What's My Account Really Worth? The Effect of Lifetime Income Disclosure on Retirement Savings

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December 22, 2011

Abstract

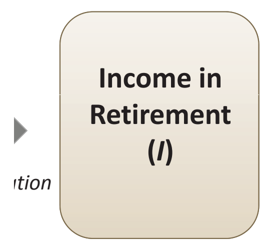
Optimal retirement saving behavior requires an accurate understanding of how current contributions can translate into income in retirement. This study uses a large-scale field experiment to measure how a low-cost, direct-mail intervention designed to inform subjects about this relationship affects their saving behavior. Using administrative data prior to and following the intervention, we measure its effect on rates of participation and the level of contributions in retirement saving accounts. Those sent income projections along with enrollment information were more likely to change participation status and increase annual contributions relative to the control group. Among those who made a change in contribution, the increase in annual contributions was approximately $800. We find evidence of behavioral aspects of decision-making in that the assumptions used to generate the projections influence the saving response.

JEL Codes: H3, J2
Keywords: saving rate, defined contribution plans, financial literacy

Acknowledgments: We are grateful to Jackie Singer and Shelly Wymer for their assistance with administering this project. The research reported herein was performed pursuant to a grant from the U.S. Social Security Administration (SSA) funded as part of the Financial Literacy Center. The authors also acknowledge additional support provided by the TIAA-CREF Institute and the University of Minnesota Carlson School of Management. The authors thank John Beshears, Jeff Brown, Wandi Bruine de Bruin, Katherine Carman, Courtney Coile, Adeline Delavande, Maria Fitzpatrick, Damon Jones, Amit Kramer, Ron Laschever, Annamaria Lusardi, Erzo F.P. Luttmer, Dayanand Manoli, Olivia Mitchell, Enrico Moretti, Robert Willis, Joanne Yoong and seminar participants at the Center for Business and Public Policy at the University of Illinois for comments. The opinions and conclusions expressed herein are solely those of the authors and do not represent the opinions or policy of SSA, any agency of the Federal Government, or any other institution with which the authors are affiliated.

1 Introduction

With the shift toward defined contribution (DC) retirement plans, Americans' retirement security increasingly requires individuals to make responsible, informed wealth accumulation decisions over their working years (Hacker 2006; Even and Macpherson 2007; Skinner 2007). Understanding how saving choices today affect consumption in retirement is quite challenging. Some facts needed to assess this relationship are easily accessible, such as one's current monthly savings rate and the current value of savings accounts. However, one must combine these facts with beliefs about future investment returns and retirement age, and have an accurate understanding of both (1) an accumulation function that maps retirement savings to assets at retirement, and (2) a decumulation function that maps retirement assets to retirement income, as depicted below.



Policy interventions to improve people's understanding of this relationship have been proposed. The U.S. Congress is considering the Lifetime Income Disclosure Act (S. 267; HR. 1534), which would require DC plan administrators to annually provide income disclosures that provide the value of a lifetime annuity, that is, the stream of guaranteed lifetime annual benefits that a plan participant could purchase at retirement, given her current retirement savings. Some administrators have recently begun including such projections in their statements voluntarily, including TIAA-CREF and Vanguard. This kind of information disclosure policy has bipartisan and commonsense appeal, as it may help people make more informed decisions, is low-cost, and does not mandate changes in saving behavior or subsidize saving.

However, evidence regarding the impact of these types of interventions on saving behavior has not been examined. Would such projections help Americans adjust their saving to better achieve their retirement-income goals? Or, would the projections be ignored either because they are already understood or are too complex to be understood? Furthermore, providing income disclosures requires the use of assumptions regarding contribution rates, investment returns, and one's retirement age. The use of these assumptions raises the possibility that the effects may differ depending on the assumptions used and that prior beliefs about these factors may be shifted in ways that could reduce welfare.

In this paper, we measure the effect of income disclosures on retirement saving behavior using a large-scale field experiment, the first study of such a policy. Using administrative data prior to and following the intervention, we measure the effect of our interventions on participation rates and contribution levels for discretionary tax-deferred retirement savings accounts by employees at the University of Minnesota. We find that providing income disclosures along with general plan information and materials assisting people through the steps of changing contribution rates resulted in a 29 percent higher probability of a change in participation relative to a control group over a six-month period. In addition, individuals sent this treatment increased their annual contributions by $68 more than the control group during the study period. Because the intervention induced a change in contribution election for a small portion of the sample, the magnitude of the increase among those who made a change was sizable (approximately $800 dollars a year). Additional features of the experiment yield insights into which components of the treatment generate the observed effects. In particular, our findings suggest that both the provision of retirement planning materials and projections contribute positively to the treatment effect, although there is not strong evidence that either the planning materials or projections alone induced a significant increase in contributions.

We administer a follow-up survey to facilitate a richer look at the effect of the intervention and to provide corroborative evidence on whether and how it influenced saving behavior. First, we measure additional characteristics to assess whether there are heterogeneous treatment effects of the intervention that are consistent with fundamental trade-offs in the saving decision. We find that, among survey respondents, individuals who report higher rates of time discounting and a tendency to procrastinate, as well as those who report liquidity constraints, are significantly less likely to respond to the intervention. Second, we utilize responses from the survey to explore the impact of our interventions on additional aspects of the saving decision-making process. Among survey respondents, those sent full income disclosures were more likely to report having recently engaged in and being more informed about retirement planning, had higher certainty about the amount of income they expect to have in retirement, and reported greater satisfaction with their overall financial condition relative to the control group. While the fact that the survey respondents are a non-random subsample of the population warrants caution when interpreting these results, these findings provide suggestive evidence that the intervention influenced saving decisions and that the results are not driven by chance alone.

While our findings indicate the intervention provided workers with information to help them re-optimize, we also find evidence of behavioral influences on decision-making. In particular, by randomizing the assumptions used to generate the projections across employees, we are able to test for framing effects on our outcomes of interest. We find that a higher assumed retirement age has a significant positive impact on changes in participation status. In addition, both a higher assumed retirement age and higher assumed hypothetical contribution amounts lead to larger increases in the level of saving; however, we find no evidence that the assumed rate of investment return affects saving behavior. These framing effects are larger among those not participating in the savings plan at the start of our intervention. Importantly, the results from the follow-up surey indicate no evidence that the assumptions used in the projections have any impact on beliefs regarding one's expected retirement age or expected rates of return. This suggests that assumptions used in the projections operate through framing, rather than affecting underlying beliefs about the likelihood of future events.

Our study builds on several related strands of literature. Many recent studies show that financial literacy is not widespread and serious errors are common when thinking through very basic financial concepts (Lusardi and Mitchell 2007). Evidence of inertia in saving decisions and the large influence of default options suggest that the costs of making independent decisions can be quite high and that many prefer to rely on simple heuristics (e.g., Madrian and Shea 2001; Beshears et al. 2006a; Mitchell et al. 2009; Goda and Manchester 2010) or are influenced by the framing effects of defaults (Bernheim et al. 2011). In addition to default provisions, other behavioral factors found to influence saving decisions are peer effects (e.g., Duflo and Saez 2003), commitments to automatic schedules of contribution rate increases (e.g., Thaler and Benartzi 2004, Choi, Laibson, Madrian and Metrick 2004), and simplification of the enrollment procedure (e.g., Beshears et al. 2006b, Choi et al. 2006).

Acquiring and processing information can be quite costly. For instance, Karlan et al. (2010) study people's failure to attend to the possibility of future lumpy expenditures. Stango and Zinman (2009) provide evidence that people systematically underestimate exponential growth, which leads to greater borrowing and less saving. Recognizing individuals' limitations in this regard may improve both economic theory (Sims 2006; Attanasio and Weber 2010) and retirement plan policy. As lifetime income disclosures reduce the cost of acquiring information about how saving now translates into income in retirement, our study provides a test of whether reducing the cost of acquiring information changes saving outcomes.[1]

Finally, economists debate the extent to which Americans save too little, too much, or just the right amount for retirement and the potential for alternative policies to improve matters (Ameriks et al. 2007; Lusardi and Mitchell (2011); De Nardi et al. 2010). Unlike interventions that "nudge" individuals to save more, the policy considered here facilitates individuals revising their saving decisions in either direction to stay on target for their goals.

[1] Mastrobuoni (2011) finds that a similar innovation - the introduction of annual Social Security benefit projection statements - did shift people's beliefs about retirement income but did not shift their retirement behavior.

The remainder of our paper proceeds as follows. Section 2 describes our experimental design, including details regarding our treatment groups and randomization procedure, and Section 3 explains our analytic approach. Section 4 discusses results on the effect of the intervention on saving behavior, while Section 5 includes results regarding detailed features of the saving decision from our follow-up survey. Section 6 develops a framework for evaluating the welfare implications of the intervention (TENTATIVE). Section 7 concludes the paper.

2 Experimental Design

2.1 Firm and Sample Characteristics

The setting of our study is the University of Minnesota. Nearly all employees at the University participate in Social Security and a retirement plan that mandates relatively high levels of retirement savings.[2] In addition to these mandatory plans, most employees are also eligible to participate in Voluntary Retirement Plans (VRPs), which allow them to make additional tax-deferred contributions of up to $33,000 per year if they desire. Participants can choose to make a flat dollar amount election each pay period or contribute a percentage of their salary.[3]

For our experiment, we consider employees eligible to participate in the VRPs who were under age 65 at the time of our intervention. Our sample consists of 16,881 employees dispersed among 1,385 departments across 5 different campuses and extension offices who

[2] Civil servants and non-faculty bargaining unit employees participate in the Minnesota State Retirement System (MSRS), while faculty, academic professionals, and administrators participate in the Faculty Retirement Plan (FRP). MSRS participants receive a defined benefit pension equal to 1.7 percent of the average of their five-highest salaries for each year of service starting at age 65 and reduced benefits for early retirement. Employees hired before July 1, 1989 are governed by a slightly different set of rules. The employee and employer each contribute 5 percent of the employee's gross salary to the retirement plan. FRP is a defined contribution plan in which eligible participants make a required tax-deferred contribution of 2.5 percent of their covered salary, matched by a 13 percent contribution by the University.

[3] There are two choices of VRP, the Optional Retirement Plan (ORP) and the Section 457 Plan. Participants must choose between several different vendors and investment options within each plan. Employees face a maximum annual tax-deferred contribution of $33,000 ($16,500 in each plan). Contributions automatically cease once a $16,500 annual plan limit is reached.

were employed by the University in both October 2010 (Period 1: prior to intervention) and May 2011 (Period 2: post intervention). We obtain administrative data from the Office of Human Resources with the assistance of an independent third party in order to protect employee anonymity. We observe each employee's VRP contribution rate in each period.[4]

Table 1 describes the administrative data for our study sample. In Period 1, 24.1 percent participate in a VRP while 24.9 percent participate in Period 2. Including contributions of zero for non-participants, the average contribution rates are 3.03 and 3.16 percent of salary prior to and following the intervention, corresponding to approximately $2,187 and $2,300 per year. Restricting to participants, contribution rates are approximately 12.5 percent of salary and average $9,000-$9,250 per year (not shown).

Table 1 also includes a summary of the demographic characteristics of our sample. The majority of the sample is female (55.7 percent) and the average age is just under 45 years. Average employment tenure at the University is 12.3 years and average salary is nearly $60,000. Employees eligible for the faculty retirement plan make up approximately 41 percent of the sample. The majority of the sample works at the Twin Cities campus, followed by the coordinate campuses of Duluth, Morris, Crookston, and Rochester. Approximately 6 percent of the sample works in an off-campus location.

2.2 Treatment Groups and Intervention

We randomly assign employees to four groups, consisting of a control group and three treatments designed to isolate the impact of different aspects of the intervention. Table 2 provides a summary of the different informational interventions. The control group received no intervention. The most basic treatment, the *planning treatment*, provides general information on saving for retirement, steps to sign up for or change contributions to a VRP, and a chart describing VRP options. This planning treatment includes no projection component.

[4]We never observe VRP account balances or values of mandatory retirement accounts. This prevents us from offering total retirement income projections, as laid forth in the Lifetime Income Disclosure Act. We focus our interventions on providing projections of additional retirement balance and income from hypothetical additional contributions while working. This marginal decision is relevant for everyone.

The other two treatments add components of the income disclosure. The *balance treatment* adds a customized projection of how hypothetical additional contributions would translate into additional assets at retirement. This is intended to improve individuals' understanding of the accumulation phase. The *income treatment* adds to the balance treatment a customized projection of the additional annual retirement income that would be generated. By adding information regarding the decumulation phase, the income treatment aims to help people understand the full mapping from current contributions to retirement income. The balance treatment provides only *partial* information because it only shows the projected relationship between contributions and savings at retirement. This element of our experimental design allows us to test for differences in saving behavior among individuals who receive the full income disclosure relative to those that receive a partial projection.

The treatment materials consist of a four-page color brochure sent through internal mail. The first page was designed to prompt individuals to think about their retirement goals.[5] For individuals in the balance and income treatment groups, the second page contains the customized account balance projection (balance group) or both the balance and income projections (income group).[6] Enrollment requires choosing a VRP, deciding on a contribution election (i.e. either an amount or rate), selecting an investment company, and finally allocating the contribution to different investment options. This process is described in a series of steps in an attempt to reduce the cognitive costs associated with enrollment in the third page of the brochure (Lusardi, Keller and Keller 2009).[7] The final page is a side-by-side comparison of the features of the two VRP options.

All groups that received a mailing also received a postcard to request an enrollment kit from the Office of Human Resources for one or both VRPs. In addition, all individuals who

[5]The brochure was designed not to encourage people to save more or to save less, but to encourage them in a neutral manner to reflect on whether they are on target to achieve their retirement income goals.

[6]We provide an example of a brochure sent to an employee in the income group in Appendix A. The top graphic contains the customized conversion of additional contributions to additional account balance at retirement, while the bottom graphic contains the customized conversion of additional contributions to additional annual income in retirement.

