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The Role of Exponential-Growth Bias and Present Bias in Retirement Savings

By Gopi Shah Goda, Matthew R. Levy, Colleen F. Manchester, Aaron J. Sojourner, and Joshua Tasoff

Research suggests that the amount of money people save for retirement may be suboptimal for many Americans. While the adequacy of retirement savings is the subject of ongoing debate, Munnell, Webb, and Delorne (2006) argue that more than 40 percent of U.S. households are saving insufficiently to maintain their standard of living into retirement. Increasing evidence from scholarly research in economics and finance suggests there are both cognitive and motivational barriers to saving. Identifying and addressing such barriers is a significant public policy concern, as the transition from traditional employer-provided pensions to defined contribution (DC) plans, such as 401(k)s, has increased individual responsibility for retirement saving over the past four decades.

Many individuals do not understand the complex calculations required to judge whether their current rate of savings will allow them to achieve their desired standard of living in retirement. This creates a cognitive barrier to saving. A central piece of this calculation is compound interest, or the interest earned on previously earned interest that has been added to the principal. Exponential-growth bias (EG bias) is the tendency for individuals to underestimate the exponential growth of an asset's value over time due to neglecting compound interest.

Figure 1 illustrates how individuals with different levels of EG bias perceive the growth of an asset over time for a given rate of return. Those who are not biased perceive that the asset would grow with compound interest at a rate that reflects the annual interest earned on the asset. Individuals who perceive the asset's value as growing linearly neglect the effects of compound interest completely and are the most biased. Other

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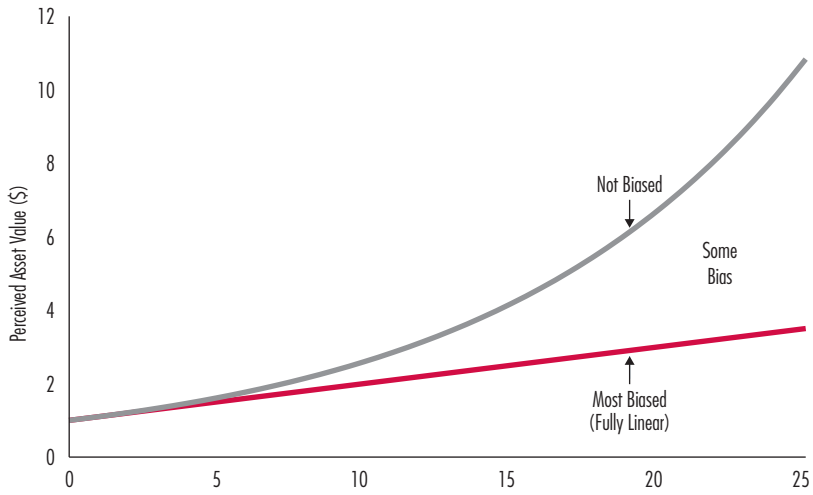
individuals display some degree of bias, meaning they perceive the asset's value to be higher than that implied by no compound interest, but do not fully appreciate the ability of compound interest to increase the asset's value. A growing body of literature suggests that EG bias is prevalent and is correlated with lower levels of wealth accumulation and higher levels of debt.

EG bias implies that individuals underestimate the future value of any retirement contributions made today, which could affect how they respond to opportunities for saving, such as those presented by employer-provided DC plans. Providing individuals with accurate information on compound interest may enable individuals to make contribution decisions that better align with their retirement goals. Previous research with University of Minnesota employees shows that providing individuals with retirement-income disclosures illustrating the relationship between retirement contributions and income in retirement increases contributions to employer-provided plans (Goda, Manchester, and Sojourner, 2014). Yet additional research is needed to understand the impact in more representative populations.

Even if an individual understands the saving rate required to meet his or her retirement-income goals, enrolling in a savings plan or changing one's contribution amount is often viewed as a tedious process that well-intentioned people may choose to delay repeatedly. In particular, individuals may exhibit "present bias," which is the tendency to exhibit patience when contemplating tradeoffs in the future, but impatience when making tradeoffs involving the present. An individual who is present biased may intend to save more in the future but never does so due to continued procrastination of the enrollment process when "the future" becomes "the present." In contrast, individuals who are not present biased follow through with intended actions because they value benefits received today and those received in the future consistently.

