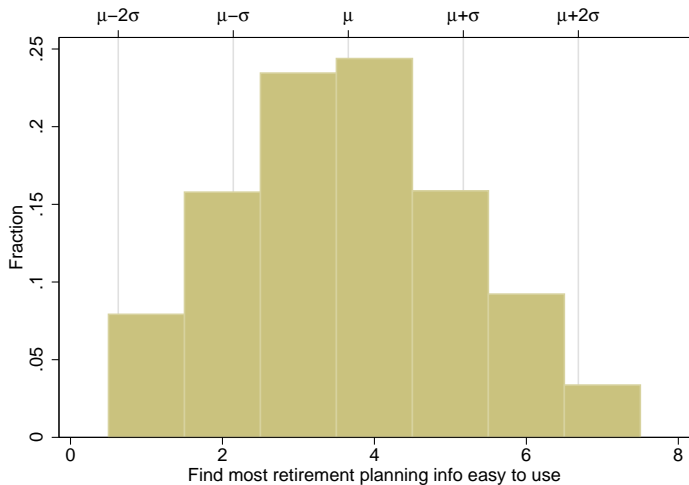
“When I make a plan to do something, I am good at following through.”



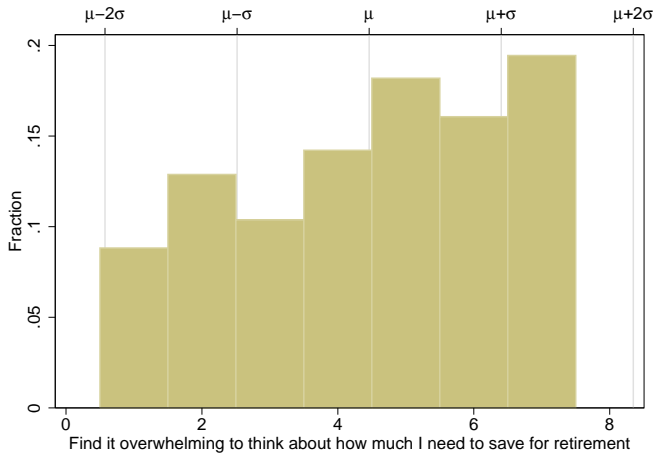
“I tend to put off thinking about how much money I need to save for retirement.”



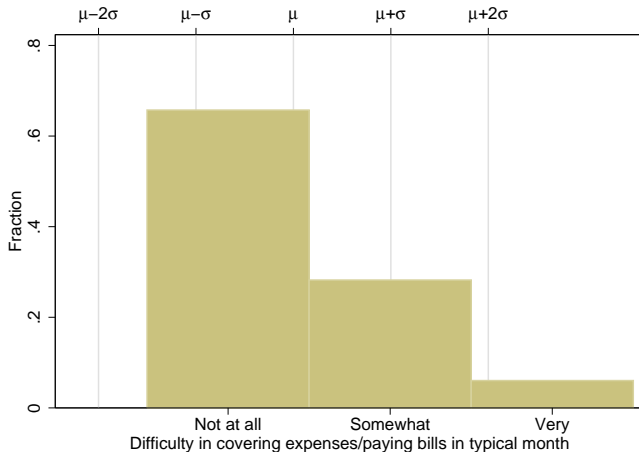
"I find most retirement planning information easy to use."



"I find it overwhelming to think about how much I need to save for retirement."



“In a typical month, how difficult is it for you to cover your expenses and pay all your bills?”



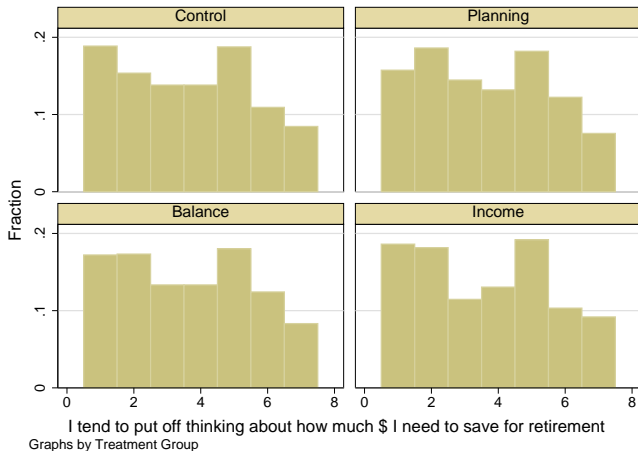
“Nowadays, a person has to live pretty much for today and let tomorrow take care of itself.”



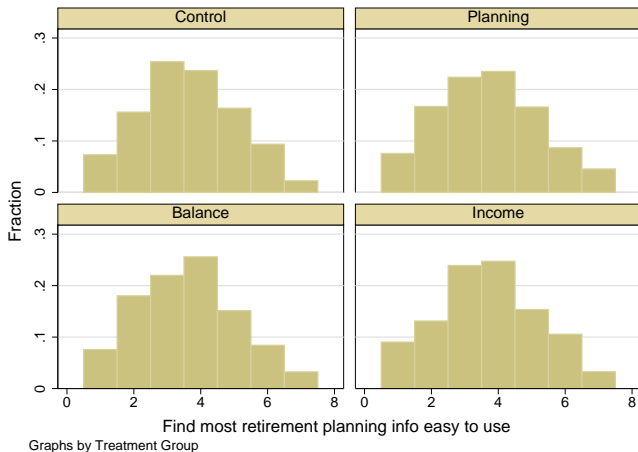
“When I make a plan to do something, I am good at following through.”