[7]The step-by-step process for enrolling in the VRP is page 2 for the planning treatment group.

participated in one or both VRPs as of Period 1 were provided with a contribution change form to reduce the transaction costs involved with making a change in their election.

Finally, individuals in the balance and income treatment groups were also provided with access to an online customization tool designed to mimic the information provided in the printed materials. Online tools of this type are readily available via investment companies' websites and would serve as complementary tools to any policy initiative surrounding income disclosure by plan sponsors. The online tool had the added ability to adjust assumptions regarding marital status, expected retirement age, and expected investment returns.[8] Visitors to the online tool from the income treatment group could also add in other sources of retirement income and expected Social Security benefits to get a more comprehensive picture of their retirement savings portfolio.[9] Table 3 contains a summary of the treatment materials sent to each experiment group.

2.3 Randomization

We perform the randomization of our four treatment groups by department in order to mitigate possible contamination across groups, as the main intervention was delivered via department-based mail. We use matched-quad randomization (matched-pair randomization with four treatment groups) for the assignment to ensure that the groups are balanced on observable characteristics that may be related to changes in plan participation. To form the matched quads, we first block departments on quartiles of VRP participation rate, quartiles of average age, and quartiles of average salary. Within block, the largest 4 departments formed one quad, the fifth to eighth largest formed another quad, and so on. This ensures each treatment group contained a similar number of individuals and that only very small departments were in "quads" of less than 4. This process resulted in a total of 1,396 depart-

[8]Appendix A provides an example screenshot of the online tool for a member of the income group.

[9]The projections on the printed materials are in nominal dollars. Individuals could input expected rate of inflation using the online tool.

ments assigned to treatment group from 374 quads.[10] Panel a of Table 4 shows the allocation of individuals in our sample to the different treatment groups.

Observable characteristics by treatment group are shown in Table 5. Each characteristic was regessed on treatment group indicators with the mean of the characteristic for the control group shown in a row below. We report the F-statistic for the joint test of the hypothesis that all coeficients on the planning, balance and income group indicator variables are zero and report the p-value of the test at the bottom of the table. The shaded columns represent characteristics which were explicitly balanced across treatment groups in the randomization procedure. The table shows that there are very few statistically significant differences in observable characteristics across treatment groups. The only characteristic that differs significantly across the different groups is gender, with a statistically higher percentage of women in the income group. For the remaining characteristics, we fail to reject the null hypothesis that there are differences across the four experimental groups.

2.4 Projections and Assumptions

For individuals in the balance and income treatment groups, we create customized projections mapping between hypothetical additional contribution amounts and projected additional account balance at retirement and, for the income treatment group, annual income in retirement as well. The translation of additional per-period contributions c into additional account balance at retirement b is performed as follows:

$$b = \frac{c(1+i)^{(r-a-1+1/26)}}{(1+i)^{1/26-1}} \tag{1}$$

where r represents the assumed retirement age, a represents current age, and i represents the assumed annual rate of investment return. Contributions c are assumed to begin immediately and continue once per pay period, or every two weeks, for a total of 26 times per year.

[10]Department size ranges from 1 to 225. Because our analytic sample drops individuals no longer employed in Period 2, it includes slightly fewer departments.

The translation of additional balance at retirement b into additional income in retirement y is simply:

$$y = \frac{b}{A_r} \tag{2}$$

where A_r represents the joint annuity value of a stream of $1 payments from retirement age r until death for a married couple. In order to avoid creating a false sense of precision, projected balances were rounded to the nearest $1,000 and annual retirement incomes to the nearest $100. Each individual in the balance treatment receives age-specific balance values only. Those in the income treatment receive both age-specific balance and income values. In each case, these projections depend on assumed values for three parameters: (r, i, c).

The intent of this kind of disclosure intervention is to help people improve their understanding of the relationships in equations (1) and (2), not to shift their beliefs about appropriate or likely values of (r, i, c). However, such assumptions are inherent in the policy of offering projections. To test the effects of these assumptions on saving behavior among individuals in the balance and income treatment groups, we randomly assign alternative values of the 3 parameters. Each person is randomized into one of 12 groups at the individual level, assigning one of three different rates of return, one of two different retirement ages, and one of two different sets of axes. The assumed investment return is either 3%, 5% or 7% and we use two different retirement ages: 65 and 67. The set of hypothetical additional contribution values displayed on the horizontal axes of the projection graphs is either {$0, $50, $100, $250} or {$0, $100, $200, $500}. By holding the relative magnitude of the contribution axes constant across the two treatments (e.g., 50/100 = 100/200), the graph itself remains fixed for everyone within treatment. Only the hypothetical contribution amounts printed under the axes, the projected balance or income amounts printed on top of the bars, and the text of the assumptions printed on the brochure vary between parameter treatments.

For each individual in the balance and income treatment groups, we construct a ratio of the realized projection printed on his or her brochure and the value that would be shown if the 3 percent investment return, retirement age of 65, and lower-valued contribution axes had been used. This creates a single, comprehensive measure of the relative magnitude of the projections accounting smoothly for the fact that the impacts of the different assumptions on the projections depend on an employee's age. For instance, for older employees, increasing the retirement age has a larger effect on projections than does increasing the investment return. For younger employees, investment return matters more. We label this ratio "Relative projection magnitude" and use it to evaluate how the magnitude of projections affects saving behavior.

The values A_r were retrieved from the Income Solutions Annuity Calculator for married males and females age 50 to 80.[11] Married individuals are assumed to be the same age and receive joint life annuities that pay the survivor 100% of the benefit after the first member of the couple dies.[12]

2.5 Supplemental Follow-Up Survey

We supplement our experiment with data collected from a follow-up web-based survey administered after the second pull of administrative data, which was approximately four months after the intervention. An invitation to complete the follow-up survey was sent by email to all subjects with a personalized link to a website which allowed the matching of survey responses to administrative data by our third party. All individuals were provided with a letter describing the survey in advance of the formal invitation. A small $2 monetary non-conditional incentive was provided to a random subsample at the outset of the experiment; however, no additional monetary incentive was provided for completing the survey.[13] All individuals who had not answered the survey after approximately two weeks were sent an email reminder.

The follow-up survey allows us to analyze heterogeneity in the effects of the treatment

[11] While only the values for ages 65 and 67 were used in the printed brochures, the online tool allowed individuals to choose retirement ages within the 50 to 80 age range.

[12] The calculator is available at https://www.incomesolutions.com/AnnuityCalculator.aspx. The values used in this study were obtained September 14, 2010.

[13] The incentive subsample's letter describing the survey also included a hand-written, "Thank you, [name]!" printed on their letter.

with respect to characteristics not available in the administrative records, such as time preferences, barriers to saving, and financial literacy. In addition, we investigate the effect of the interventions on the saving process to provide corroborative support for the treatment effect. Finally, the survey asks about beliefs regarding expected retirement income, expected rates of return, and expected retirement ages in order to assess the effects of the interventions on these beliefs.[14]

3 Empirical Methods

We examine both the propensity to make any change in one's saving behavior as well as the magnitude and direction of the change using four primary outcomes. Our first outcome variable is any change in participation status, measured by a binary variable that equals 1 if participation status in Period 1 is not equal to participation status in Period 2. We also construct a binary variable that equals 1 if the employee made any change in his contribution election, which implicitly includes any change in participation status.

Next, we construct two measures of the change in the level of contributions, Δ Contribution (Rate) and Δ Contribution (Amount). The variable Δ Contribution (Rate) measures the increase in the contribution rate as a percent of salary from Period 1 to Period 2. Similarly, Δ Contribution (Amount) measures the increase in the annual contribution dollar amount from Period 1 to Period 2. It is important to note that for individuals who elect a dollar contribution amount, accounting for the majority of participants, an increase in salary results in a mechanical decrease in the contribution rate if no increase in the election amount is made. We construct both measures for all individuals using data on annual salary regardless of whether contributions are specified as a rate or an amount.

The means and standard deviations of the four saving outcomes by treatment group

[14]To the extent possible, we use validated survey questions from tested sources, such as Lusardi and Mitchell (2007); the National Financial Capability Study led by FINRA and designed by a multi-disciplinary team, including Annamaria Lusardi and Robert Willis; the Health and Retirement Study; and Oreopoulos and Salvanes (2011).

are displayed in Table 6. Figure 1 depicts the means of the outcomes along with a 95 percent confidence interval. Overall, 1.57 percent of individuals in the sample change their participation status and the rate of change is higher for the balance and income groups relative to the planning treatment and control group. The percentage of the sample that change their contribution is 5.60 percent overall, but ranges from 4.77 in the control group to 6.27 in the balance group. The average change in the contribution rate is +0.13 percent of salary or +$113 per year. Both of these measures are higher for individuals who received the full income projections. These descriptive measures provide suggestive evidence that income disclosures influence saving behavior.

We formalize these results in a regression framework. Given the experimental methodology, the empirical method used to evaluate the effect of the treatments on saving behavior is straightforward. We estimate the following equation:

$$S_i = \alpha + T_i\delta + X_i\beta + \eta_b + \epsilon_{i,d} \tag{3}$$

for our vector of saving outcomes S_i where T_i is a vector of treatment group dummy variables, X_i is a vector of demographic controls, and η_b are randomization-block fixed effects. The error term, $\epsilon_{i,d}$ is clustered at the department-level (d), which is the unit of primary randomization. The vector X_i contains quadratics in age and tenure, log salary, percent change in salary, and indicators for gender (1), faculty (1), and campus (5). We also consider the effect of the assumptions used in the projections by restricting the sample to individuals in the balance and income groups and estimating the effect of the different assumptions used in the projection on the same saving outcomes.

We present results for the entire sample and also by splitting the sample on initial (i.e. Period 1) participation status. While the disclosure policy being debated in Congress would target only DC plan participants, providing income projections might affect non-participants as well.

4 Administrative Data Results

4.1 Main Results

We first evaluate the effect of the interventions on the binary saving outcomes, an indicator of a change in participation status and an indicator of a change in one's contribution election. Our results are reported in Table 7. Columns (1) and (2) display the effect of the treatments using the entire sample, Column (3) is restricted to those who were non-participants in Period 1 (for whom the two outcomes are identical), and Columns (4) and (5) include only initial participants (where a change in participation implies termination of contributions). All specifications also include our demographic controls.[15]

For the whole sample, we see that individuals in the balance and income treatment groups were significantly more likely to make a change in participation status relative to the control group (Table 7, Column (1)). While the magnitude appears small, the difference relative to the control group is meaningful: individuals in the balance and income treatment groups were approximately 29 percent more likely to change their participation status relative to the control group ($0.286 = \frac{0.004}{0.014}$).

Column (2) shows a significant difference between each treatment group and the control group in the propensity to change the contribution election. The largest effect is seen for the balance treatment, where the probability of changing is 38 percent higher than the control group ($0.356 = \frac{0.017}{0.0477}$) and the effect for the income treatment is not significantly different from that for the balance treatment. While this outcome variable includes both changes in participation status as well as changes in contributions among those already participating, the results in Columns (3) through (5) show that the effect is mainly driven by changes in contributions among initial participants rather than by initial non-participants.

The above results describe changes in saving behavior on the extensive margin but do not allow us to understand the magnitude or direction of the changes made. Therefore, we

[15] Estimates without controls are essentially the same but less precise.

repeat our analysis using the continuous measures of the change in the level of contributions described above. Table 8 summarizes our results. As in Table 7, Table 8 displays the results from the full sample followed by those for the initial non-participant and initial participant subsamples.

The income treatment significantly increased saving, measured in terms of changes in saving rate and amount. Compared to the control group, individuals in the income treatment raised savings by an additional 0.167 percent of salary or \$68.47 annually (Table 8, Columns (1) and (2)). Among employees who made a change, those in the income treatment group increased savings by about \$806 per year relative to the control group. This effect is mainly driven by changes made by initial participants, as there are no detectable differences in the magnitude of the change across treatment groups for initial non-participants. Among initial participants, we find that the change in contribution rate among individuals in the income group as a percent of annual salary is 0.47 percent higher than that of the control group, or approximately \$154 additional annual contributions, on average (Columns (5) and (6)).

To better understand what features of the full intervention contribute to this increase in contributions, we can compare the treatment effects among the income group to those in the planning and balance groups using the estimates from Table 8. Relative to the control group, the planning treatment did not display a statistically significant increase in contributions. The treatment effect for the balance treatment was statistically significant at the 10 percent level, but only when measuring the change in the contribution rate. Therefore, it appears that each part of the income treatment (i.e. planning materials and projections) contributed positively to its treatment effect, although there is not strong evidence that either component alone induced a significant increase in contributions.

The combined results from Tables 7 and 8 indicate that the treatment materials together induce individuals to make changes; however, only those sent full income projections display systematic positive changes in their saving rate. These findings suggest that the mailing induced a response in part by reducing the transaction costs associated with changing participation status and contribution levels. Furthermore, they suggest that the relationship between current contributions and income in retirement was not completely understood prior to the intervention, as the information contained in the income treatment led individuals to change their rate of saving on average. Finally, the positive direction of the average change in the saving rate suggests that people overestimate the amount of annual retirement income that results from current contributions.

4.2 Effects of Projection Assumptions on Outcomes

An important part of any policy aimed at requiring the disclosure of retirement income projections is the decision about what assumptions to use in the calculation. Assumptions regarding the rate of investment return and retirement age affect the magnitude of the projected values and could affect one's response to the information or beliefs about those future values. In addition, any hypothetical contribution amounts used to illustrate the projections may affect the behavior of individuals due to framing effects. To assess this possibility and as described in Section 2.4, we randomly assign projection assumptions for those in the balance and income treatment groups.

