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# Using behavioral prompts to improve saving and investment decisions

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## Summary

Changes in the retirement landscape make it increasingly important for people to be consistent investors over their working careers. National data suggest that younger generations are saving at a slower rate than previous generations, which raises concerns about their future retirement security. In an incentivized laboratory experiment, with salient financial outcomes, we study participants' investment and asset allocation decisions over a meaningful time horizon and test the efficacy of alternative behavioral prompts to motivate saving decisions. We find that individual risk tolerance and discount rates each have a persistent and significant impact on saving and investment decisions. Financial literacy is a third important driver of investment decisions. Higher levels of financial literacy, higher levels of risk tolerance, and lower discount rates increase the rate of saving and expected return. Controlling for these factors, we find that behavioral prompts encouraging reflection on goals and future needs have significant effects on allocation decisions and expected returns. We also find that the prompts increase expected returns for women and individuals with lower levels of financial literacy.

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## Introduction

Younger generations face many challenges to saving and investing relative to previous generations. Longer retirement periods, the decline in defined benefit plan coverage, Social Security solvency issues, and the overhang of student loan debt are all issues that make retirement saving by millennials (born between 1981 and 1996) and Generation Z (born after 1996) both more challenging and more important. These two generations now represent more than half of working-age adults, and that percentage is increasing with the continued retirement of baby boomers.

Several recent reports have highlighted the special challenges faced by younger generations in financing an adequate retirement (See, e.g., Munnell and Hou, 2018; Bajtelsmit and Rappaport, 2018; Johnson, Smith, Cosic, and Wang, 2018; Brown, 2018). Early evidence suggests that millennials are in worse shape for retirement than prior generations were at the same age. Based on analysis of individuals ages 25-35 in the Current Population Survey (CPS), Munnell and Hou (2018) find that they have less wealth in their 30s relative to earlier cohorts, which they hypothesize to be the result of economic conditions and student loan debt. Using a microsimulation model, Johnson et al. (2018) conclude that millennials are not accumulating wealth as fast as earlier generations. Although some of these differences can be attributed to personal choices, such as delayed marriage, there may also be differences in generational characteristics, such as risk aversion, discount rates, present bias, financial literacy, and confidence that result in different saving and investment choices.

The objective of this research is to enhance understanding of the individual characteristics and behavioral biases that may adversely affect saving and investment decisions and financial outcomes for today's younger generations. Plan sponsors and policymakers can potentially use retirement plan design and choice architecture to help people make better decisions that will enhance retirement outcomes. We are interested in which biases are most problematic for younger savers, how those biases interact with financial literacy, and which interventions most effectively encourage saving and investing.

In this study, we conduct a fully incentivized laboratory experiment to test for the presence of behavioral biases and the efficacy of particular interventions that can improve saving and investment decisions. We measure subject-specific risk preferences, discount rates, present bias, financial literacy, and overconfidence regarding financial knowledge. Subjects choose an asset allocation based on brief fund descriptions. In a between-subjects design, we test the impact of the following interventions on the choice to save and the allocations to investment choices:

- *Goals Prompt:* Setting goals prior to making investment allocation decision
- *Goals + Investment Advice Prompt:* Setting goals and receiving investment advice prior to making investment allocation decision
- *Future Self Prompt:* Thinking about future financial needs prior to making investment allocation decision