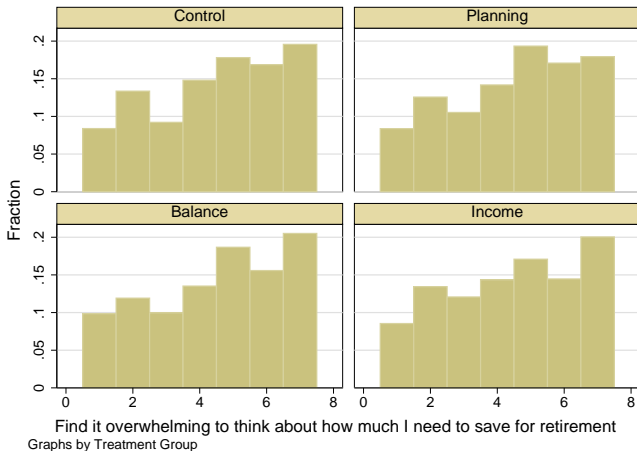
“I tend to put off thinking about how much money I need to save for retirement.”



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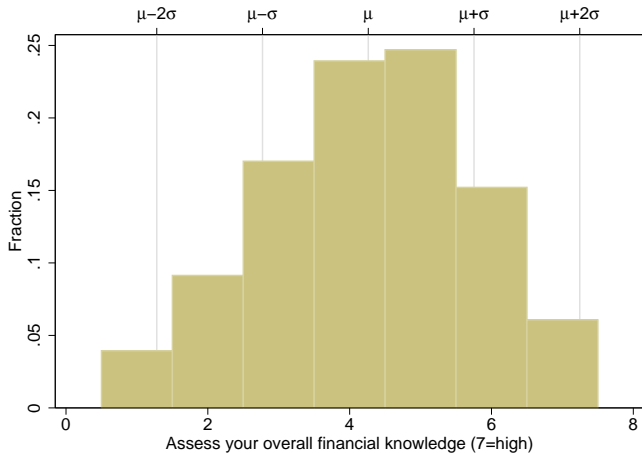


“In a typical month, how difficult is it for you to cover your expenses and pay all your bills?”

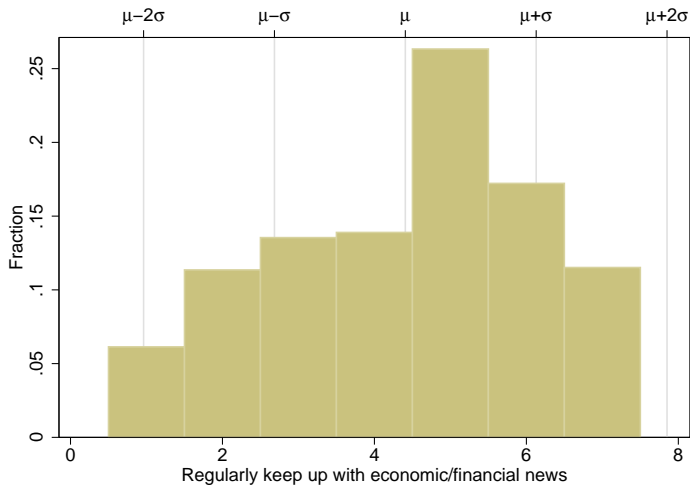


Graphs by Treatment Group

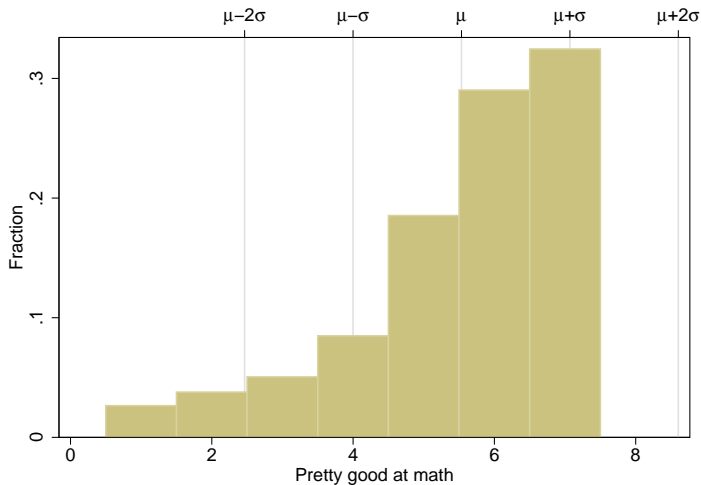
“On a scale from 1 to 7, how would you assess your overall financial knowledge?”