Restricting the sample to individuals in either of these two treatment groups, we study the effect of the different projection assumptions — rate of investment return, retirement age, and hypothetical additional contribution amounts — on our extensive and intensive saving outcomes. The results in Table 9 indicate that a higher assumed retirement age (67 instead of 65) has a significant effect on changes in participation status, particularly for initial non-participants. In addition, Table 10 shows that both using a higher retirement age and using higher-valued axes (i.e. {\$100, \$200, \$500} instead of {\$50, \$100, \$250}) leads to increases in contribution elections among initial non-participants. For instance, presenting individuals with the higher-valued axes instead of the lower-valued axes increased annual contributions by \$96, or \$1,008 among changers. However, we find no evidence that the assumed rate of investment return affects participation or contribution levels. In addition, we find little evidence of the effects of our assumptions among initial participants, suggesting that initial non-participants are more susceptible to framing effects.

In Tables 11 and 12, we use a single measure of the relative magnitude of the projected amounts regardless of which kind of assumption drives the change in magnitude, as described in Section 2.4, to test whether individuals are more responsive to larger-valued projections. We find no evidence of a differential change in participation status but do find that the level of contributions is significantly and positively related to the relative magnitude of the projections.

These findings suggest that employee response is sensitive to psychological framing effects that operate through the magnitude of the projection, consistent with prior work (e.g., Bernheim and Rangel 2009; Bernheim et al. 2011). However, it is also possible that the assumptions used in the projections influence response by changing employees' beliefs about future uncertainties. This alternative explanation is more plausible explaining the sensitivity of saving rates to assumed retirement age but less plausible for explaining why the effect varies with the hypothetical contribution amounts listed on the axes. We investigate whether the projection assumptions affected beliefs about investment returns and retirement age using data collected in the follow-up survey.

5 Follow-Up Survey Analysis

We analyze the results of our follow-up survey in order to further investigate the effects of our interventions on additional aspects of the saving process, and to explore heterogeneity in the estimated treatment effects. First, we assess the validity of our survey results by testing for balance in response rates and demographics among our survey subsample.

5.1 Survey Response and Balance

The overall response rate of the follow-up survey was approximately 22 percent. While this response rate is similar to response rates found in many research studies, there is concern that the subset of survey responders differs systematically from the overall population of employees at the University of Minnesota. There may also be concern that the likelihood of response was affected by our interventions.

Table 13 presents evidence on what factors influence survey response by regressing a dummy variable for survey response on treatment group and incentive group indicators. Column 1 shows that being assigned into one of the three groups sent printed materials significantly reduced the likelihood of response: the response rate was 24 percent in the control group, and 2-3 percentage points lower in the planning, balance, and income groups. These estimates suggest that the reduction in survey response was due to a general hassle factor from receiving repeated communication from the researchers rather than a specific piece of information contained in the balance or income group mailings. Column 2 shows that the small $2 non-conditional incentive sent at the outset of the experiment led to a statistically significant increase in response rates, and Column 3 shows that the effect of the incentive on response rates did not significantly differ across treatment groups.[16]

We next examine the demographic characteristics of the survey respondents, how they differ from our full administrative sample, and whether the differences in response rates across treatment groups led to observable differences across treatment groups in our survey subsample. Table 14 shows the results of regressing several observable characteristics on treatment group dummies for the survey subsample. As in Table 5, we report the mean of the characteristic for the control group and the p-value for the joint test of the hypothesis that all coeficients on the planning, balance and income group indicator variables are zero at the bottom of the table.

[16]The incentive had a substantial effect on survey response despite the fact that it was provided approximately four months prior to the survey.

Compared to Table 5, our survey subsample is more likely to be female, has a greater number of faculty, and are more likely to be VRP participants. However, there are very few instances where observable characteristics differ significantly across treatment groups within the survey subsample. The reported p-values are generally higher than conventional levels of significance, with the exception of that for age, where the respondents in the income group are approximately one year older than respondents in the control group. Table 15 shows the treatment effects of our administrative outcomes in our survey subsample. The estimated treatment effects are larger in magnitude relative to our full administrative sample.

Together, this evidence indicates that survey responders are not an entirely representative sample of our population, as there are some differences in observable characteristics between survey responders and the entire sample, and treatment effects are larger. However, the results in Table 14 suggest that the differential response rate across treatment groups did not create large imbalances in observable characteristics across treatment groups within the survey subsample. Assuming that the data are missing at random conditional on observables, there are still insights to be gained from the richer set of information available from survey responders.

5.2 Heterogeneity in Effect of Interventions

We investigate the presence of heterogeneity in the effect of our interventions by measuring characteristics known to influence saving decisions. In particular, we collect information on components of time preference, procrastination, barriers to saving, and financial literacy. We convert our survey responses into Z-scores by subtracting the sample mean and dividing by the sample standard deviation and then investigate the impact of interactions between the Z-score and treatment indicators on our administrative outcomes. The interpretation of the coefficients of these interactions is the effect of a one standard deviation change in each measure on the treatment effect.

5.2.1 Time Preferences

Our measures of time preferences come from a series of statements to which survey respondents are asked to respond by rating how much they agree or disagree with the given statement on a 7-point scale.[17] We investigate responses to three statements that aim to differentiate those with higher discount rates and a proclivity for procrastination:

- "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."

The distribution of responses to the above statements along with the mean response and the placement of the various Z-scores are provided in the first three graphs in Figure 2. The average respondent disagrees with the first statement, agrees with the second statement and neither agrees nor disagrees with the third statement.

The first three columns of Table 16 display the results of estimating Equation 3 on the change in contribution amount among our survey subsample, including the Z-score of the response to the statement indicated in the column heading along with the Z-score interacted with our treatment dummies, and our standard set of control variables. The results show evidence of heterogeneity in the treatment effects with respect to time preferences. Specifically, a one standard deviation increase in our measure of time discounting is associated with a \$167 reduction in the change in contribution amount for the income group, suggesting that individuals with higher discount rates are less likely to respond to the income treatment. Proclivities for procrastination appear to be associated with differential changes as well, as a one standard deviation decrease in one's ability to follow through with plans leads to a \$274 decrease in the change in contribution amount for the income group and a one standard deviation increase in putting off thinking about saving for retirement leads to a \$196

[17] All survey questions offered respondents the ability to answer "Don't know" and "Prefer not to say" in order to maintain comparability with the validated survey questions and improve the quality of the provided responses. These responses were coded as missing in the subsequent analysis.

decrease.

5.2.2 Barriers to Saving

We next measure barriers to saving, including cognitive barriers that make it difficult for individuals to optimize their level of retirement contributions and liquidity constraints that make it difficult to follow through with desired plans. We provide two agree/disagree statements regarding cognitive barriers:

- "I find most retirement planning information easy to use."
- "I find it overwhelming to think about how much I need to save for retirement."

We also ask respondents to answer, "In a typical month, how difficult is it for you to cover your expenses and pay all your bills?" with options, "Not at all," "Somewhat," and "Very." The bottom three graphs of Figure 2 display the distribution of responses to these three questions. The average respondent neither agrees nor disagrees with the first two statements and is not liquidity constrained.

The last three columns of Table 16 show the results from repeating the analysis procedure outlined above with our measures of cognitive barriers to saving and liquidity constraints. We find evidence of heterogeneity in the treatment effects with respect to liquidity constraints. Specifically, a standard deviation increase in one's response to the difficulty in covering expenses reduces the income treatment effect by $152. However, there does not seem to be evidence that cognitive barriers to saving mediate the estimated treatment effects.

5.2.3 Financial Literacy

We include a series of questions that allow us to construct four measures of financial literacy in order to assess whether the interventions had a differential effect among those with different levels of financial literacy. Our measures include two measures of self-assessed financial literacy, a measure of actual financial literacy as measured by the number of questions correctly answered on a standard set of financial literacy questions, and a combined measure which reflects all three.

The first measure of self-assessed financial literacy comes from the answer to, "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?" The second measure is a composite of the 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."

The questions which test actual financial literacy are provided in Appendix B. The distribution of responses is provided in Figure 3. Survey respondents tend to score themselves highly on self-assessed financial literacy measures and answer, on average, approximately four out of six financial literacy questions correctly.

We construct Z-scores for each of the four self-assessed financial literacy questions and for the number of questions correctly answered on the financial literacy quiz. The composite measures are simply the sum of the Z-scores for the relevant responses. Table 17 shows the results of estimating Equation 3 on the change in contribution amount with our survey subsample, including the Z-score of the financial literacy measure indicated in the column heading along with the Z-score interacted with our treatment dummies and our standard set of control variables. The results show no evidence that treatment effects were significantly different across the different measures of financial literacy.[18]

[18]We also examine whether financial literacy operates non-linearly by including main and interaction effects of each squared financial literacy index. These results are available upon request and show no evidence that treatment effects vary with respect to financial literacy.

5.3 Effect of Interventions on Additional Aspects of the Saving Process

Observed changes in saving behavior result from an involved saving process, which entails multiple steps. Therefore, it is possible that our interventions affected parts of the saving process, regardless of whether they ultimately resulted in changes in VRP saving behavior. To assess outcomes other than those found in the administrative data, we ask people to respond to the following:

- "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, thinking of your assets, debts and savings, how satisfied are you with your current personal financial condition?"

Respondents were asked to rate their agreement, level of certainty, or satisfaction level on a 7-point scale with the exception of the third question which required a simple Yes/No response. The distribution of responses is provided in Figure 4. As before, to conduct our analysis, we construct Z-scores of the scaled responses.

Table 18 displays the results of estimating Equation 3 on the outcome measures described above, including our standard set of control variables. The dependent variables in Columns 1, 2, 4, 5 and 6 are specified as Z-scores; therefore, the interpretation of a coefficient β on a particular treatment group dummy indicates that that treatment group increased the outcome measure by β standard deviations relative to the control group. The dependent variable in Column 3 is a simple binary measure with Yes coded as 1.

The results show that the income disclosures had a statistically significant impact on almost all measured aspects of the retirement saving process. Specifically, the point estimates indicate that, relative to the control group, the income group's difficulty in finding information to decide how much to save for retirement is 0.12 standard deviations lower; they are 0.20 standard deviations higher in their informedness about retirement planning relative to 6 months prior; they are 5.1 percentage points (or 12 percent) more likely to have figured out how much to save for retirement; they are 0.10 standard deviations more certain about their retirement income; and 0.078 standard deviations higher in their financial satisfaction. While the planning and balance treatment groups, who did not receive the full income disclosures, often show point estimates in the same direction as the treatment group, they are largely statistically insignificant. None of the treatment groups differed significantly in their reported understanding of how savings today can affect income in retirement; however, the responses to this question are heavily concentrated in "strongly agree" bin, as shown in Figure 4.

These results are interesting for a number of reasons. First, they provide evidence that the income disclosures have important implications for various steps in the retirement planning process. There are significant effects on steps that would conceivably occur prior to making changes in retirement contributions (finding information, being informed about retirement planning, and figuring how much to save for retirement) as well as outcomes that may be more apparent later in the process (such as being more certain about their expected retirement income and more satisfied with their financial condition). Second, these results show that individuals in the planning and balance groups, who were sent either no income projections or incomplete income projections, generally do not have statistically different outcomes relative to the control group, suggesting that full income projections drive the observed outcomes. Finally, the results suggest that the treatment effects on our administrative outcomes are not spurious or driven by a small group of outliers and represent more informed saving decisions.

5.4 Effects of Interventions and Projection Assumptions on Beliefs

Assumptions regarding rates of return and retirement age are necessary in developing income and balance projections; however, the interventions may be welfare-reducing if beliefs regarding either are inaccurately influenced by the provided materials. Importantly, this is a potential explanation for our finding that employee response to the intervention was sensitive to the retirement age used in the projections. Therefore, we ask survey respondents to provide the age at which they expect to claim retirement benefits as well as the average annual real rate of return they expect to earn until retirement.[19]

Figure 5 shows the distribution of responses on both questions. The average expected retirement age among the control and planning groups (who were not sent any projections) is 65.63 and 66.01, respectively, very close to our average retirement age assumption of 66. Similarly, the average expected investment return among the control and planning groups is 5.29 and 5.42, only slightly higher than our average investment return assumption of 5 percent. The value of these beliefs, which were independent of our interventions, suggest that our assumptions are not likely to have shifted beliefs about these values among individuals sent the projections.

To further analyze the effect of our interventions and assumptions on beliefs, we regress beliefs regarding expected retirement age and expected rates of return on treatment dummies. We then restrict attention to the balance and income treatment groups and investigate whether the brochure assumptions, which were randomly assigned, influenced beliefs about one's expected retirement age and expected rate of return. Table 19 shows the results. We find no evidence that either the interventions or the assumptions used for the balance and income groups had a systematic effect on beliefs about these assumptions. This indicates that our intervention did not influence prior beliefs and that the sensitivity of saving results

[19] We winsorize the top and bottom 1 percent of the expected retirement age distribution and the top 5 percent of the expected return distribution.

to projection assumptions likely operates through framing effects. [20]

6 Welfare Analysis (TENTATIVE - in progress)

This section aims to provide a theoretical lens through which to view the results of the experiment. In particular, we are interested in assessing the welfare implications of our finding that sending individuals information on lifetime income projections increases saving on average. We develop a very simple model that allows individuals to have biased understandings of the accumulation and decumulation processes and seek to measure the extent to which the intervention affected these biases. This potential for misunderstanding the accumulation and decumulation process is intended to capture the fundamental motivation behind lifetime income disclosure policies. However, the present version of the model does not include the possibility of framing effects

Consider a two-period model in which a worker must decide how much to consume now (C_1) and how much to save for retirement (A_2) given current wealth A_1, current income Y_1, years to retirement k, and degenerate beliefs about other sources of retirement income Y_2, gross rates of investment return R, and annuity prices p.