## The laboratory experiment

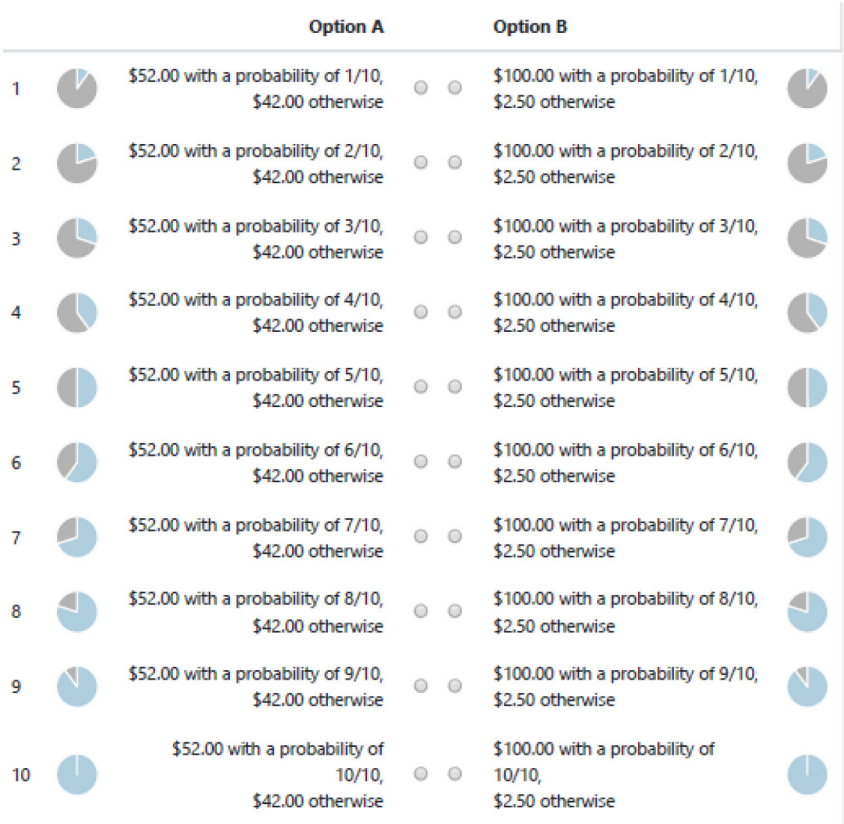
We use a convenience sample of student volunteers from a large public university (234 participants over 12 sessions, average age 21). In all sessions, the experiment proceeded in three phases: Instructions, Tasks, and Payment. In the Instructions phase, the procedures, tasks (with screenshots), payment methods, and payment amounts were explained in detail, followed by a brief assessment to ensure understanding of the experiment tasks and payment methods. All participants earned at least $20 for participation, and three participants from each session were randomly selected for payment based on the decisions made in the experiment tasks (up to $270).

**Incentivized Tasks.** In the Tasks phase, subjects performed several tasks (labeled Green, Blue, and Orange to facilitate randomizing the order of task presentation) that elicited measures of their financial literacy, overconfidence, time discounting, present bias, risk aversion, and savings and investment decisions.

Each of the tasks included monetary incentives of similar value.

- ***Green Tasks (Financial Literacy and Overconfidence):*** Participants answered 15 questions related to financial literacy, numeracy, and personal finance. At the end of the quiz, participants estimated their own quiz score and the average quiz score for other participants. The participant selected for payment for the Green Task received $5 for each correct answer, $12.50 for estimating their own score within +/- one question, and $12.50 for estimating the others' average score within +/- one question. The maximum that a participant could earn based on the Green Tasks was $120 (if they had a perfect score and accurately estimated their own and others' scores).
- ***Blue Tasks (Risk Preferences)***: Participants chose between a series of paired lotteries labeled Option A and Option B in a standard presentation known as a multiple price list (MPL). **Figure 1** shows an example screenshot for this task. In the 10 decision scenarios, the high and low payoffs in the drawings are the same, but the probability of the high payoff changes (from 10% to 100%). The expected payoff for each lottery is $p_L$ x (Low Payoff) + $p_H$ x (High Payoff), ranging from $43 to $52 for Option A versus $12.25 to $100 for Option B. The breakpoint where risk-neutral subjects would be indifferent between Option A and Option B occurs between Decisions 4 and 5.

**Figure 1. Example screenshot for Blue Task MPL risk preference elicitation**



The participant selected for payment based on the Blue Task received $17.50 for making the 10 choices, plus the payoffs from their lottery choice in a randomly selected decision row. We used a spinner with 10 slots to select which of the 10 lotteries to play, and the choice between the High or Low outcome was determined by a public draw from a bingo cage containing 10 balls labeled H or L in the corresponding proportions. The possible payments from the Blue Task were $59.50 (=$17.50 + $42), $20 (=$17.50 + $2.50), $69.50 (=$17.50 + $52.00), and $117.50 (=$17.50+$100).

- ***Orange Tasks (Risk Preferences, Time Preferences, Investing, Behavioral Prompts):*** The Orange Tasks began with participants earning $120 for answering survey questions designed to elicit risk aversion (no right/wrong answers). Participants were told that they would receive $20 of their earnings on the day of the experiment but could choose to save or invest the remaining $100 in a series of 46 savings and investment choices. In the first 45 decisions, participants chose between receiving the $100 sooner (without interest) or later (with interest) through another standard multiple price list presentation. Fifteen of the decisions required choices between payment in 1 week versus 13 weeks, 15 were decisions between 13 weeks and 26 weeks, and 15 were choices between 1 week and 26 weeks. In each case, the participants selected from Option A (sooner time) and Option B (later time), with the decisions presented in order from lower to higher interest rates.