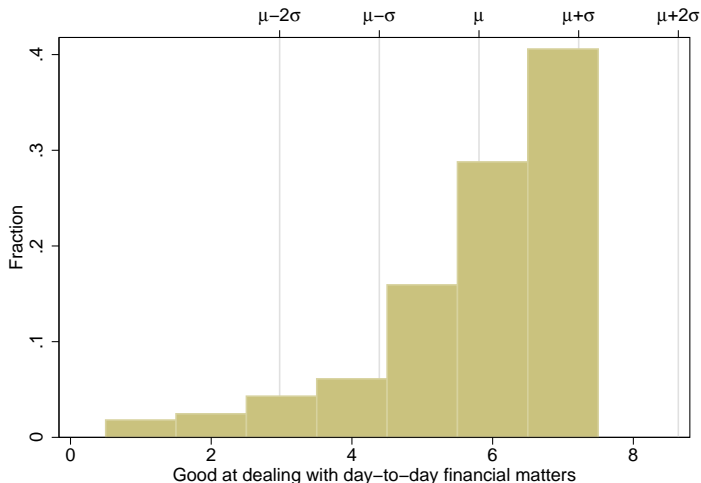
"I regularly keep up with economic and financial news."



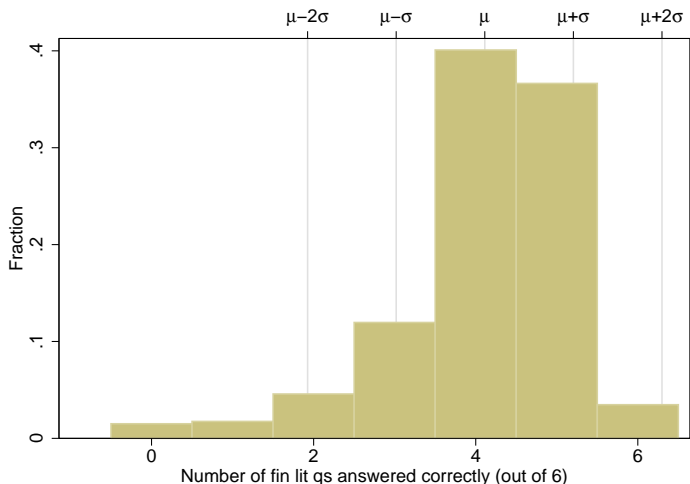
"I am pretty good at math."



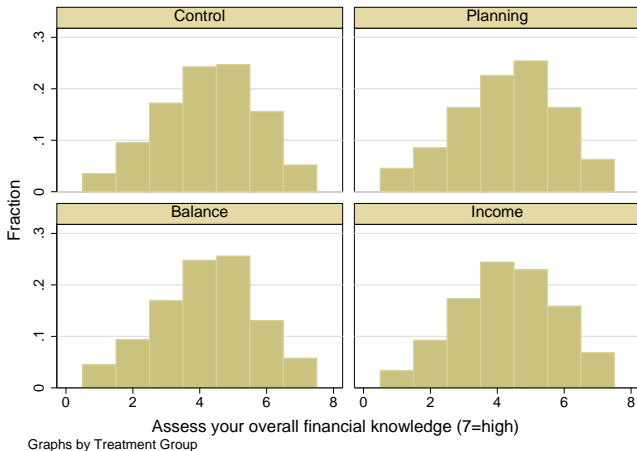
“I am good at dealing with day-to-day financial matters...”



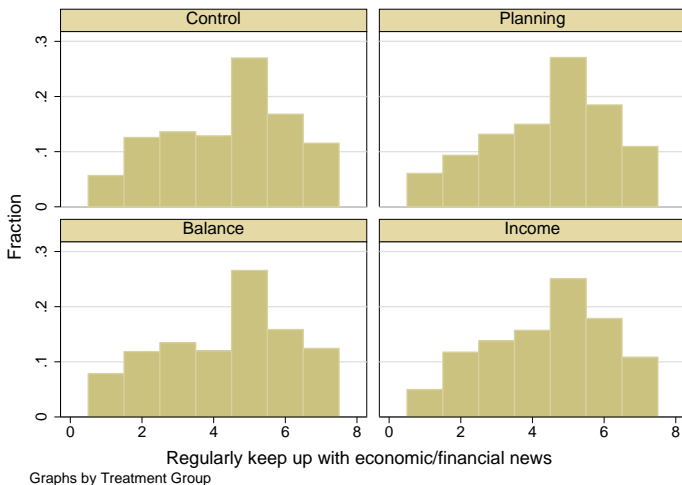
Questions Answered Correctly on Financial Literacy Quiz



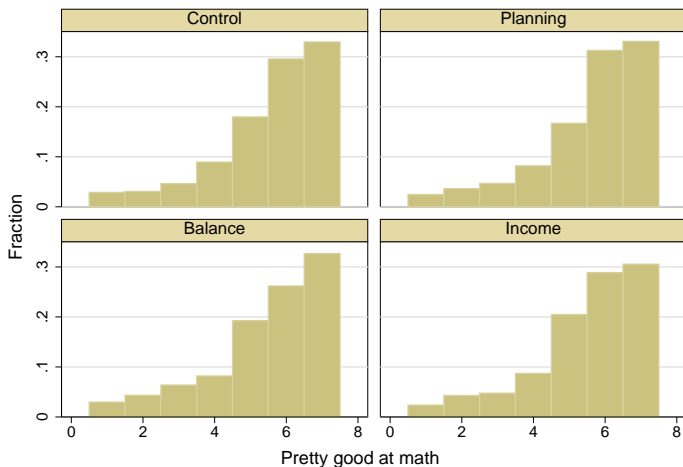
“On a scale from 1 to 7, how would you assess your overall financial knowledge?”