Our model differs from a standard inter-temporal budgeting model in that we allow people to misperceive the functions by which assets grow leading up to retirement and by which they decumulate into retirement income. Rather than assuming people accurately understand exponential growth, we allow for exponential growth bias parameterized by $\theta > 0$ (Wagenaar and Sagaria 1975; Eisenstein and Hoch 2007; Stango and Zinman 2009). People think assets grow according to $f(R, k, A; \theta) = R^{k\theta} A$. Their understanding is unbiased if $\theta = 1$. They underestimate returns from exponential growth if $\theta < 1$ and overestimate if $\theta > 1$. This

[20] We also investigate the impact of the interventions and assumptions on certainty about retirement age and future investment returns. We find the income treatment had a positive, statistically significant effect on certainty about these assumptions, suggesting the treatment reduced the variance of beliefs. This result could be innocuous if it occurred via the induced planning behavior and learning. However, it could also reflect an unintended, welfare-reducing effect of the interventions if it reflects a collapsing of subjects' prior beliefs towards assumed levels used in the projections.

captures potential misperception of the accumulation phase. We also allow perception of the annuitization factor to be off by a proportion in order to capture misperception of the decumulation phase. Individuals have beliefs about the annuitization factor, parameterized by $\alpha > 0$. No bias is expressed by $\alpha = 1$, underestimates of how much annual retirement income will be provided by a given level of assets at retirement are expressed by $\alpha < 1$, and overestimating how annual income derived from retirement assets is expressed by $\alpha > 1$.[21]

The subjective savings problem is to choose A_2 to maximize:

$$U(C_1) + \beta^k U(C_2) \tag{4}$$

subject to:

$$\begin{aligned} A_2 + C_1 &= Y_1 + A_1 && (5) \\ C_2 &= Y_2 + \alpha p R^{k\theta} A_2 && (6) \end{aligned}$$

The first-order condition for optimal saving is

$$A_2^* \quad : \quad U'(C_1^*) = \alpha p U'(C_2^*)[\beta R^\theta]^k \tag{7}$$

Intuitively, how should savings respond to changes in α or θ? Increases in the value of either bias parameter raises the perceived marginal benefit of saving. This is qualitatively similar to an increase in expected rate of return in a standard savings model, although each of these three factors affect the subjective decision differently as can be seen from equation (7).

In any case, an increase in the subjective marginal benefit of saving would have two countervailing effects: an income and a substitution effect. The income effect would encourage people to reduce working period consumption and to save more because the marginal benefit of each dollar saved is higher – the income earned by savings increases. On the other

[21] We ignore the general equilibrium implications for interest rate determination.

hand, the increase in the subjective value of saving raises the subjective value of a person's endowment and encourages her to consume more in both periods by reducing saving. The effect on optimal savings is ambiguous and depends on which effect dominates, as Figure 6 illustrates.

To understand how the optimal decision responds to changes in bias, we develop comparative statics. Let $\epsilon(\theta,\alpha) \equiv -\frac{U'(C_2^*)}{U''(C_2^*)\alpha p R^{k\theta} A_2^*} = -\frac{U'(C_2^*)}{U''(C_2^*)(C_2^*-Y_2)}$. In a model where all retirement income comes from savings (i.e. $Y_2 = 0$), this expression is analogous to the standard elasticity of intertemporal substitution (EIS), which is also the inverse of Arrow-Pratt relative risk aversion. As in the standard model, this governs whether the increases in (θ, α) increase or decrease optimal savings.

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

$$sign\left[\epsilon(\theta,\alpha) - 1\right] = sign\left[\frac{\partial A_2^*}{\partial \alpha}\right] = sign\left[\frac{\partial A_2^*}{\partial \theta}\right] \tag{8}$$

□

Proof in Appendix C.

The income treatment provided random shocks to α and θ. In our experiment, this shock led to increased savings on average. What can we infer? Either: 1) $\epsilon > 1$ and the shocks to α and θ were positive, or 2) $\epsilon < 1$ and the shocks to α and θ were negative.

The balance treatment provided a random shock to θ alone, without perturbing α. The balance treatment also led to an increase in saving relative to the planning and control groups although this increase was smaller and less robustly significant than that caused by the income treatment. Similarly, we can infer that either: 1) $\epsilon > 1$ and the shock to θ was positive, or 2)$\epsilon < 1$ and the shock to θ was negative.

The literature suggests EIS ≤ 1 (Attanasio and Weber 2010). Assuming $\epsilon \leq EIS \leq 1$, then the larger increases in savings among employees in the income and balance treatment groups implies that the intervention provided negative shocks to α and θ on average.

How did this affect welfare? Assume that revisions towards unbiasedness (i.e. $\alpha = \theta = 1$) are welfare enhancing and those away from it are welfare reducing. If inidividuals were overestimating the payoff from retirement savings prior to treatment ($\alpha > 1 \bigcap \theta > 1$), then the intervention would be welfare enhancing. If they were underestimating either parameter ($\alpha < 1 \bigcup \theta < 1$), then this is not necessarily welfare enhancing. These regions are depicted in Figure 7 defined in relation to an origin of $(1, 1)$. Therefore, the welfare implications depend on the magnitude of α and θ prior to the intervention.

What can we say about α and θ prior to the intervention? If we assume that our intervention removes the bias from the accumulation and decumulation decisions, we can back out the prior values of θ and α using the solution to the model. We can also assess the extent to which individuals exhibit a proportional shift in beliefs about interests rates by replacing R with ηR in Equation 4 and solving for η. For a CRRA utility function, $\frac{c^{1-\sigma}}{1-\sigma}$, the solution to the contribution decision can be defined as an implicit function of $\sigma, \beta, p, A_1, Y_2$, and R and μ_T and $Y_{1,T}$, which are the mean contribution rates and salary for each treatment group T taken from the data, and α, θ, and η, which are the objects of interest.[22] Assuming that our balance and income treatment resulted in $\theta = 1$, $\alpha = 1$, and the possibility of a proportional shift in beliefs about interests rates, η, we can solve for θ, α, and η using the system of equations below, given $\sigma, \beta, p, A_1, Y_2$, R and k. The first-order condition implies:

$$\begin{aligned}
f(\theta, \alpha, 1|\sigma, \beta, p, A_1, Y_2, R; \mu_P, Y_{1,P}) &= \left[\frac{(1-\mu_P)Y_{1,P}}{Y_2 + \alpha p R^{k\theta}(\mu_P Y_{1,P} + A_1)}\right]^{-\sigma} - \alpha p \left[\beta R^{\theta}\right]^k = 0 \\
f(1, \alpha, \eta|\sigma, \beta, p, A_1, Y_2, R; \mu_B, Y_{1,B}) &= \left[\frac{(1-\mu_B)Y_{1,B}}{Y_2 + \alpha p (\eta R)^k(\mu_B Y_{1,B} + A_1)}\right]^{-\sigma} - \alpha p \left[\beta \eta R\right]^k = 0 \\
f(1, 1, \eta|\sigma, \beta, p, A_1, Y_2, R; \mu_I, Y_{1,I}) &= \left[\frac{(1-\mu_I)Y_{1,I}}{Y_2 + p (\eta R)^k(\mu_I Y_{1,I} + A_1)}\right]^{-\sigma} - p \left[\beta \eta R\right]^k = 0.
\end{aligned}$$

where P denotes the planning group for whom α, θ, and η were not perturbed; B denotes the

[22] We restrict the analysis to the three groups that received an intervention in order to remove the influence of transaction costs because all treatment groups received the same information pertaining to how to start or change contribution elections.

balance group for whom only θ, and η were perturbed, and I denotes the income group for whom α, θ, and η were all perturbed.

The challenge posed by this exercise is the large set of parameters that need to be specified in order to solve for θ, α, and η. Isolating values of $\sigma, \beta, p, A_1, Y_2$, and R that provide plausible values for the parameters of interest has proven to be a difficult task. Alternatively, we are considering building an optimization procedure that uses individual-level data, which would allow us to estimate A_1 and Y_2 as a function of observables. Ultimately, we are interested in how far θ, α, and η are from 1 in order to make welfare statements using the concept of compensating variation (i.e. how much consumption is the revised knowledge about accumulation and decumulation worth).

7 Conclusion

The shift toward DC retirement plans has placed much of the responsibility for retirement security in the hands of individuals. Optimal retirement saving behavior in this current landscape requires an understanding of the relationship between current contributions and income in retirement, but requires a level of financial sophistication that many Americans may lack. We evaluate the effect of an intervention aimed at increasing the understanding of this relationship using a large-scale field experiment. We find that individuals who were sent income projections were significantly more likely to increase their contribution election. Our results suggest that this relationship is not universally well-understood and that, absent the intervention, prior beliefs overestimate the amount of annual retirement income supported by current saving rates on average.

The results of our follow-up survey provide corroborative evidence that the intervention influenced saving decisions. We find that higher discount rates, tendencies to procrastinate, and liquidity constraints mitigate the effects of our interventions, which is consistent with known trade-offs in the saving decisions. In addition, those sent full income projections report less difficulty finding information regarding retirement planning, are better informed about retirement planning, and are more likely to have figured out how much to save. They are also more certain about their expected retirement income, and rate themselves higher in overall financial satisfaction.

This study provides proof of concept for a policy that requires no additional mandate on individuals or subsidy for saving. Providing retirement income projections – an extremely low-cost intervention – can actually affect individuals savings behavior. However, the effects manifested were not large on average and were found in only in a small share of the sample. Among those who made changes, effects were substantial and suggest that similar policies may help individuals move closer to their retirement goals. However, this policy is not likely to lead to a savings revolution.

The findings from the study also pose a policy challenge by demonstrating the sensitivity of savings behavior to projection assumptions. The concern is that individuals may be susceptible to any overly-optimistic assumptions or perceived promises implied by projections and induced to over-save, or, analogously, to under-save from too pessimistic projections. Supplementing simple projections with accessible tools that give people a richer chance to explore how outcomes depend on savings choices under a wide range of assumptions and uncertainty may counteract the effect of framing.

The study offers the first direct evidence of the potential value of the kind of intervention recently proposed by Congress. The policy intervention is still under debate and the findings from this study may be informative. However, the intervention that tested here differs in some dimensions from the current congressional proposal. First, the intervention was a one-time mailing sent via an employee's work mail, while the proposed initiative would likely include information in a quarterly statement sent to one's home. Second, while the proposed policy would only require projections be sent to those with active DC accounts, this intervention was also sent to individuals not currently contributing. Third, the researchers did not have access to current account balances and therefore could not provide total projected retirement income. Fourth, the sample of employees at the University of Minnesota is more highly educated, more financially literate, and engaged in higher levels of mandatory retirement saving than Americans generally. While there is room for debate, there are reasons to think each of these factors would lead these study results to understate the true effects of the policy in the national population.

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Table 1: Summary Statistics: Administrative Data

	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	3.030	8.340	0	100
VRP Contr. Rate, post	3.162	8.530	0	100
VRP Contr. Amount, pre	2187.8	5882.2	0	33000
VRP Contr. Amount, post	2300.9	6032.7	0	33000
1(Female)	0.557	0.497	0	1
Age	44.89	11.16	19	64
Tenure	12.34	9.387	0.301	46.64
Salary, pre	58386.9	32527.5	480.7	686587.5
Salary, post	59227.1	33348.7	480.7	686587.4
1(Faculty Ret. Plan)	0.412	0.492	0	1
1(Twin Cities campus)	0.810	0.393	0	1
1(Crookston campus)	0.0129	0.113	0	1
1(Duluth campus)	0.0890	0.285	0	1
1(Morris campus)	0.0206	0.142	0	1
1(Rochester campus)	0.00427	0.0652	0	1
1(Off-campus)	0.0636	0.244	0	1
Observations	16881			

Table 2: Treatment Group Summary

	Control	Planning	Balance	Income
General information on saving for retirement and signing up for VRP		✓	✓	✓
Customized information regarding conversion of hypothetical additional contributions to **additional account balance** at retirement			✓	✓
Customized information regarding conversion of hypothetical additional contributions to **additional annual income** in retirement				✓

Notes: VRP stands for Voluntary Retirement Plan is a tax-deferred savings plan to which employees in the sample can contribute.

Table 3: Treatment Group Materials

	C	P	B	I
Printed Brochures				
General information on saving for retirement		✓	✓	✓
Personalized estimated retirement balance			✓	✓
Personalized 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				✓

Table 4: Summary Statistics: Treatment Groups and Assumptions

(a) Treatment Groups

	mean	sd	min	max
1(Control)	0.241	0.428	0	1
1(Planning)	0.257	0.437	0	1
1(Balance)	0.258	0.437	0	1
1(Income)	0.245	0.430	0	1
Observations	16881			

(b) Assumptions for Projections

	mean	sd	min	max
Inv Return(%)	5.002	1.632	3	7
1(Ret Age=67)	0.499	0.500	0	1
1(Higher axes)	0.501	0.500	0	1
Observations	8484			

Table 5: Demographics by Treatment Group: Full Sample

	(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	-0.070	0.009	-0.004	-0.022	0.001	-54.499
	(0.021)	(0.165)	(0.255)	(0.013)	(0.003)	(0.023)	(0.005)	(131.473)
1(Balance)	-0.015	0.041	0.069	-0.008	-0.005	-0.005	0.002	80.842
	(0.021)	(0.190)	(0.259)	(0.014)	(0.003)	(0.022)	(0.005)	(129.419)
1(Income)	0.061***	0.134	-0.050	-0.001	-0.004	-0.019	0.002	-56.340
	(0.023)	(0.175)	(0.275)	(0.014)	(0.003)	(0.025)	(0.005)	(136.815)
Adj. R^2	0.057	0.139	0.065	0.241	0.117	0.151	0.087	0.050
Control Mean	0.5388	44.9451	12.4280	10.8471	0.0190	0.4263	0.2419	2203.9425
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	0.5617
p-value	0.0048	0.7666	0.9409	0.6828	0.5067	0.7461	0.9530	0.6404

Notes: Dependent variable as indicated in column header. Shaded columns indicate variables used to balance randomization. Sample is restricted to employees present in both Period 1 and Period 2. Standard errors clustered at unit of randomization (Department) with unit of stratification fixed effects. Control variables include gender indicator variable, quadratic in age, quadratic in tenure, ln(salary), percentage change in salary, faculty indicator, and indicators for different campuses. * Significantly different at the 10% level; ** at the 5% level; *** at the 1% level.