  **Figure 2** provides a partial screenshot example for the 1 week versus 13 week decisions. Both the annualized rates of interest (ranging from the 15% shown to 85%) and the dollar payment (adjusted for the appropriate time period) are shown. It is expected that participants will choose Option A if their discount rate exceeds the rate offered in Option B. The switching point is then used to estimate their subjective discount rate. Comparison of rates between the different time periods is used to estimate present bias.

**Figure 2. Example partial screenshot for the Orange Task MPL discount rate elicitation**

| | 1 Week | | | 13 Weeks | |
|---|---|---|---|---|---|
| | Amount | Option A | Option B | Annualized interest rate | Amount |
| 1 | $100.00 | ○ | ○ | 15% | $103.75 |
| 2 | $100.00 | ○ | ○ | 20% | $105.00 |
| 3 | $100.00 | ○ | ○ | 25% | $106.25 |

In the final (46th) decision for the Orange Tasks, participants were required to allocate their $100 across four possible options, briefly described as in **Figure 3**, for a 26-week investment period. They could receive some or all of the money in one week, or allocate any portion into three different investments. After all decisions were made, the actual returns for each of the risky investments were determined by random spinners that each had 10 possible return outcomes consistent with the investment descriptions. Each participant's payoff for the 46th decision was determined by the random returns and their individual investment allocations.

**Figure 3. Example screenshot of Orange Task investment choices**

| Investment Choice | Information About This Investment |
|---|---|
| **Do Not Invest (receive in 1 week)** | You will receive the money, with no additional interest, in 1 week. |
| **Conservative 26-week Investment** | This investment choice provides a moderate rate of interest and does not expose you to any risk of loss.<br>•Average annualized return = 10%<br>•Range of possible annualized returns: 3% to 18% gain |
| **Moderate Growth 26-week Investment** | This investment could potentially provide a high rate of return, but also exposes you to the risk of losing some of your money.<br>•Average annualized return = 25%<br>•Range of possible annualized returns: 5% loss to 55% gain |
| **High Growth 26-week Investment** | This investment has the highest potential rate of return, but also exposes you to the risk of losing some or all of your money.<br>•Average annualized return = 50%<br>•Range of possible annualized returns: 45% loss to 150% gain |

**Payment.** After all the tasks were completed, we resolved the uncertainty about payments. The participants' computer screens displayed a summary of their performance on the Green Task financial literacy quiz and estimation, and the total they would receive if they were selected for payment based on that task. A computerized spinner identified the Blue Task lottery to be played and then the public bingo ball drawing determined whether it would be a High or Low payout. We resolved the Orange Task outcomes by displaying computerized random spinners to determine the annualized return for each of the three risky investment choices and conducting a bingo ball drawing (with balls labeled 1-46) to determine which decision would be used for payment. Participants each viewed individual summaries on their monitors of what their payments would be if they were selected for payment based on each of the tasks. Lastly, we randomly drew the three participants who would be paid for each of the tasks. All participants received $20 in cash, and the three participants selected for payment based on their task decisions were given a written contract that summarized how and when they would be paid. The timing of payments depended on their choices in the experiment, but were either 1 week, 13 weeks, or 26 weeks from the session date. To minimize the risk that transactions costs for different methods of receipt of payment would influence decisions, participants were told at the beginning of the experiment that they could select from three options for future payments: cash, check, or an electronic mobile money payment. All participants also completed a brief anonymous demographic survey. The average time for each session, including payments, was two hours.

**Treatments.** Each session was assigned to one of four treatments:

- Treatment 1 (Base Case)
- Treatment 2 (Goals Prompt)
- Treatment 3 (Goals plus Investment Advice Prompt)
- Treatment 4 (Future Self Prompt)

The base case treatment did not include any behavioral prompts and proceeded as described above. In both Treatments 2 and 3, participants were asked to set goals for their experiment earnings prior to making the saving and investing decisions. They could select from the following options:

- My goal is to receive the money as soon as possible even if I will have to forego earning any interest on the money.
- My goal is to choose investments that may earn some interest over the next six months but have no risk of loss.
- My goal is to choose investments that will give me the best chance of receiving the highest amount of money possible.
- My goal is to choose investments that will provide me with a chance to receive a lot more than $100, but guarantee that I will end up with at least [here we displayed a dropdown menu with $30, $70, and $90]
- I have no goals for how much I will receive from this experiment.

In Treatment 3 (Goals + Investment Advice), after setting their goals, participants received accurate advice as to the saving or investment allocations that would best meet their identified goals. For example, if they said they wanted to receive the money as soon as possible, they were advised to put all $100 in Do Not Invest, whereas if their stated goal was to guarantee that they earned at least a certain amount, they were told to put that amount in the Conservative investment and the remainder in the High Growth investment.