Figure 1
Illustration of Exponential-Growth (EG) Bias



Note: The figure shows the perceived asset value with a starting value of $1 at time zero growing at an annual interest rate of 10 percent for savers with varying levels of linearized exponential growth bias.

Table1
Illustration of Present Bias

Employee Type	Planned Behavior	Actual Behavior
Not Present Biased	"I'll get it done tomorrow."	Tomorrow she clears her schedule for an hour to complete the paperwork.
Present Biased	"I'll get it done tomorrow."	Each day she delays doing the paperwork; she may never complete it.

Table 1 illustrates the difference between individuals who are time consistent versus those who are present biased in the context of completing the necessary paperwork for enrolling in a retirement savings plan. A time-consistent individual will make a plan and follow through, while a present-biased individual makes a plan, but may continually push off action for a later date. Existing research shows how present bias is predicted to decrease savings in theory, and that it is related to credit card debt, BMI, smoking, drinking, seatbelt use, and insurance purchase. However, there is a lack of empirical research relating present bias to retirement-saving behavior.

Another critical gap in knowledge is to what extent EG bias and present bias overlap and jointly contribute to inadequate retirement saving decisions. EG bias may reinforce tendencies for present-biased behavior by reducing the perceived cost of procrastination because those with EG bias underestimate the cost of delaying retirement contributions to the future. Policies designed to mitigate one bias may not address the other. Indeed, Goda, Manchester, and Sojourner (2014) find no evidence that retirement-income disclosures had an effect on self-reported procrastinators.

Understanding the prevalence and influence of these biases is critical for designing effective public policy in the context of retirement saving. We address this important gap in knowledge by estimating the prevalence of EG bias and present bias in the U.S. population. We relate these biases to accumulated retirement wealth, and assess how treatments designed to mitigate these biases are likely to influence an individual's response to retirement savings opportunities presented by employer-provided retirement savings plans.

Description of Study

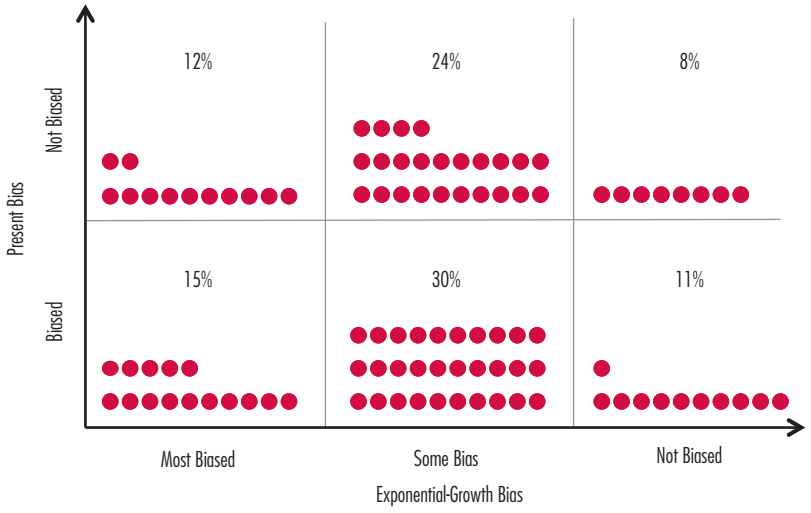
We fielded two online surveys to the American Life Panel (ALP), whose members are recruited and maintained by RAND Corporation. ALP provides computer and Internet services as needed to reach segments of the population without such access. In addition, ALP makes available a host of previously collected background information on panelists, such as age, gender, employment status, and education.