Table 6: Summary Statistics of Outcome Variables by Treatment Group

	Control	Planning	Balance	Income	Total
$\mathbf{1}(\Delta$ Participation): Pre $\neq$ Post	0.0140	0.0138	0.0175	0.0174	0.0157
	(0.118)	(0.117)	(0.131)	(0.131)	(0.124)
$\mathbf{1}(\Delta$ Contribution): Pre $\neq$ Post	0.0477	0.0545	0.0627	0.0588	0.0560
	(0.213)	(0.227)	(0.242)	(0.235)	(0.230)
Δ Contribution (Rate): Post - Pre	0.0365	0.104	0.180	0.205	0.132
	(2.999)	(2.595)	(2.998)	(3.062)	(2.917)
Δ Contribution (Amount): Post - Pre	80.80	106.0	126.1	138.7	113.1
	(1688.2)	(1656.4)	(1924.6)	(1571.5)	(1717.5)

Notes: Mean of each variable with standard deviation in parentheses. $\mathbf{1}(\Delta$ Participation) indicates a change in participation status. $\mathbf{1}(\Delta$ Contribution) is an indicator for whether there was any change in the election. Δ Contribution (Rate) is Period 2 contribution rate (as percentage of salary) minus Period 1 contribution rate (as percentage of salary) and Δ Contribution (Amount) is Period 2 contribution dollar amount minus Period 1 contribution dollar amount.

Table 7: Change in Participation & Change in Contribution

Sample	All		Initial Non-Participants	Initial Participants	
LHS	**1**(Δ Part.)	**1**(Δ Contrib.)	**1**(Δ Part.)	**1**(Δ Part.)	**1**(Δ Contrib.)
	(1)	(2)	(3)	(4)	(5)
1(Planning)	0.000	0.008*	0.001	0.000	0.029*
	(0.002)	(0.005)	(0.003)	(0.005)	(0.016)
1(Balance)	0.004*	0.017***	0.004*	0.007	0.055***
	(0.002)	(0.005)	(0.003)	(0.005)	(0.017)
1(Income)	0.004*	0.012**	0.005*	0.002	0.029*
	(0.002)	(0.005)	(0.003)	(0.005)	(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

Notes: **1**(Δ Part.) indicates a change in participation status. **1**(Δ Contrib.) is an indicator for whether there was any change in the election. Control group is the excluded category. Sample is restricted to employees present in both Period 1 and Period 2. Standard errors clustered at unit of randomization (Department) with unit of stratification fixed effects. Control variables include gender indicator variable, quadratic in age, quadratic in tenure, ln(salary), percentage change in salary, faculty indicator, and indicators for different campuses. * Significantly different at the 10% level; ** at the 5% level; *** at the 1% level.

Table 8: Change in Level of Contribution

Sample	All		Initial Non-Participants		Initial Participants	
LHS	Δ Rate	Δ Amt	Δ Rate	Δ Amt	Δ Rate	Δ Amt
	(1)	(2)	(3)	(4)	(5)	(6)
1(Planning)	0.076	36.475	0.030	26.945	0.184	67.598
	(0.059)	(36.299)	(0.047)	(31.405)	(0.195)	(119.929)
1(Balance)	0.121*	48.949	0.059	38.025	0.291	80.128
	(0.063)	(37.921)	(0.048)	(29.959)	(0.194)	(121.735)
1(Income)	0.167***	68.468**	0.061	43.724	0.466**	154.445
	(0.061)	(33.787)	(0.045)	(28.810)	(0.206)	(112.524)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.038	0.000	-0.003	0.008	0.094	-0.009
Control Mean	0.0365	80.8042	0.1468	94.6256	-0.3093	37.4983
Departments	1,385	1,385	1,336	1,336	980	980
Individuals	16,881	16,881	12,808	12,808	4,073	4,073

Notes: Δ Rate is Period 2 contribution rate (as percentage of salary) minus Period 1 contribution rate (as percentage of salary) and Δ Amount is Period 2 contribution dollar amount minus Period 1 contribution dollar amount. Control group is the excluded category. Sample is restricted to employees present in both Period 1 and Period 2. Standard errors clustered at unit of randomization (Department) with unit of stratification fixed effects. Control variables include gender indicator variable, quadratic in age, quadratic in tenure, ln(salary), percentage change in salary, faculty indicator, and indicators for different campuses. * Significantly different at the 10% level; ** at the 5% level; *** at the 1% level.

Table 9: Change in Participation & Change in Contribution: Effect of Assumptions

Sample	All		Initial Non-Participants	Initial Participants	
LHS	**1**(Δ Part.)	**1**(Δ Contrib.)	**1**(Δ Part.)	**1**(Δ Part.)	**1**(Δ Contrib.)
	(1)	(2)	(3)	(4)	(5)
1(Income)	-0.001	-0.006	0.000	-0.004	-0.026*
	(0.002)	(0.004)	(0.003)	(0.005)	(0.014)
Inv Return(%)	-0.001	-0.001	-0.001	-0.000	-0.001
	(0.001)	(0.002)	(0.001)	(0.002)	(0.006)
1(Ret Age=67)	0.007***	0.009	0.009***	0.005	0.007
	(0.003)	(0.006)	(0.003)	(0.006)	(0.021)
1(Higher axes)	0.003	0.005	0.004	0.001	0.007
	(0.003)	(0.006)	(0.003)	(0.007)	(0.020)
Controls	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.002	0.039	0.016	-0.004	0.029
Balance Mean	0.0175	0.0627	0.0163	0.0212	0.2106
Departments	681	681	657	480	480
Individuals	8,484	8,484	6,443	2,041	2,041

Notes: **1**(Δ Part.) indicates a change in participation status. **1**(Δ Contrib.) is an indicator for whether there was any change in the election. Balance group is the excluded category. Sample is restricted to employees present in both Period 1 and Period 2 in the balance and income group. Standard errors clustered at unit of randomization (Department) with unit of stratification fixed effects. Control variables include gender indicator variable, quadratic in age, quadratic in tenure, ln(salary), percentage change in salary, faculty indicator, and indicators for different campuses. * Significantly different at the 10% level; ** at the 5% level; *** at the 1% level.

Table 10: Change in Level of Contribution: Effect of Assumptions

Sample	All		Initial Non-Participants		Initial Participants	
LHS	Δ Rate	Δ Amt	Δ Rate	Δ Amt	Δ Rate	Δ Amt
	(1)	(2)	(3)	(4)	(5)	(6)
1(Income)	0.047	17.977	0.003	3.691	0.195	69.282
	(0.052)	(29.118)	(0.045)	(30.345)	(0.189)	(94.365)
Inv Return(%)	0.004	-4.281	-0.016	-9.775	0.071	16.250
	(0.020)	(12.675)	(0.015)	(9.609)	(0.069)	(41.799)
1(Ret Age=67)	0.066	63.294	0.178***	94.203***	-0.294	-32.497
	(0.070)	(39.396)	(0.060)	(34.296)	(0.205)	(119.958)
1(Higher axes)	0.185***	96.074**	0.111*	71.043**	0.433*	179.080
	(0.069)	(39.858)	(0.059)	(33.366)	(0.222)	(138.233)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	-0.002	0.000	-0.016	-0.000	0.003	-0.039
Balance Mean	0.1799	126.1428	0.1834	118.4246	0.1689	150.7297
Departments	681	681	657	657	480	480
Individuals	8,484	8,484	6,443	6,443	2,041	2,041

Notes: Δ Rate is Period 2 contribution rate (as percentage of salary) minus Period 1 contribution rate (as percentage of salary) and Δ Amount is Period 2 contribution dollar amount minus Period 1 contribution dollar amount. Balance group is the excluded category. Sample is restricted to employees present in both Period 1 and Period 2 in the balance and income group. Standard errors clustered at unit of randomization (Department) with unit of stratification fixed effects. Control variables include gender indicator variable, quadratic in age, quadratic in tenure, ln(salary), percentage change in salary, faculty indicator, and indicators for different campuses. * Significantly different at the 10% level; ** at the 5% level; *** at the 1% level.

Table 11: Change in Participation & Change in Contribution: Effect of Relative Projection Magnitude

Sample	All		Initial Non-Participants	Initial Participants	
LHS	**1**(Δ Part.)	**1**(Δ Contrib.)	**1**(Δ Part.)	**1**(Δ Part.)	**1**(Δ Contrib.)
	(1)	(2)	(3)	(4)	(5)
1(Income)	-0.000	-0.006	0.000	-0.004	-0.026*
	(0.002)	(0.004)	(0.003)	(0.005)	(0.014)
Relative projection magnitude	0.001	0.001	0.001	0.001	-0.004
	(0.001)	(0.002)	(0.002)	(0.004)	(0.010)
Controls	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.002	0.039	0.014	-0.003	0.030
Balance Mean	0.0175	0.0627	0.0163	0.0212	0.2106
Departments	681	681	657	480	480
Individuals	8,484	8,484	6,443	2,041	2,041

Notes: **1**(Δ Part.) indicates a change in participation status. **1**(Δ Contrib.) is an indicator for whether there was any change in the election. Balance group is the excluded category. Sample is restricted to employees present in both Period 1 and Period 2 in the balance and income group. Standard errors clustered at unit of randomization (Department) with unit of stratification fixed effects. Control variables include gender indicator variable, quadratic in age, quadratic in tenure, ln(salary), percentage change in salary, faculty indicator, and indicators for different campuses. * Significantly different at the 10% level; ** at the 5% level; *** at the 1% level.

Table 12: Change in Level of Contribution: Effect of Relative Projection Magnitude

Sample	All		Initial Non-Participants		Initial Participants	
LHS	Δ Rate	Δ Amt	Δ Rate	Δ Amt	Δ Rate	Δ Amt
	(1)	(2)	(3)	(4)	(5)	(6)
1(Income)	0.050	19.269	0.003	4.088	0.187	69.194
	(0.052)	(29.231)	(0.045)	(30.451)	(0.186)	(92.866)
Relative projection magnitude	0.073**	32.915**	0.040	23.122	0.179	57.541
	(0.031)	(16.758)	(0.027)	(14.069)	(0.114)	(66.579)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	-0.003	-0.000	-0.018	-0.002	0.001	-0.039
Balance Mean	0.1799	126.1428	0.1834	118.4246	0.1689	150.7297
Departments	681	681	657	657	480	480
Individuals	8,484	8,484	6,443	6,443	2,041	2,041

Notes: Δ Rate is Period 2 contribution rate (as percentage of salary) minus Period 1 contribution rate (as percentage of salary) and Δ Amount is Period 2 contribution dollar amount minus Period 1 contribution dollar amount. Balance group is the excluded category. Sample is restricted to employees present in both Period 1 and Period 2 in the balance and income group. Standard errors clustered at unit of randomization (Department) with unit of stratification fixed effects. Control variables include gender indicator variable, quadratic in age, quadratic in tenure, ln(salary), percentage change in salary, faculty indicator, and indicators for different campuses. * Significantly different at the 10% level; ** at the 5% level; *** at the 1% level.

Table 13: Survey Response by Treatment Group and Incentives

	(1)	(2)	(3)
1(Planning)	-0.024**		-0.021*
	(0.010)		(0.011)
1(Balance)	-0.039***		-0.042***
	(0.010)		(0.011)
1(Income)	-0.028***		-0.030***
	(0.010)		(0.011)
1(Incentive)		0.090***	0.083***
		(0.013)	(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

Notes: Dependent variable is indicator variable for survey responder. Control group is the excluded category. 1(Incentive) is indicator variable for receipt of non-conditional $2 incentive in beginning of study. Sample is restricted to employees present in both Period 1 and Period 2. Columns 2 and 3 restrict attention to the Twin Cities campus because only that campus was eligible to receive the non-conditional incentive. Standard errors clustered at unit of randomization (Department) with unit of stratification fixed effects. Control variables include gender indicator variable, quadratic in age, quadratic in tenure, ln(salary), percentage change in salary, faculty indicator, and indicators for different campuses. * Significantly different at the 10% level; ** at the 5% level; *** at the 1% level.

Table 14: Demographics by Treatment Group: Follow-up Survey Sample

	1(Female)	Age	Tenure	ln(Salary)	% Δ Salary	1(Faculty)	Participant	Cont. Amt.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1(Planning)	-0.001	-0.060	-0.285	0.000	0.001	-0.058**	0.007	-144.635
	(0.027)	(0.480)	(0.461)	(0.017)	(0.003)	(0.027)	(0.018)	(284.469)
1(Balance)	0.007	0.096	-0.261	-0.011	0.004	-0.001	0.004	0.271
	(0.029)	(0.561)	(0.498)	(0.020)	(0.003)	(0.028)	(0.018)	(284.241)
1(Income)	0.037	1.096**	0.174	0.029	0.004	-0.009	0.025	-61.790
	(0.027)	(0.510)	(0.516)	(0.018)	(0.003)	(0.030)	(0.018)	(290.593)
Adj. R^2	0.038	0.137	0.059	0.189	-0.010	0.088	0.093	0.031
Control Mean	0.6219	46.5902	13.9888	10.9388	0.0129	0.4652	0.3402	3010.2598
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	0.1117
p-value	0.4518	0.0454	0.7566	0.1713	0.5331	0.1070	0.5579	0.9533

Notes: Dependent variable as indicated in column header. Control group is the excluded category. Sample is restricted to employees present in both Period 1 and Period 2 who responded to follow-up survey. Standard errors clustered at unit of randomization (Department) with unit of stratification fixed effects. Control variables include gender indicator variable, quadratic in age, quadratic in tenure, ln(salary), percentage change in salary, faculty indicator, and indicators for different campuses. * Significantly different at the 10% level; ** at the 5% level; *** at the 1% level.