In Treatment 4 (Future Self Prompt), participants were given the following prompt prior to making their saving/investing decisions:

Thinking about future financial obligations now may give you more options for adjusting your plans. Which of the following expenses do you expect to pay for within the next six months (select all that apply):

- Education-related expenses (tuition, books, fees, etc.)
- Living expenses (rent, food, utilities, phone, etc.)
- Entertainment and sports
- Big items or events (move, buy house, buy car, wedding, travel, etc.)
- Family expenses (childcare, help to parents and siblings, etc.)
- Medical expenses (insurance, prescriptions, optometrist, dentist, etc.)
- Other [Allow the participant to fill in]

## Individual characteristics and behavioral biases

Although many behavioral biases have been identified in the literature, we focus our attention on those that are particularly relevant to financial planning and retirement decisions. Behavioral biases can affect retirement planning at various stages: enrolling in a plan, choosing contribution amounts, allocating investments, and rebalancing allocations (Benartzi, et al., 2007). In this research, we measure and focus on the following behavioral biases and individual characteristics:

- *Financial Literacy:* Understanding of basic financial concepts (compound interest, diversification, and inflation) and basic math (percentages, probability).
- *Risk aversion:* Tendency to prefer certain amounts over a risky gamble that has the same expected value.
- *Present bias:* Having higher discount rates for nearer time periods than for equivalent-length future periods.
- *Exponential growth bias:* Failure to account for compounding.
- *Overconfidence:* Tendency to believe that your own performance is better than it actually is or that your own performance is better than average.

**Financial Literacy and Overconfidence.** Fundamental to making appropriate long-term saving and investment decisions is that individuals need a basic understanding of inflation, compound interest, and diversification (often termed "the Big Three"), as well as some degree of numeracy. Lusardi and Mitchell (2007, 2011) designed a set of standard questions and have implemented them in various surveys in the United States and other countries. Several recent studies have highlighted the effects of generally low levels of financial literacy (Fernandes, et al., 2014; Lusardi, Michaud, and Mitchell, 2017; vanRooij, Lusardi, and Alessie, 2011; Thaler, 2013). These questions were deliberately designed to be simple and easy to compare across groups. In the Green Task, participants took a 15-question quiz that included the Big Three questions as well as numeracy and financial knowledge questions.

Based on the quiz results summarized in **Table 1**, the participants in this experiment exhibited higher financial literacy than has been found in other studies, with an average quiz score of 12.5 out of 15 questions answered correctly, and 17% answering all 15 questions correctly. Only 10% of the sample answered less than 2/3 correctly. The average score on the Big Three financial literacy questions was 2.7 out of 3, with 88.7% answering all three correctly. We attribute this to several factors. First, our sample is more educated than the average person in their age group, and more than half were majoring in business, economics, or STEM disciplines. While this is relatively consistent with the student population at our university, it is not nationally representative of people their age. Second, we provided a calculator to each participant, whereas it is possible that test-takers in other studies may not consistently have had access to a calculator. The third factor, and most important in our view, is that we provided substantial incentives for correct answers ($5 each).

**Table 1. Financial literacy and numeracy (N=223)**

| Statistic | Big 3 | Big 5 | Financial Knowledge | Numeracy | Exponential Growth |
|---|---|---|---|---|---|
| Avg. Number Correct | 2.66 | 4.34 | 2.62 | 4.24 | 2.13 |
| Avg. Score | 88.70% | 86.80% | 87.33% | 84.80% | 71.00% |
| Stand. Dev. | 0.61 | 0.89 | 0.65 | 0.88 | 0.87 |
| Minimum | 0 | 0 | 0 | 0 | 0 |
| Maximum | 3 | 5 | 3 | 5 | 3 |

Another interesting finding from the Lusardi and Mitchell research is that, even though financial literacy levels are relatively low, individuals tend to be fairly confident of their financial knowledge. Women, however, are more likely to rate their knowledge lower and to answer "Don't Know" when given that option, rather than guessing. To measure overconfidence, we compare the participants' estimate of their score on the financial literacy quiz to their actual score (out of 15) and to their estimate of others' average score. On average, participants do not exhibit overconfidence in their financial literacy. The mean own-score estimate was 12.15/15 (81%) and the actual average score was 12.30/15 (82%), which indicates that they are relatively well calibrated, and the difference between participants' actual scores and their estimated scores is not significantly different from zero. However, their average estimate of others' average score was 10.44, showing some evidence of a better-than-average bias. The average score for women in the sample was 78% and it was 86% for men, which is significantly different at the 5% level. Both women and men estimated their own performance as better than average.