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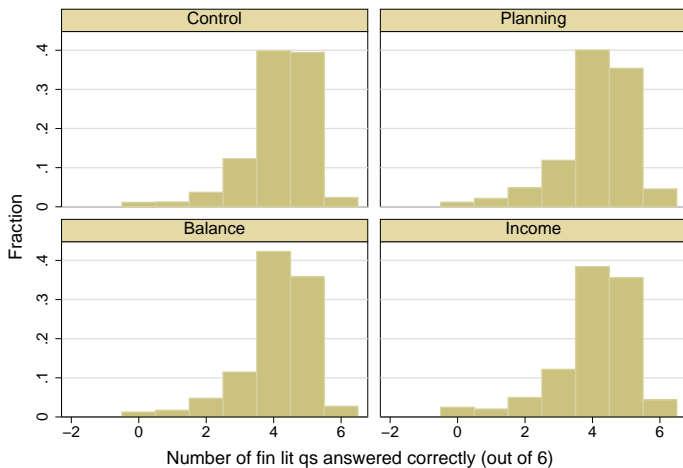


Graphs by Treatment Group

“I am good at dealing with day-to-day financial matters...”

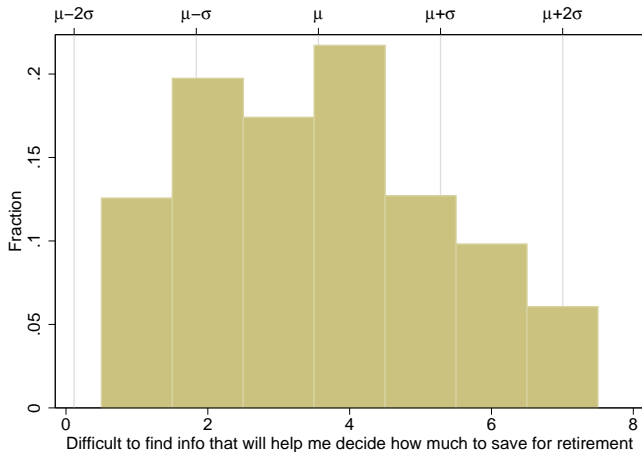


Questions Answered Correctly on Financial Literacy Quiz

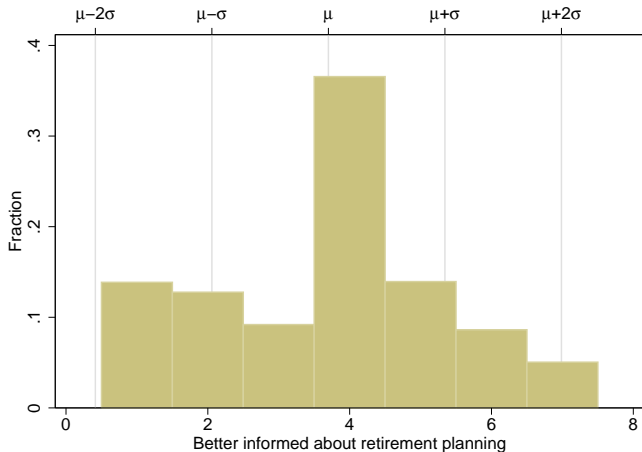


Graphs by Treatment Group

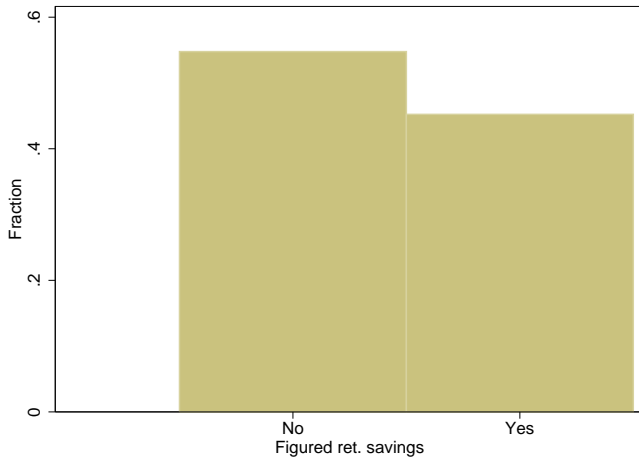
“It is difficult to find information that will help me decide how much to save for retirement.”



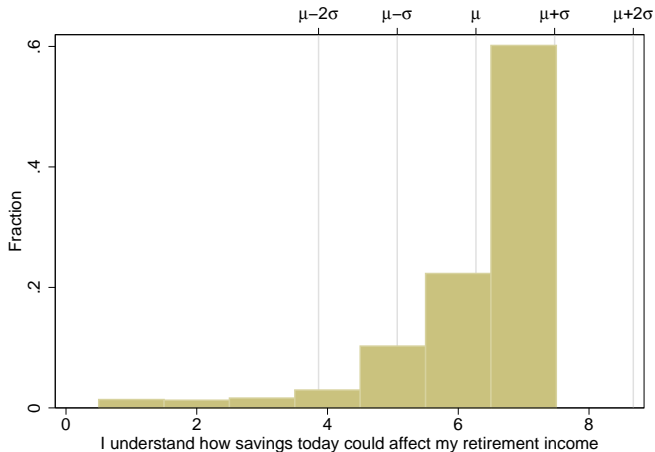
"I am better informed about retirement planning than I was 6 months ago."