Table 15: Administrative Outcomes: Follow-Up Survey Subsample

	(1)	(2)	(3)	(4)
	1(Δ Part.)	**1**(Δ Cont.)	Δ Rate	Δ Amt
1(Planning)	0.010	0.039***	0.330**	162.768*
	(0.007)	(0.012)	(0.168)	(96.459)
1(Balance)	0.017**	0.057***	0.288*	124.366
	(0.008)	(0.014)	(0.170)	(113.832)
1(Income)	0.018**	0.055***	0.454***	340.890***
	(0.007)	(0.012)	(0.149)	(101.590)
Controls	Yes	Yes	Yes	Yes
Adj. R^2	-0.005	0.019	-0.021	-0.016
Control Mean	0.0195	0.0656	0.0880	110.6366
Departments	996	996	996	996
Individuals	3,688	3,688	3,688	3,688

Notes: **1**(Δ Part.) indicates a change in participation status. **1**(Δ Contrib.) is an indicator for whether there was any change in the election. Δ Rate is Period 2 contribution rate (as percentage of salary) minus Period 1 contribution rate (as percentage of salary) and Δ Amount is Period 2 contribution dollar amount minus Period 1 contribution dollar amount. Control group is the excluded category. Sample is restricted to employees present in both Period 1 and Period 2 who responded to follow-up survey. Standard errors clustered at unit of randomization (Department) with unit of stratification fixed effects. Control variables include gender indicator variable, quadratic in age, quadratic in tenure, ln(salary), percentage change in salary, faculty indicator, and indicators for different campuses. * Significantly different at the 10% level; ** at the 5% level; *** at the 1% level.

Table 16: Change in Contribution Amount: Interactions with Survey Responses

	Time Preferences			Barriers to Saving		
	(1)	(2)	(3)	(4)	(5)	(6)
	Live for today	Follows through	Puts off planning	Easy to use	Overwhelming	Liq. constrained
1(Planning)	174.105*	163.362*	164.749*	142.252	148.623	152.229
	(96.774)	(96.566)	(96.063)	(98.488)	(96.533)	(94.724)
1(Balance)	147.437	126.641	120.937	110.686	105.602	140.020
	(114.269)	(113.957)	(113.673)	(122.212)	(114.002)	(114.222)
1(Income)	352.568***	339.400***	341.672***	352.942***	331.207***	354.698***
	(102.112)	(100.604)	(101.241)	(106.978)	(103.158)	(103.531)
Z-Score	-20.086	-135.067*	-0.282	-12.675	-39.304	-46.843
	(49.537)	(72.278)	(67.302)	(71.067)	(82.367)	(46.112)
Z-Score X 1(Planning)	-22.777	176.065*	19.738	50.184	82.240	-32.341
	(74.944)	(90.159)	(89.995)	(99.882)	(114.885)	(66.250)
Z-Score X 1(Balance)	39.827	115.747	132.050	130.790	49.352	-119.564*
	(76.607)	(104.799)	(102.369)	(115.731)	(114.828)	(72.201)
Z-Score X 1(Income)	-167.150**	274.533**	-196.788*	156.102	38.182	-152.450*
	(72.054)	(107.490)	(104.808)	(117.731)	(117.882)	(80.598)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	-0.016	-0.015	-0.014	-0.017	-0.018	-0.013
Control Mean	110.6366	110.6366	110.6366	110.6366	110.6366	110.6366
Departments	992	995	992	979	989	986
Individuals	3,663	3,675	3,668	3,512	3,648	3,604

Notes: Z-Score represents standardized response to survey question in column header. Control group is the excluded category. Sample is restricted to employees present in both Period 1 and Period 2 who responded to follow-up survey. Respondents who answer "Don't know" or "Prefer not to say" were omitted. Standard errors clustered at unit of randomization (Department) with unit of stratification fixed effects. Control variables include gender indicator variable, quadratic in age, quadratic in tenure, ln(salary), percentage change in salary, faculty indicator, and indicators for different campuses. * Significantly different at the 10% level; ** at the 5% level; *** at the 1% level.

Table 17: Change in Contribution Amount: Interactions with Financial Literacy

	(1)	(2)	(3)	(4)
	Self-Assessed 1	Self-Assessed 2	Actual	Combined
1(Planning)	138.060	142.426	169.249*	119.757
	(95.940)	(93.544)	(96.274)	(91.321)
1(Balance)	122.608	127.145	133.100	130.041
	(115.188)	(114.140)	(113.779)	(114.073)
1(Income)	335.080***	345.579***	351.624***	340.769***
	(103.456)	(101.143)	(102.056)	(101.638)
Z-Score	-14.964	-8.219	93.904	2.453
	(73.058)	(28.180)	(60.911)	(20.115)
Z-Score X 1(Planning)	113.757	39.547	-94.968	23.693
	(101.443)	(41.128)	(82.395)	(27.910)
Z-Score X 1(Balance)	-0.567	-4.473	39.374	0.816
	(97.327)	(38.463)	(111.680)	(27.914)
Z-Score X 1(Income)	121.579	61.884	38.748	43.088
	(119.294)	(49.773)	(73.596)	(34.239)
Controls	Yes	Yes	Yes	Yes
Adj. R^2	-0.015	-0.016	-0.015	-0.014
Control Mean	110.6366	110.6366	110.6366	110.6366
Departments	992	994	996	991
Individuals	3,632	3,664	3,688	3,619

Notes: Z-Score represents standardized financial literacy score as indicated in column header. Control group is the excluded category. Sample is restricted to employees present in both Period 1 and Period 2 who responded to follow-up survey. Respondents who answer "Don't know" or "Prefer not to say" were omitted. Standard errors clustered at unit of randomization (Department) with unit of stratification fixed effects. Control variables include gender indicator variable, quadratic in age, quadratic in tenure, ln(salary), percentage change in salary, faculty indicator, and indicators for different campuses. * Significantly different at the 10% level; ** at the 5% level; *** at the 1% level.

Table 18: Effects of Interventions on Additional Aspects of Saving Process

	(1)	(2)	(3)	(4)	(5)	(6)
	Diff. to find info	Better informed	Figured ret. savings	Understand sav-inc	Ret. income certainty	Financial satisfaction
1(Planning)	-0.061	0.067	0.022	-0.002	-0.000	-0.001
	(0.044)	(0.042)	(0.021)	(0.046)	(0.040)	(0.040)
1(Balance)	-0.052	0.084**	0.018	-0.019	0.009	-0.021
	(0.048)	(0.041)	(0.023)	(0.046)	(0.042)	(0.039)
1(Income)	-0.123**	0.201***	0.051**	0.060	0.102**	0.078*
	(0.048)	(0.045)	(0.021)	(0.052)	(0.040)	(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

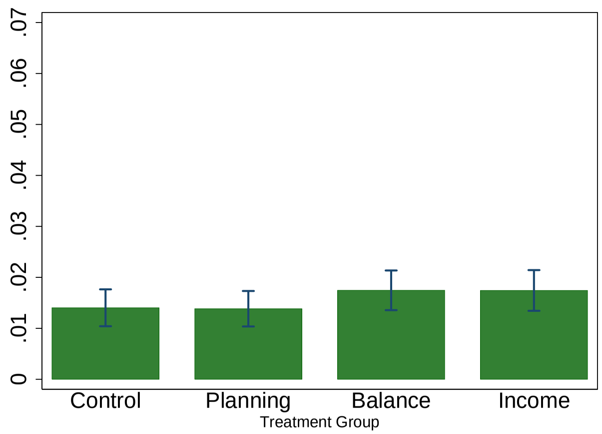
Notes: Dependent variable in Column (3) represents binary response to, "In the last 6 months, have you tried to figure out how much you need to save for retirement?" Dependent variables in remaining columns represent Z-scores of scaled survey responses for difficulty in finding retirement planning information, improvement in being informed about retirement planning, understanding the link between saving now and income in retirement, certainty in expected retirement income, and satisfaction with personal financial condition. Control group is the excluded category. Sample is restricted to employees present in both Period 1 and Period 2 who responded to follow-up survey. Respondents who answer "Don't know" or "Prefer not to say" were omitted. Standard errors clustered at unit of randomization (Department) with unit of stratification fixed effects. Control variables include gender indicator variable, quadratic in age, quadratic in tenure, ln(salary), percentage change in salary, faculty indicator, and indicators for different campuses. * Significantly different at the 10% level; ** at the 5% level; *** at the 1% level.

Table 19: Effects of Interventions and Assumptions on Retirement Age and Investment Return Beliefs

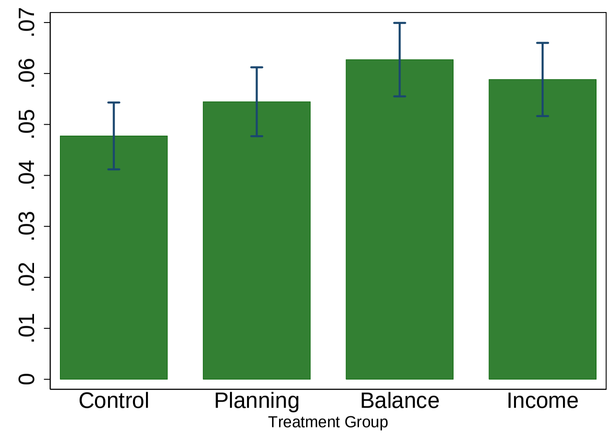
	(1)	(2)	(3)	(4)
	Exp. Ret Age	Exp. Return	Exp. Ret Age	Exp. Return
1(Planning)	0.383**	0.131		
	(0.162)	(0.119)		
1(Balance)	0.281	0.095		
	(0.184)	(0.122)		
1(Income)	-0.086	0.104	-0.336	0.131
	(0.174)	(0.119)	(0.208)	(0.134)
Inv Return(%)			-0.033	0.038
			(0.061)	(0.040)
1(Ret Age=67)			0.216	0.091
			(0.209)	(0.141)
1(Higher axes)			0.141	0.024
			(0.213)	(0.135)
Controls	Yes	Yes	Yes	Yes
Adj. R^2	0.090	0.023	0.077	0.010
Control Mean	65.6266	5.2896		
Balance Mean			66.0049	5.3682
Departments	940	847	455	394
Individuals	3,188	2,440	1,537	1,151

Notes: Dependent variable is as indicated in column heading. Control group is the excluded category in Columns 1 and 2; balance group is the excluded category in Columns 3 and 4. Sample is restricted to employees present in both Period 1 and Period 2 who responded to follow-up survey. Columns 3 and 4 restrict attention to the balance and income groups. Respondents who answer "Don't know" or "Prefer not to say" were omitted. Standard errors clustered at unit of randomization (Department) with unit of stratification fixed effects. Control variables include gender indicator variable, quadratic in age, quadratic in tenure, ln(salary), percentage change in salary, faculty indicator, and indicators for different campuses. * Significantly different at the 10% level; ** at the 5% level; *** at the 1% level.

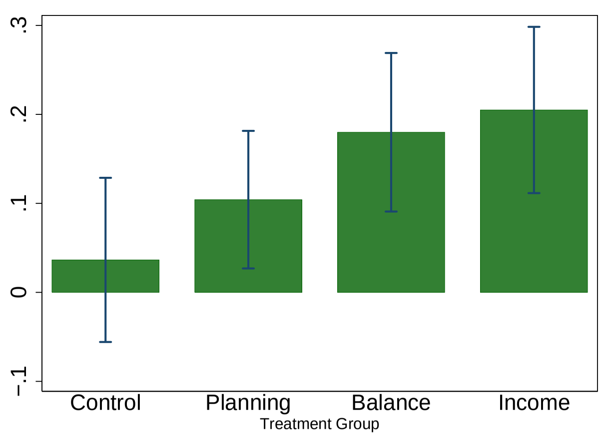
Figure 1: Outcome Variables by Treatment Group



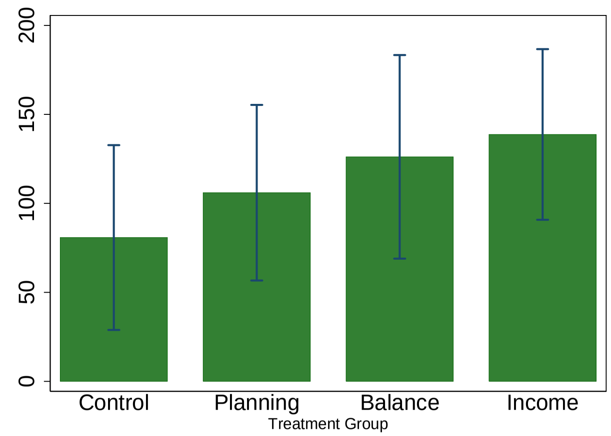
(a) $\mathbf{1}(\Delta$ Participation)



(b) $\mathbf{1}(\Delta$ Contribution)



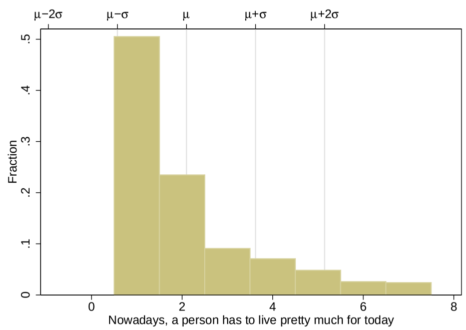
(c) Δ Contribution (Rate): Post - Pre



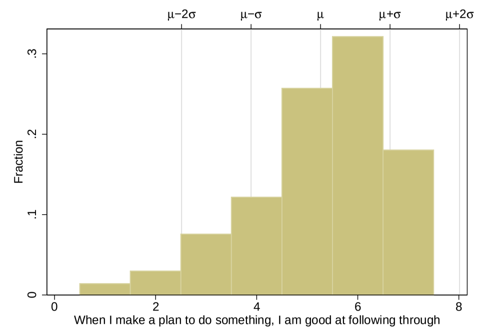
(d) Δ Contribution (Amount): Post - Pre

Notes: $\mathbf{1}(\Delta$ Participation) indicates a change in participation status. $\mathbf{1}(\Delta$ Contribution) is an indicator for whether there was any change in the election. Δ Contribution (Rate) is Period 2 contribution rate (as percentage of salary) minus Period 1 contribution rate (as percentage of salary) and Δ Contribution (Amount) is Period 2 contribution dollar amount minus Period 1 contribution dollar amount. Height of bar equals mean of each variable and brackets indicate 95% confidence interval.