**Risk Preferences.** Most people are risk averse to some extent, and this characteristic influences individual risk taking and financial decisions. We estimate risk aversion parameters based on participants' risky choices in the experiment using standard techniques (see Andersen, Harrison, Lau, and Rutstrom, 2008). Our primary measure is derived from their choices between lotteries with different payoffs in the Blue Task, as described above. **Table 2** summarizes their decisions and the resulting metric to capture their level of risk aversion, the constant coefficient of relative risk aversion (CRRA). Most people are averse to risk and this is captured by their preference to receive a certain amount of money (or a less risky gamble with "higher lows" and "lower highs") over a gamble that could pay more or less, but on average pays out more than the sure thing. As the probability of the high payout from the gamble rises, at some point, the gamble's average payoff grows large enough that people are willing to take the risk. Determining where that point is leads to the CRRA range. For example, those participants in the CRRA range of 0.41 to 0.67 switched to the riskier outcome when the probability of the higher payout increased from 60% to 70%. Those in the lower CRRA categories switched at lower probabilities, while those in the higher categories switched later. Some people seek out risk, so even if the riskier gamble pays out *less* on average, they will take it, and this is reflected in the negative CRRA categories. The distribution of CRRA corresponds fairly well with that found in other studies using student experiment participants.

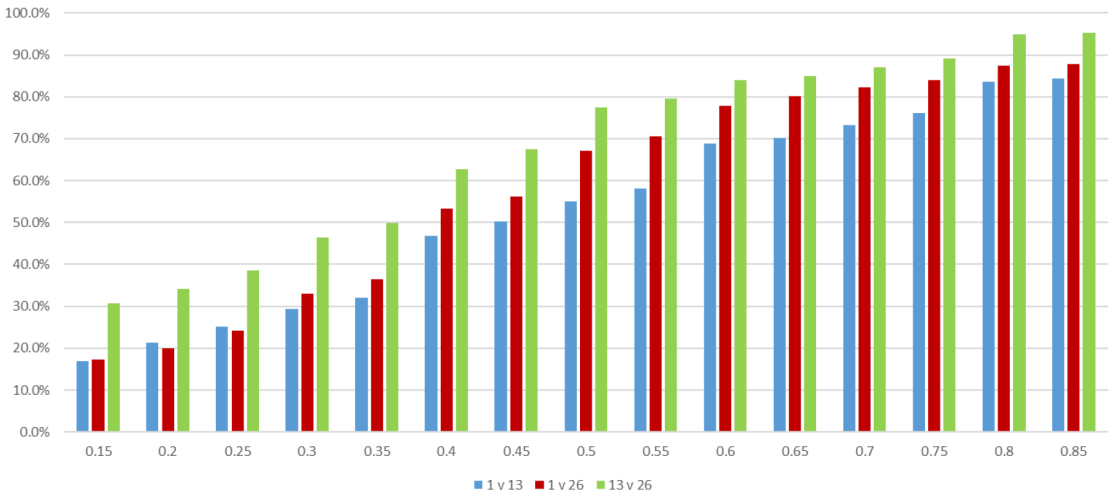
**Table 2. Risk preferences using MPL binary lotteries (N = 216)**

| Number of Safe Choices | Proportion of Total | Proportion of Females | Proportion of Males | Range of Coefficient of Relative Risk Aversion (CRRA) | Midpoint |
|---|---|---|---|---|---|
| <2 | 1.79% | 0.89% | 1.35% | <-1.74 | -1.74 |
| 2 | 4.04% | 4.46% | 3.67% | -0.97 to -0.50 | -0.735 |
| 3 | 6.28% | 8.04% | 4.59% | -0.50 to -0.15 | -0.325 |
| 4 | 16.59% | 10.71% | 22.02% | -0.15 to 0.14 | -0.005 |
| 5 | 11.21% | 12.50% | 10.09% | 0.14 to 0.40 | 0.27 |
| 6 | 31.39% | 33.04% | 30.28% | 0.41 to 0.67 | 0.535 |
| 7 | 17.49% | 15.18% | 20.18% | 0.67 to 0.96 | 0.815 |
| 8 | 7.62% | 10.71% | 3.67% | 0.96 to 1.36 | 1.16 |
| >8 | 3.59% | 4.46% | 2.75% | >1.36 | 1.36 |
| Total | 100.00% | 100.00% | 100.00% | | |