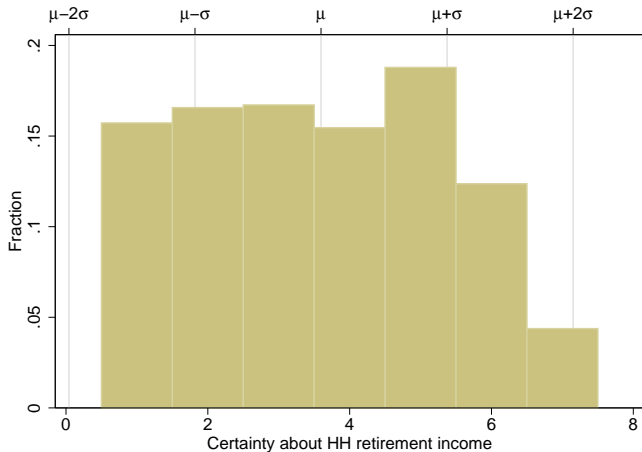
“In the last 6 months, have you tried to figure out how much you need to save for retirement?”



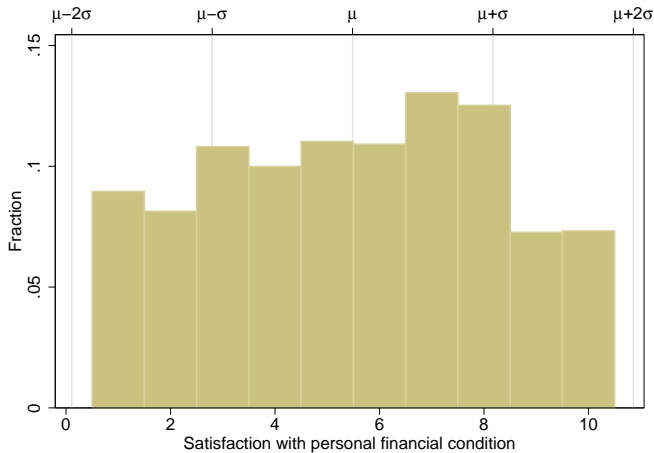
“I understand how savings today could affect my retirement income.”



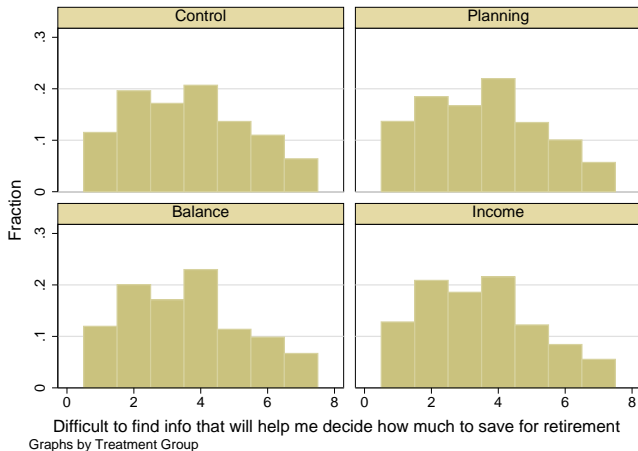
“How certain are you about the amount of annual retirement income you expect your household to have?”



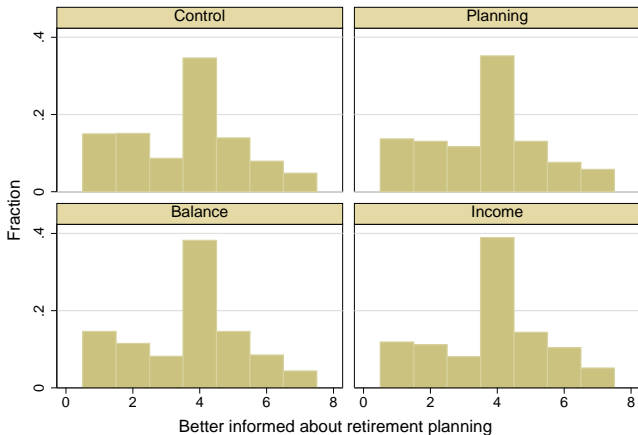
“Overall, how satisfied are you with your current personal financial condition?”



“It is difficult to find information that will help me decide how much to save for retirement.”

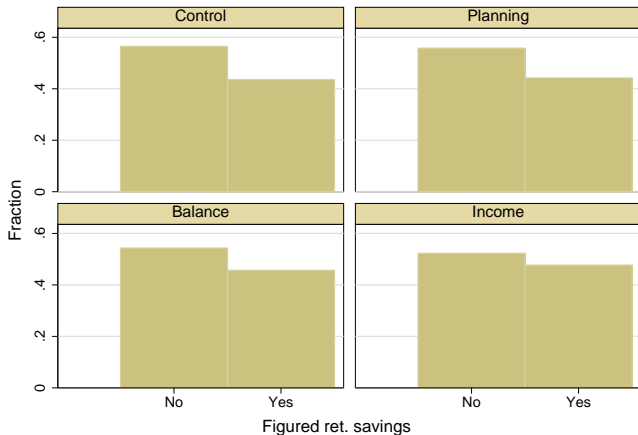


"I am better informed about retirement planning than I was 6 months ago."