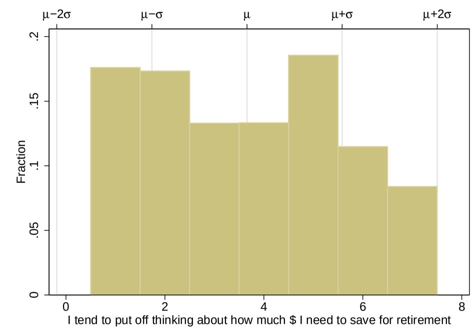
Figure 2: Survey Responses: Time Preferences and Barriers to Saving



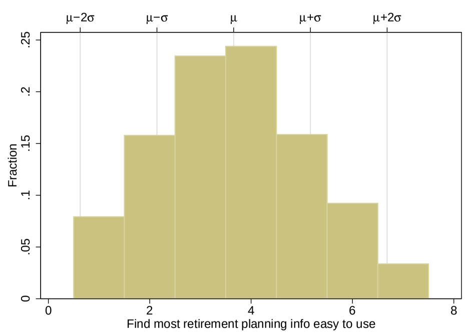
(a) “Nowadays, a person has to live pretty much for today and let tomorrow take care of itself.”



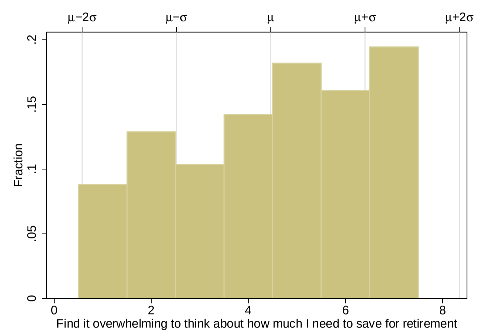
(b) “When I make a plan to do something, I am good at following through.”



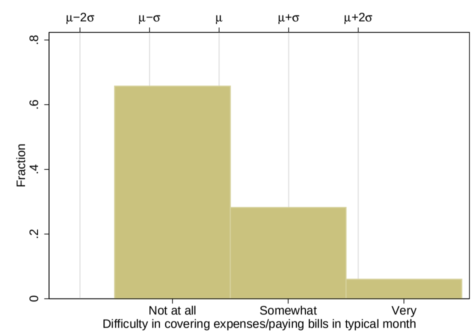
(c) “I tend to put off thinking about how much money I need to save for retirement.”



(d) “I find most retirement planning information easy to use.”



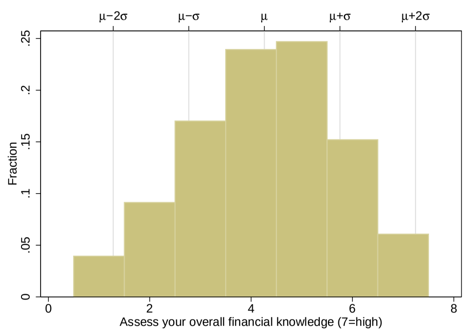
(e) “I find it overwhelming to think about how much I need to save for retirement.”



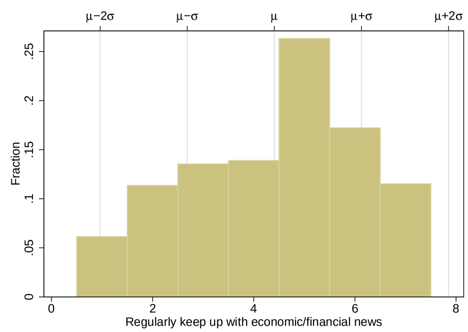
(f) “In a typical month, how difficult is it for you to cover your expenses and pay all your bills?”

Notes: Survey questions answered by subset of full sample. Responses exclude individuals who answered “don’t know” or “prefer not to say.”

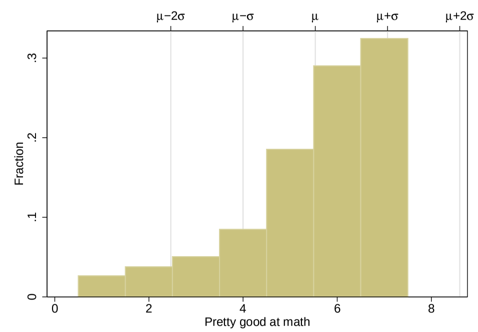
Figure 3: Survey Responses: Financial Literacy



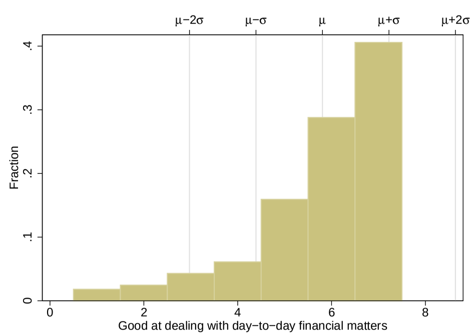
(a) “On a scale from 1 to 7, where 1 means very low and 7 means very high, how would you assess your overall financial knowledge?”



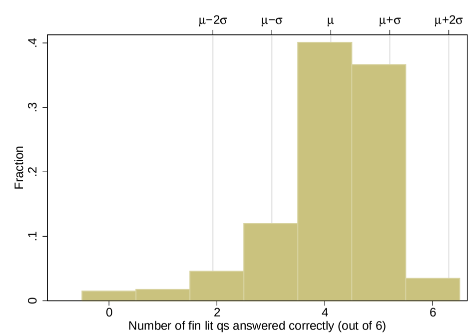
(b) “I regularly keep up with economic and financial news.”



(c) “I am pretty good at math.”



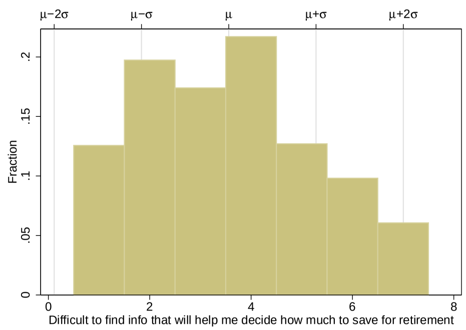
(d) “I am good at dealing with day-to-day financial matters...”



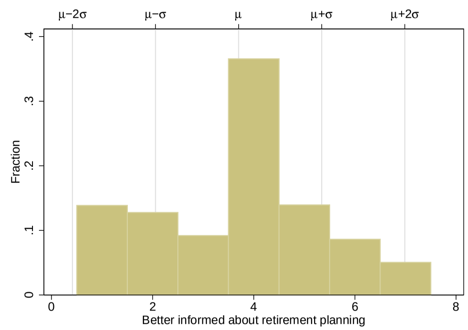
(e) Number of questions qnswered correctly on financial literacy quiz

Notes: Survey questions answered by subset of full sample. Responses exclude individuals who answered “don’t know” or “prefer not to say.”

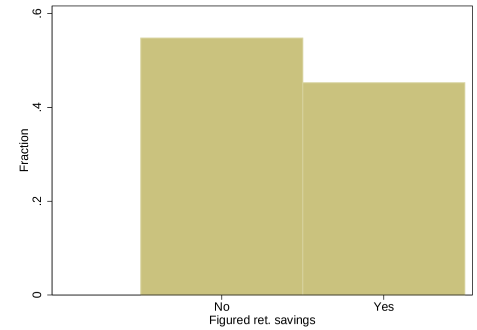
Figure 4: Survey Responses: Alternative Outcomes



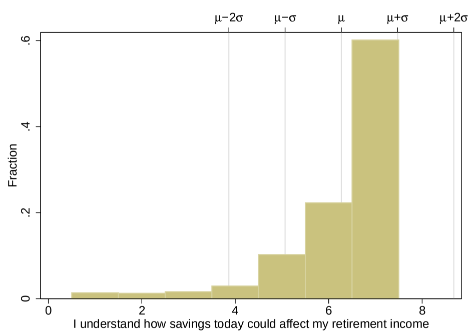
(a) "It is difficult to find information that will help me decide how much to save for retirement."



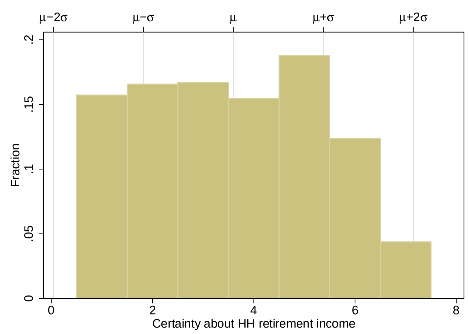
(b) "I am better informed about retirement planning than I was 6 months ago."



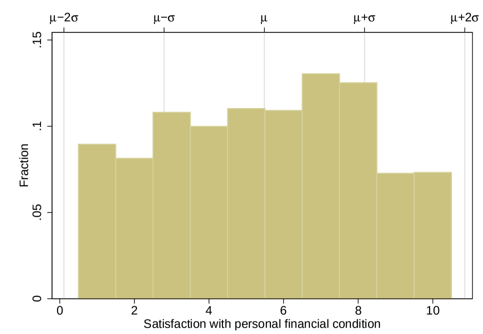
(c) "In the last 6 months, have you tried to figure out how much you need to save for retirement?"



(d) "I understand how savings today could affect my retirement income."



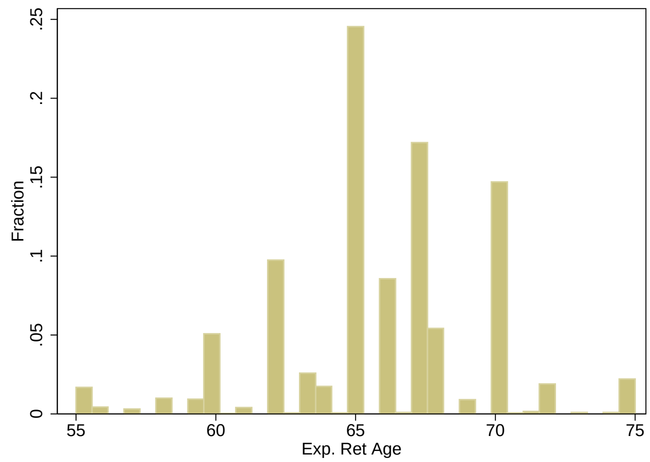
(e) "How certain are you about the amount of annual retirement income you expect your household to have?"



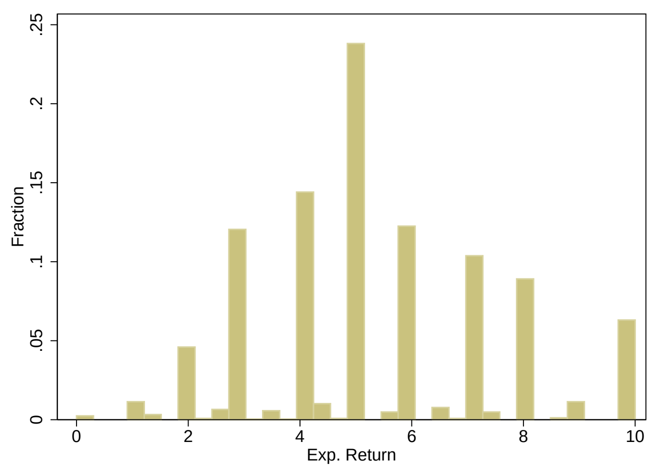
(f) "Overall, thinking of your assets, debts and savings, how satisfied are you with your current personal financial condition?"

Notes: Survey questions answered by subset of full sample. Responses exclude individuals who answered "don't know" or "prefer not to say."