**Time Preferences.** Present bias and exponential growth bias can both adversely impact motivations to save and invest (Andreoni and Sprenger, 2012; Bradford, et al., 2019; Goda, et al., 2015, 2018). High discount rates favor current consumption over saving/investing even when it results in a substantial reduction in future consumption. We measure individual discount rates using the Orange savings task, in which participants made 45 decisions between receiving $100 in 1 week versus receiving $100 plus interest in the future. The point at which a person switches from $100 without interest (present) to $100 plus interest (future) provides a bound on the discount rate that makes those two options equivalent to the participant. While preferring less money sooner to more money later does not indicate a bias, observed inconsistencies in discount rates have been labeled as biases. The term "hyperbolic discounting" refers to the case in which a person's discount rate is inconsistent such that it *decreases* as the delay (until the future payment occurs) *increases*. If someone's discount rate is inconsistent over the *same length of delay*, such that the discount rate is higher if the delay occurs in the near future versus the more distant future, this indicates present bias. In our experiment, we test for evidence of hyperbolic discounting if the estimated discount rate for 1 versus 13 weeks is greater than the estimated discount rate for the 1 versus 26 week period. Similarly, we test for evidence of present bias if the estimated discount rate for 1 versus 13 weeks is greater than the discount rate for the 13- versus 26-week period.

**Figure 4** illustrates the participants saving decisions in each of the three present-future and future-future scenarios. As interest rates rise, more participants choose to save in all three scenarios. The average discount rate for present consumption versus future savings is 52% in the 1-week versus 13-week scenarios and 47% for the 1-week versus 26-week saving period. However, in the future-future scenario (future 13-week versus future 26-week saving period), the average discount rate is only 37%. Statistical tests show that the 13-week discount rate is significantly higher than the 26-week discount rate, displaying an inconsistency that suggests hyperbolic discounting as defined above. Further, the discount rate for the future-future scenario is significantly lower than the discount rates for either of the two present-future decisions, suggesting the existence of present bias in our subject pool.

**Figure 4. Proportion choosing saving with interest over different time frames, by interest rate**




The blue bars represent the proportion of participants who select Option B (saving with interest) for 13 weeks over current consumption (Option A) in the Orange Task decisions. The red bars represent the proportion who choose to save for 26 weeks (with interest) over current consumption, and the green bars represent the proportion who choose to save for 26 weeks (with interest) over 13 weeks (without interest). The x-axis is the interest rate offered for the saving option.

## Investment decisions

In the final part of the Orange Task, participants allocated their $100 earnings between four choices, two that had no risk of loss (Do Not Invest and Conservative) and two that had a chance of both gain and loss (Moderate Growth and High Growth). The Conservative, Moderate Growth, and High Growth investment choices required a 26-week delay of receipt of funds with investment earnings, whereas the Do Not Invest (DNI) choice was paid out in one week. Prior to making these decisions, participants in Treatment Groups 2, 3, and 4 received behavioral prompts. **Table 3** shows the average allocations made by participants in each of the four treatment groups. On average, about 20% of the experiment funds were taken for current consumption and the remainder was invested, with the most popular investment choice being Moderate Growth. Although the DNI allocation is higher with all of the prompts, this does not necessarily imply that the prompts were ineffective because the goals identified could have a variety of effects on allocations across all of the accounts.

**Table 3. Average allocations to investment choices, by treatment**

| | | Average Allocation to Investment | | | |
|---|---|---|---|---|---|
| Treatment | N | Do Not Invest | Conservative | Moderate Growth | High Growth |
| T 1 Base Case | 49 | 18.5 | 21.7 | 34.5 | 25.3 |
| T 2 Goals Prompt | 48 | 22.5 | 15.3 | 35.1 | 27.1 |
| T 3 Goals + Advice Prompt | 72 | 20.1 | 19.1 | 31.5 | 29.4 |
| T 4 Future Self Prompt | 54 | 23.5 | 19.9 | 37.6 | 19.0 |
| All Treatments | 223 | 20.7 | 18.8 | 34.2 | 26.3 |

In **Table 4**, we report the results of regressions that test the effects of personal characteristics and behavioral prompts on the percentage allocation to each alternative. We also include interactions to evaluate the impact of the treatments in which participants received behavioral prompts. An individual's 26-week discount rate has a significant positive effect on the percentage of money allocated to Do Not Invest (receiving cash in one week) and decreases the percentage allocated to the Conservative and Moderate Growth investment choices. Higher risk aversion increases the allocation to cash and decreases the allocation to the riskiest investment choice. These results indicate that, on average, participants make allocation decisions that are consistent with their preferences as measured by discount rates and risk aversion. Financial education also makes a difference, with business/economics majors allocating less to cash and those with higher financial literacy allocating less to Conservative and more to High Growth.