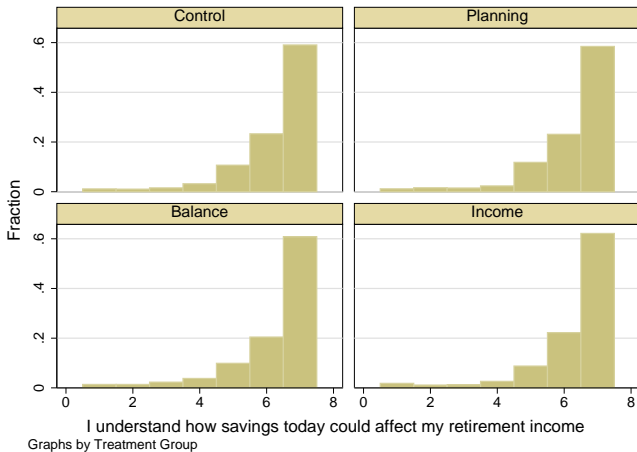


Graphs by Treatment Group

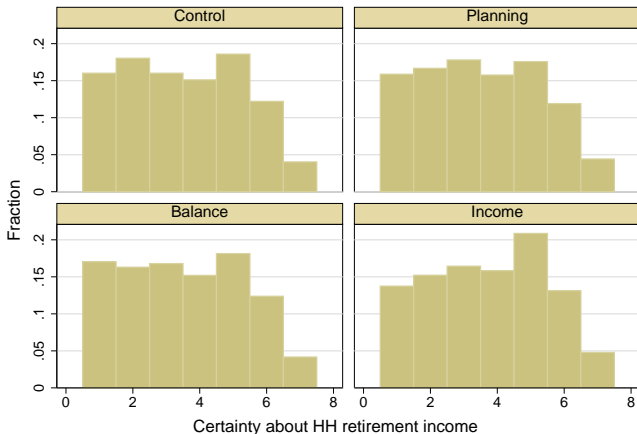
“In the last 6 months, have you tried to figure out how much you need to save for retirement?”



“I understand how savings today could affect my retirement income.”

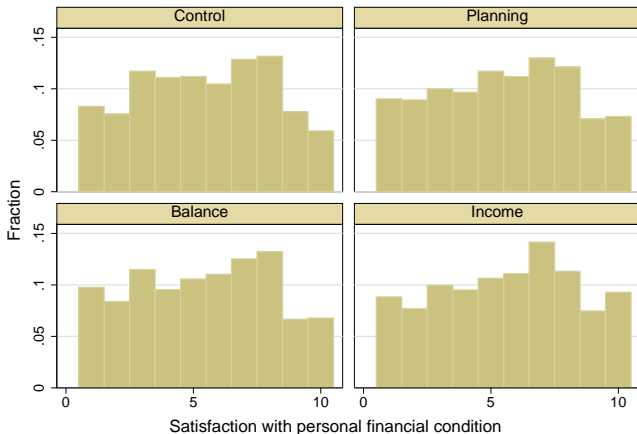


“How certain are you about the amount of annual retirement income you expect your household to have?”



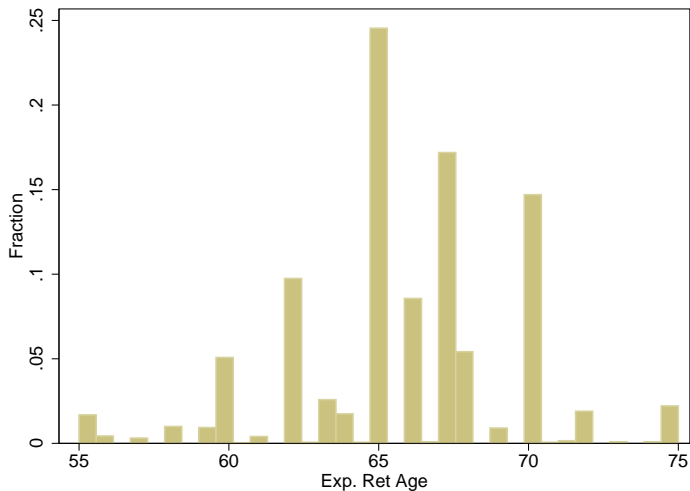
Graphs by Treatment Group

“Overall, how satisfied are you with your current personal financial condition?”