Figure 5: Survey Responses: Retirement Age and Investment Return Beliefs



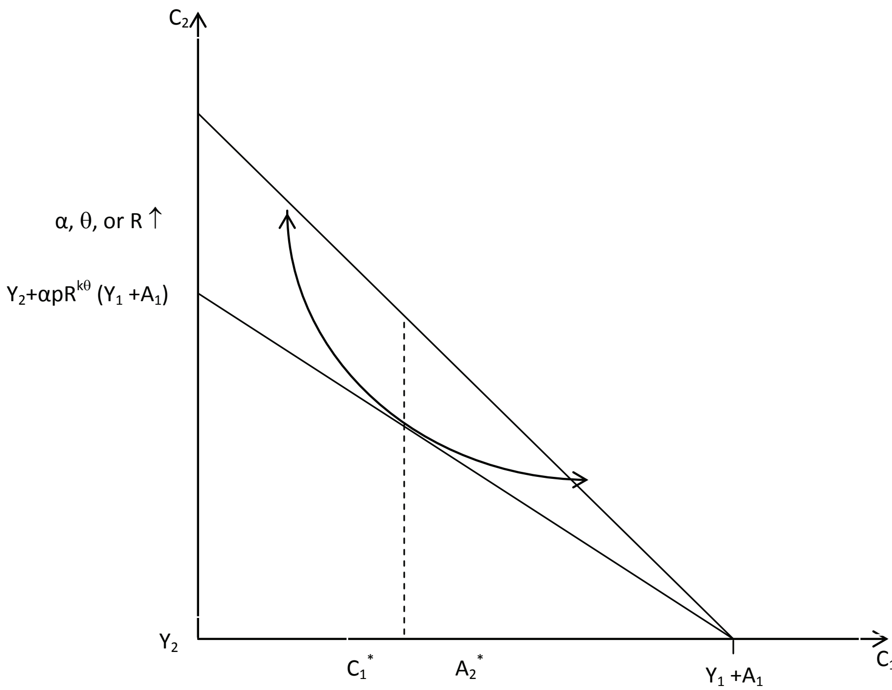
(a) Expected Retirement Age



(b) Expected Rate of Return

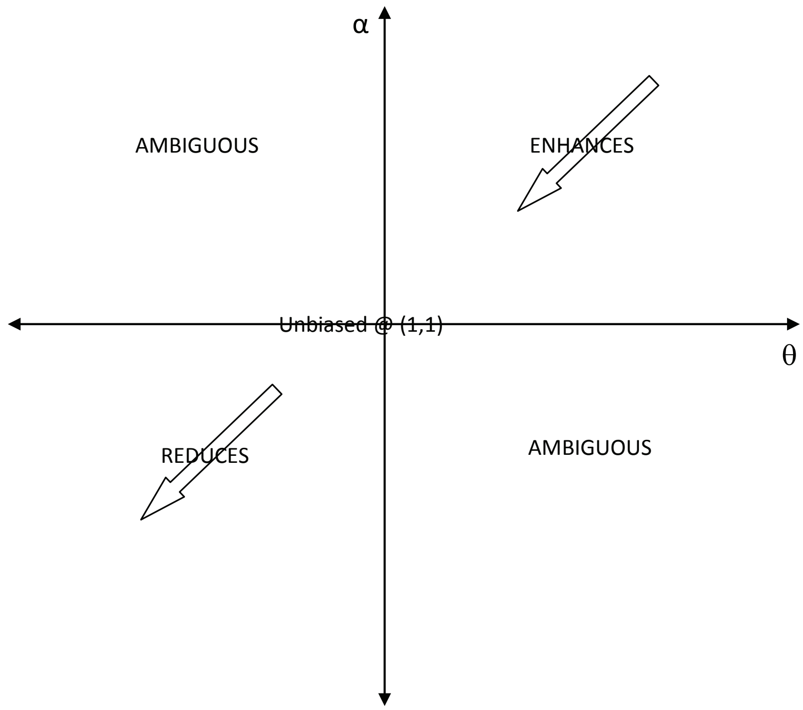
Notes: Survey questions answered by subset of full sample. Responses exclude individuals who answered "don't know" or "prefer not to say."

Figure 6: Change in Saving (Income versus Substitution Effect)



Note: An increase in the subjective marginal benefit of saving through an increase in α, θ or R would raise (lower) savings A_2^* if the income (substitution) effect dominates.

Figure 7: Welfare Implications of Intervention



Note: Welfare impact of negative shocks to α and θ depend on initial level of bias (unbiased at $\alpha = \theta = 1$).

Appendix A: Treatment Intervention

Figure A-1: Income Treatment Brochure Example: Page 1

Am I on Target to Meet My Retirement Goals?

Retirement Savings at the University of Minnesota

What sources of income will be available to me in retirement?

- Most University employees participate in **mandatory retirement plans**.
  - o The Minnesota State Retirement System provides a traditional pension to most civil service and non-faculty bargaining unit employees.
  - o The Faculty Retirement Plan is a defined contribution plan to which most faculty and academic professionals and administrators (P&A employees) contribute.
- Most employees are eligible to participate in **Voluntary Retirement Plans**, which allow up to $16,500 of pre-tax contributions per year. The two types of Voluntary Retirement Plans are the
  - o Optional Retirement Plan (ORP) and
  - o Section 457 Deferred Compensation Plan.
- Substantially all University employees also participate in the federal **Social Security** system.

How much retirement income will I want?

People typically want retirement income to be between 75% and 90% of their expected income prior to retirement, depending on their desired lifestyle.

My goal is: $____________ per year.

Am I on target to meet my goals?

Social Security and mandatory retirement plans provide some, but often not all, of the retirement income desired. Consult plan statements, Social Security benefit statements, or advisors for estimates of retirement income from these sources.

From Social Security and my mandatory retirement plan, I expect $____________ per year.

What else can I do?

Voluntary Retirement Plans can help fill any gap. Nearly 5,000 University of Minnesota employees take advantage of these additional tax-advantaged savings opportunities.

Brought to you by:

Center for
Human Resources
and Labor Studies

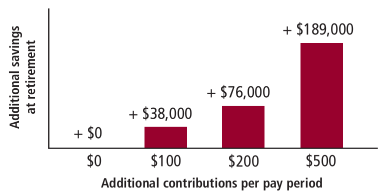
CARLSON
SCHOOL OF MANAGEMENT
UNIVERSITY OF MINNESOTA

Figure A-2: Income Treatment Brochure Example: Pages 2-3

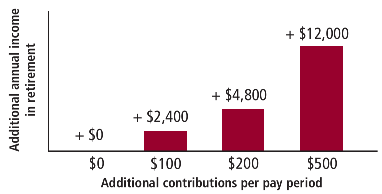
Estimated Retirement Income Statement for
[redacted]

If I begin making additional contributions now…

…how much additional <u>savings at retirement</u> can I expect to have?



…how much additional <u>annual income in retirement</u> 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 Intercampus 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.

8765

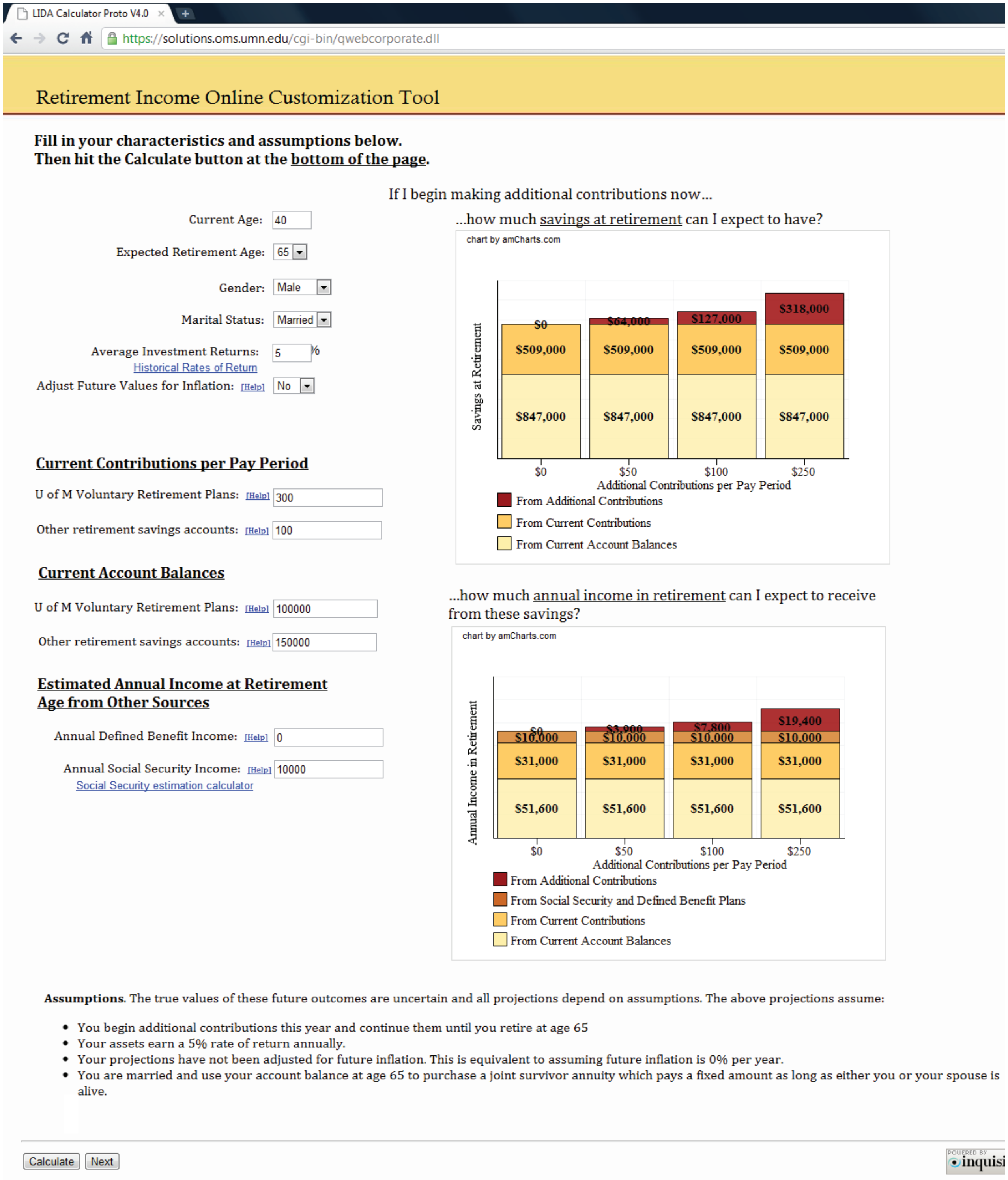
Figure A-3: Income Treatment Brochure Example: Page 4

Comparing the Optional Retirement and 457 Plans

Pension law simplified 457 Plans to bring them more in line with qualified retirement plans like the Optional Retirement Plan. However, differences still exist. To help you understand these differences – so you can make the most of your retirement saving opportunities – review the chart below.

	Optional Retirement Plan	457 Plan
In-service distributions while employed	• Distributions may be made for any financial hardship, in cluding college education (at the University's discretion) • Available after age 59½ for any reason	Distributions are only available for unforeseeable emergencies (at the University's discretion) or if: • Your balance does not exceed $5,000 • There have been no previous in-service distributions • You've made no contributions in the previous two years • You elect such a distribution
Annual contribution limits	$200 Minimum $16,500 Maximum	No minimum $16,500 Maximum
Catch-up contributions	May be made beginning at age 50	In the three years prior to the year in which you turn age 65, you may contribute up to a maximum of twice that year's maximum contribution amount
Loans	Up to 50 percent of your balance may be available to you as a loan, to a maximum of $50,000	Not allowed
Investment options	Range from aggressive growth mutual funds to conservative interest-bearing accounts with Securian Retirement, Fidelity, Vanguard, and DWS Scudder Investments	Range from aggressive growth mutual funds to conservative interest-bearing accounts with Securian Retirement, Fidelity, and Vanguard
Money becomes available	The earlier of termination of employment or reaching age 59½	The later of termination or the calendar year in which you attain age 70½

Figure A-4: Online Customization Tool Screenshot: Income Treatment



Appendix B: Financial Literacy Questions

The following questions comprise the financial literacy quiz provided to survey respondents.[23] Correct answers are marked in **bold**.

1. Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account?
   (a) More than today
   (b) Exactly the same
   (c) **Less than today**
   (d) Don't know
   (e) Prefer not to say

2. Do you think the following statement is true or false? "Buying a single company stock usually provides a safer return than a stock mutual fund."
   (a) True
   (b) **False**
   (c) Don't know
   (d) Prefer not to say

3. Suppose you had \$100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow:
   (a) **More than \$102**
   (b) Exactly \$102
   (c) Less than \$102
   (d) Don't know
   (e) Prefer not to say

4. If interest rates rise, what will typically happen to bond prices?
   (a) They will rise
   (b) **They will fall**
   (c) They will stay the same
   (d) There is no relationship between bond prices and the interest rate
   (e) Don't know
   (f) Prefer not to say

5. Do you think the following statement is true or false? "A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest paid over the life of the loan will be less."

[23] Questions taken from Lusardi and Mitchell (2007).

(a) **True**
(b) False
(c) Don't know
(d) Prefer not to say

6. Let's say you have $200 in a savings account. The account earns 10 percent interest per year. How much would you have in the account at the end of two years? [open-ended; correct answer = **$242**]

Appendix C: Proof of Proposition 1

Proof. Using equations (7) and (5), define

$$G(\alpha, \theta, C_1^*) \equiv U'(C_1^*) - \alpha(\beta R^\theta)^k U' \Big(Y_2 + \alpha p R^{k\theta} \left(Y_1 - C_1^* + A_1\right)\Big) = 0$$

Applying the implicit function theorem reveals that (TBA: change to put in terms of A_2^* rather than C_1^*),

$$\frac{\partial C_1^*}{\partial \alpha} = -\frac{\frac{\partial G}{\partial \alpha}}{\frac{\partial G}{\partial C_1^*}} = \frac{(\beta R^\theta)^k \left[U'(C_2^*) + U''(C_2^*)\alpha p R^{k\theta} A_2^*\right]}{U''(C_1^*) + (\alpha p)^2 (\beta R^{2\theta})^k U''(C_2^*)} \tag{9}$$

The denominator is negative and the leading term of the numerator is positive. Therefore, the sign is opposite that of the bracketed term in the numerator, which follows the sign of $\epsilon - 1$. The sign of the effect on A_2^* must be opposite that of C_1^* so the sign of $\frac{\partial A_2^*}{\partial \alpha}$ is the same as the sign of $\epsilon - 1$.

The logic of response to changes in θ is similar. The partial of C_1^* with respect to θ has the same negative denominator as (9), the leading term in the numerator is also positive, and the bracketed term in the numerator follows the sign of $\epsilon - 1$.

$$\frac{\partial C_1^*}{\partial \theta} = -\frac{\frac{\partial G}{\partial \theta}}{\frac{\partial G}{\partial C_1^*}} = \frac{(\alpha \beta^k k \ln(R) R^{k\theta}) \left[U'(C_2^*) + U''(C_2^*)\alpha p R^{k\theta} A_2^*\right]}{U''(C_1^*) + (\alpha p)^2 (\beta R^{2\theta})^k U''(C_2^*)} \tag{10}$$

□