After controlling for preferences, we are interested in the effects of behavioral prompts on these decisions. The interaction terms show that women in Treatment 2 (Goals Prompt) and Treatment 4 (Future Self Prompt) allocate less to cash and more to the Moderate Growth investment than those who did not receive behavioral prompts.

**Table 4. The effect of personal characteristics, preferences, and behavioral prompts on saving and investment choices**

| Investment Choice | Factors that significantly increase allocation to the fund | Factors that significantly decrease allocations to the fund |
|---|---|---|
| Do Not Invest (Receive Cash in 1 Week) | Risk Aversion**<br>Discount Rate***<br>Female w/o Behavioral Prompts*** | Business/Economics Major**<br>Female w/ Goals Prompt***<br>Female w/ Future Self Prompt*** |
| Conservative Investment | | Discount Rate***<br>Financial Literacy** |
| Moderate Growth Investment | Female w/ Goals Prompt*<br>Female w/ Future Self Prompt** | Discount Rate***<br>Female w/o Behavioral Prompts* |
| High Growth Investment | Financial Literacy**<br>Business/Economics Major* | Risk Aversion**<br>Female w/o Behavioral Prompts* |

***significant at the 1% level, **significant at the 5% level, *significant at the 10% level

This table reports the results of OLS regressions in which the dependent variables are the percentage allocations by experiment participants to Do Not Invest and the three risky investments (Conservative, Moderate Growth, High Growth). The amount allocated (out of $100) to DNI is received in one week without interest. The amounts allocated to the three investment choices are received in 26 weeks and the rate of return for each choice is subject to a risky distribution. The Conservative investment was described as having an average annual return of 10% and a range of 3% to 18%. The Moderate Growth investment was described as having an average annual return of 25% and a range of -5% to 55%. The High Growth investment was described as having an average annual return of 50% and a range of -45% to 150%. (N= 223)

Another method of measuring asset allocation is to estimate the expected return for each participant's investment portfolio. We determine each participant's expected return based on the weighted average of returns according to their individual allocations. Although we do not provide the full regression details here, the results tell a similar story to that of Table 4. On average, participants with lower discount rates, lower risk aversion, and higher financial literacy earn significantly higher expected returns. In addition, controlling for the other factors, male participants and business or economics majors have higher expected returns.

While the behavioral prompts are insignificant on average, we find some interesting results when we examine the interactions between the variables. Although women have lower expected returns than men on average, the women who receive a behavioral prompt have higher expected returns than those who do not. As we found in the analysis of allocation decisions, women in Treatment 2 (Goals prompt) and Treatment 4 (Future Self prompt) have higher expected returns compared to those who did not receive a prompt.

Turning our attention to financial literacy, which is a highly significant factor in explaining expected return, we find that prompts have a larger impact on expected return for participants with lower levels of financial literacy. This suggests, encouragingly, that prompts may substitute for financial literacy in saving and investing decisions.

## Consistency between goals and decisions

By more carefully analyzing the impact of goal setting on investment allocations, we find that setting goals changes average allocations and that goal setters make investment choices that are generally consistent with their goals. **Table 5** shows the average allocations for participants based on the goals that they set in Treatments 2 and 3, and compares these to the decisions made by participants in Treatments 1 and 4 who did not set goals for their experiment earnings prior to making their investment allocation decision. Means tests confirm that goal setting makes a significant difference in the allocations made by the participants in Treatments 2 and 3 as compared with those who did not set goals in Treatments 1 and 4, with those in the

goals treatments allocating more to the higher return/risk choices (29% in High Growth as compared to 23% in Treatments 1 and 4). Average allocations by men and women are significantly different in the Conservative and High Growth categories. Regression analyses not reported here also confirm that goals have a significant impact on account allocations. Participants who choose receiving cash as their goal allocate significantly more to cash, while those who identify a goal of no risk of loss allocate more to the Conservative investment, and those who select the maximum return as their goal do, in fact, allocate significantly more money to the High Growth investment. The corresponding expected returns for these participants are impacted accordingly.