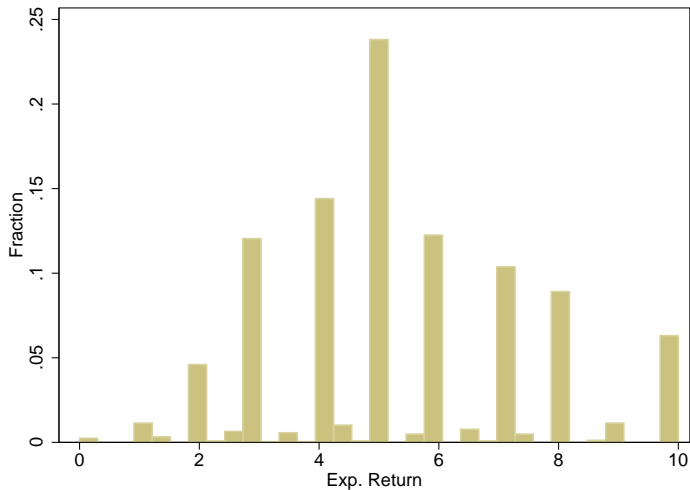


Graphs by Treatment Group

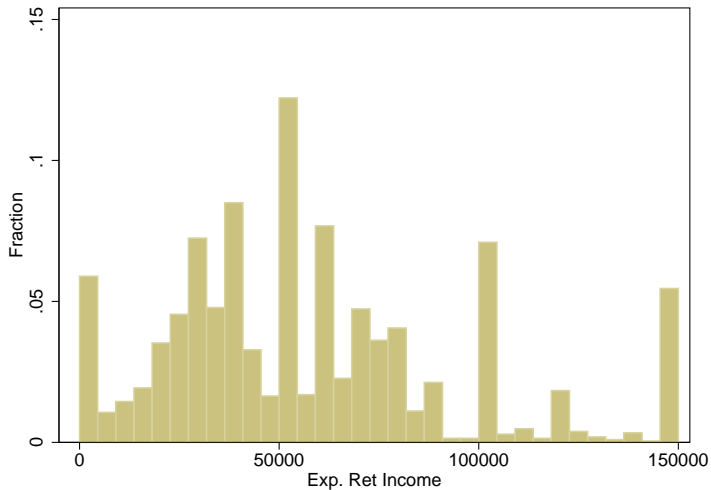
Expected Retirement Age



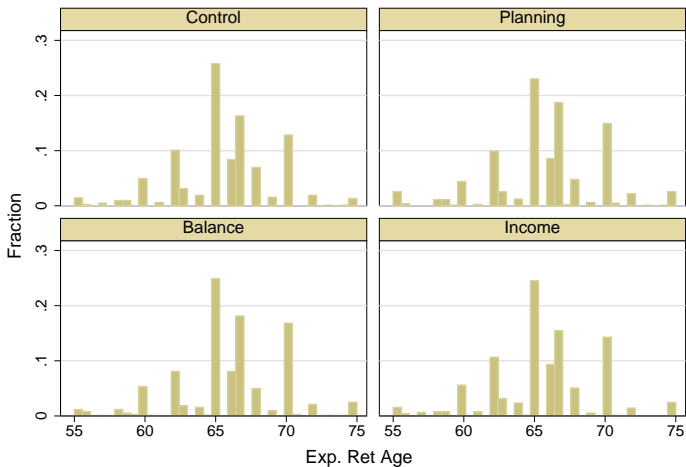
Expected Annual Real Rate of Return



Expected Annual Household Retirement Income

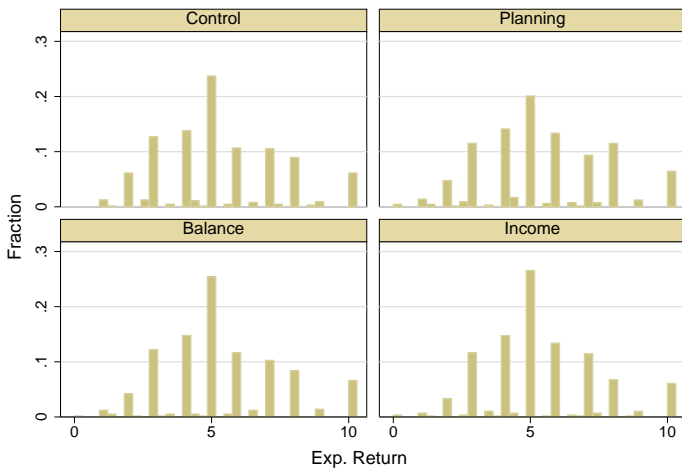


Expected Retirement Age



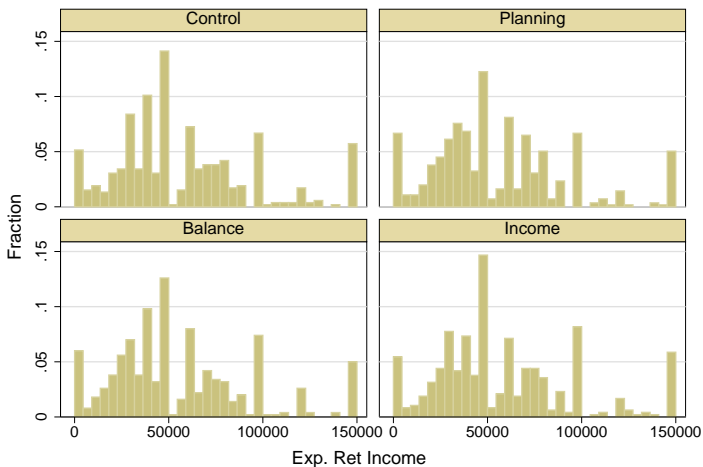
Graphs by Treatment Group

Expected Annual Rate of Return



Graphs by Treatment Group

Expected Annual Household Retirement Income



Graphs by Treatment Group

Name	Current Age	Retirement Age	Rate of Return	Additional Contributions Per Pay Check	Additional Balance at Retirement	Additional Annual Income in Retirement
Sally	45	65	5%	\$100	\$88,000	\$5,400
	45	65	5%	\$200	\$176,000	\$10,800
	45	67	5%	\$100	\$103,000	\$6,500
	45	65	3%	\$100	\$71,000	\$4,300
Julie	35	65	5%	\$100	\$177,000	\$10,800
	35	67	5%	\$100	\$201,000	\$12,800