**Table 5. Investment allocations by participant goals**

| | | Average Allocations to Investments | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Stated Goal for the Experiment** | **N** | **Do Not Invest (Cash in 1 week)** | | | **Conservative** | | | **Moderate Growth** | | | **High Growth** | | |
| | | **All** | **Male** | **Female** | **All** | **Male*** | **Female** | **All** | **Male** | **Female** | **All** | **Male*** | **Female** |
| **No Return:** Receive cash as soon as possible | 13 | 85.8 | 87.5 | 83.0 | 1.9 | 0.0 | 5.0 | 3.1 | 0.0 | 8.0 | 9.2 | 12.5 | 4.0 |
| **No Risk:** Earn some interest but incur no risk of loss | 25 | 8.8 | 10.9 | 7.1 | 38.2 | 40.5 | 36.4 | 36.6 | 24.5 | 46.1 | 16.4 | 24.1 | 10.4 |
| **Guarantee Return:** Earn at least [30,70,90] and chance to earn more than $100 | 32 | 10.9 | 3.6 | 16.7 | 15.2 | 6.4 | 21.9 | 39.3 | 54.0 | 27.8 | 34.7 | 36.0 | 33.6 |
| **Maximize Return:** Chance to receive highest amount possible | 44 | 12.1 | 14.4 | 9.3 | 14.1 | 9.2 | 20.0 | 34.7 | 29.6 | 40.8 | 39.2 | 46.9 | 30.0 |
| **No Goal:** Subject has no goals for their experiment earnings | 6 | 51.7 | 33.3 | 70.0 | 4.2 | 3.3 | 5.0 | 35.8 | 50.0 | 21.7 | 8.3 | 13.3 | 3.3 |
| **With Goal Setting:** Weighted average allocations for Treatments 2 and 3 | 120 | 21.0 | 21.9 | 20.2 | 17.6 | 12.8 | 22.4 | 32.9 | 31.4 | 34.4 | 28.5 | 33.9 | 23.0 |
| **Without Goal-Setting:** Weighted average allocations for Treatments 1 and 4 | 103 | 21.2 | 18.4 | 23.8 | 20.8 | 16.1 | 25.4 | 36.2 | 36.6 | 35.7 | 22.0 | 28.9 | 15.2 |

*Significantly different from Female at the 1% level based on paired two sample means test.

## Conclusions and policy implications

Based on previous research, we know that individual characteristics, behavioral biases and heuristics can affect saving and investing decisions, resulting in suboptimal retirement outcomes. However, identifying optimality for individual decisions requires gathering some information on their underlying preferences. For example, pressuring a highly risk averse individual to allocate money to a high-growth retirement account because the expected wealth accumulation is high may not be the best course of action. On the other hand, present bias and financial illiteracy may cause people to save too little or too late. High levels of risk aversion for some individuals may result in overly conservative investment portfolios compared to their saving and investment goals. The changing retirement landscape implies that younger generations will need to save more to support their expected longer retirement periods.

In this study, we use an incentivized laboratory experiment to consider the role of behavioral biases and individual characteristics in investment decisions of younger individuals and to test the efficacy of alternative behavioral prompts to motivate improved outcomes. As compared with many lab experiments, our experiment incorporates salient financial incentives (up to $270) over a meaningful time horizon (26 weeks). We consider the effects on saving and investment decisions of setting goals in advance of saving/investment decisions, receipt of investment advice targeted to achieving goals, and invoking the future self. In addition to testing the effects of these behavioral prompts, our experiment design differs from previous research in that we carefully measure and control for risk aversion, time discounting, and financial literacy.

Although our sample exhibits higher financial literacy than has been found in previous survey research, we still find that financial literacy has a highly significant effect on saving and investment decisions, with the more financially literate participants being more likely to save for the future and more likely to invest in higher-risk assets. Consistent with findings of other studies on time discounting, our sample of young adults exhibits generally high discount rates, and those with higher discount rates are significantly less likely to save. We also find that individuals are more willing to save at lower rates of return if the allocation to saving takes place further in the future. For plan sponsors and policymakers interested in encouraging increased retirement saving, this suggests that plan prompts that focus on future saving decisions will be more successful for clients inclined toward present bias. For example, individuals with a present bias would be more likely to agree to salary reduction agreements that apply to future income rather than current income.

Our most important contribution is that these behavioral prompts alone do not have a statistically significant effect on average levels of asset allocation, and should not be administered according to a “one size fits all” policy. Prompts that provide additional information guiding careful decisions can help to align allocations with individual goals but must take into consideration individual risk preferences and discount rates. In these circumstances, setting goals prior to making investment decisions can significantly impact investment allocation and returns.

Younger generations are saving too little from society’s standpoint, but their level of saving may be consistent with their risk attitudes and time preferences. Even if behavioral prompts can nudge people toward saving more, the results of our study suggest that helping young people understand how to think about and process risk and delay may be more important than telling them how much to save or which investment to choose. Risk in retirement planning architecture is often presented as the risk of losing some of the investment. Instead, perhaps the risk of having too little money in the future should be emphasized.

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