Table 7: Change in Participation Status & Change in Contribution Election

Sample LHS	All		Initial Non- Participants	Initial Participants	
	1(Δ Part.)	1(Δ Contrib.)	1(Δ Part.)	1(Δ Part.)	1(Δ Contrib.)
	(1)	(2)	(3)	(4)	(5)
1(Planning)	0.000 (0.002)	0.008* (0.005)	0.001 (0.003)	0.000 (0.005)	0.029* (0.016)
1(Balance)	0.004* (0.002)	0.017*** (0.005)	0.004* (0.003)	0.007 (0.005)	0.055*** (0.017)
1(Income)	0.004* (0.002)	0.012** (0.005)	0.005* (0.003)	0.002 (0.005)	0.029* (0.017)
Controls	Yes	Yes	Yes	Yes	Yes
Adj. R ²	0.004	0.031	0.012	0.015	0.020
Control Mean	0.0140	0.0477	0.0133	0.0163	0.1556
Departments	1,385	1,385	1,336	980	980
Individuals	16,881	16,881	12,808	4,073	4,073

Table 8: Change in Level of Contributions

Sample LHS	All		Initial Non-Participants		Initial Participants	
	Δ Rate	Δ Amt	Δ Rate	Δ Amt	Δ Rate	Δ Amt
	(1)	(2)	(3)	(4)	(5)	(6)
1(Planning)	0.073 (0.061)	36.305 (38.473)	0.033 (0.047)	29.910 (32.314)	0.199 (0.207)	57.397 (130.504)
1(Balance)	0.137** (0.063)	59.687 (40.850)	0.060 (0.049)	38.325 (30.865)	0.380* (0.206)	123.795 (137.365)
1(Income)	0.177*** (0.063)	85.408** (37.017)	0.071 (0.047)	50.242* (30.282)	0.547** (0.217)	210.447* (126.476)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R ²	-0.002	0.000	-0.002	0.009	-0.005	-0.012
Control Mean	0.0828	83.4144	0.1478	96.4113	-0.1211	42.6917
Departments	1,385	1,385	1,336	1,336	980	980
Individuals	16,881	16,881	12,808	12,808	4,073	4,073

Measuring financial literacy

- Self-assessed (1): *“On a scale from 1 to 7, where 1 means very low and 7 means very high, how would you assess your overall financial knowledge?”*
- Self-assessed (2): Composite of following statements:
 - *“I regularly keep up with economic and financial news.”*
 - *“I am pretty good at math.”*
 - *“I am good at dealing with day-to-day financial matters, such as checking accounts, credit and debit cards, and tracking expenses.”*
- Actual: Number of questions correctly answered on financial literacy quiz (6 questions)
- Combined: Composite of (1), (2), and (3)

Heterogeneity in Effect of Interventions on Contribution Amount: Financial Literacy

	(1)	(2)	(3)	(4)
	Self-Assessed 1	Self-Assessed 2	Actual	Combined
1(Planning)	132.047 (108.476)	138.808 (105.741)	163.666 (108.358)	115.836 (103.845)
1(Balance)	153.355 (129.729)	157.601 (128.708)	164.528 (128.059)	160.858 (128.438)
1(Income)	380.692*** (116.603)	390.823*** (114.577)	396.500*** (115.500)	386.580*** (114.769)
Z-Score	-30.944 (82.740)	-5.189 (30.743)	99.427 (63.758)	2.904 (22.197)
Z-Score X 1(Planning)	115.492 (110.950)	24.937 (45.391)	-104.944 (87.404)	15.819 (30.587)
Z-Score X 1(Balance)	16.891 (115.924)	-12.336 (45.335)	70.144 (125.427)	0.988 (32.733)
Z-Score X 1(Income)	150.011 (134.796)	61.345 (54.493)	33.331 (80.362)	45.078 (38.427)
Controls	Yes	Yes	Yes	Yes
Adj. R ²	-0.017	-0.018	-0.016	-0.016
Control Mean	119.7863	119.7863	119.7863	119.7863
Departments	992	994	996	991
Individuals	3,632	3,664	3,688	3,619

Note: Dependent variable is change in contribution amount. "Z-Score" indicates z-score of variable in column header.

Effect of assumptions on 1(Δ Contribution)

	(1)	(2)	(3)	(4)	(5)
1(Income)	-0.002 (0.004)	-0.002 (0.004)	-0.002 (0.004)	-0.002 (0.004)	-0.002 (0.004)
1(Inv Ret = 5%)	-0.002 (0.006)				0.002 (0.007)
1(Inv Ret = 7%)	-0.004 (0.006)				0.004 (0.011)
1(Ret Age = 67)		0.012** (0.005)			0.016** (0.006)
1(High Axes)			0.006 (0.005)		0.016 (0.012)
ln(RPM)				0.005 (0.006)	-0.015 (0.016)
Controls	Yes	Yes	Yes	Yes	Yes
Adj. R ²	0.028	0.029	0.028	0.028	0.029
Balance Mean	0.0526	0.0526	0.0526	0.0526	0.0526
Departments	681	681	681	681	681
Individuals	8,484	8,484	8,484	8,484	8,484