We measure the presence of EG bias using individuals' responses to questions about the future value of an asset given various assumptions on the interest rate and time horizon. For example, individuals were asked: "An asset has an initial value of $100 and grows at an interest rate of 10 percent each period. What is the value of the asset after 20 periods?" EG bias is assessed based on the accuracy of the respondents' answers.[1]

Our measure of present bias uses individual reports of how they value receiving various amounts of money over different time horizons. For

1 Calculators and other forms of help were neither explicitly forbidden nor overtly suggested. Respondents were told they could use whatever approaches they preferred to answer the questions.

Figure 2
Prevalence of EG Bias and Present Bias



Notes: N=1,647.

example, they were asked, "Would you rather receive $100 today or $125.40 in 12 months?" and "Would you rather receive $120.00 in 12 months or $150.50 in 24 months?" Individuals who indicate that they value payments received today relative to payments received in 12 months *more than* they value payments received in 12 months relative to 24 months display characteristics of present bias.

The next two sections report the results of our study. First, we discuss results on the prevalence of EG bias and present bias in the U.S. population, and the relationship between these biases and retirement savings. Second, we report how response to a hypothetical retirement saving opportunity is affected by treatments designed to mitigate these biases.

Findings on Biases and Retirement Savings

A key contribution of this study is providing descriptive information on the prevalence of present bias and EG bias in the U.S. population. We classify individuals into one of three categories of EG bias and one of two categories of present bias, for a total of six possible combinations of EG bias and present bias. Figure 2 shows the distribution of our sample across these groups. We find that both biases are prevalent in the sample: 56 percent of the sample is present biased and 81 percent of the sample either underestimates ("some bias") or neglects ("most biased") compound interest. Only 8 percent of the sample displays neither bias, and 15 percent displays both present bias and the most extensive EG bias. Importantly, having one bias is not positively related to having the other bias.

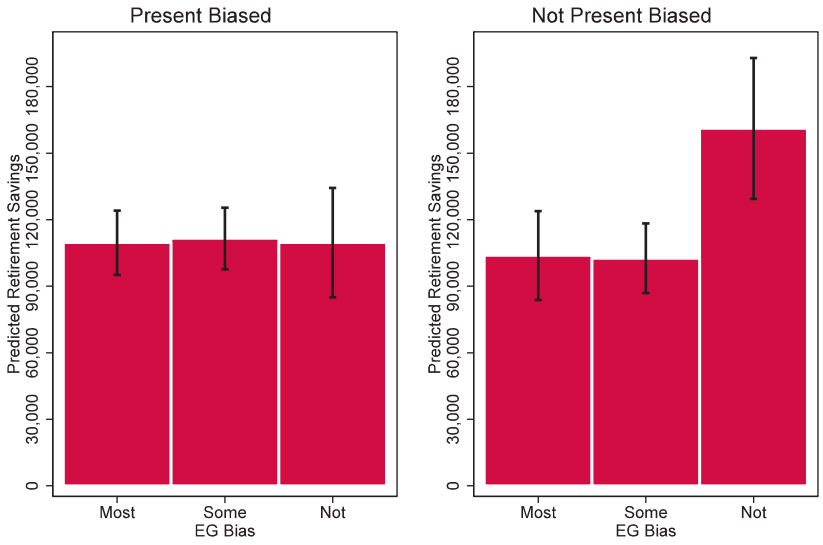
To assess how retirement saving relates to these biases, we ask individuals to report their actual, current retirement savings in Survey 1. Because one's level of retirement savings also depends on factors other than biases, such as age, gender, ethnicity, and income, we control for these factors when isolating how retirement savings differs for those with EG bias and/or present bias. We also control for differences in financial literacy, as measured by a battery of three questions about risk diversification, inflation, and interest rates; a proxy for IQ, measured by five questions from an IQ exam; and one's general preference for making tradeoffs in future dates.[2] We then use our model to predict retirement wealth for the sample under six different combinations of EG bias and present bias to determine the role of these biases in retirement saving decisions.[3]

Figure 3 shows the predicted retirement wealth under these scenarios. We also indicate the range of estimates based on a 95 percent level of confidence to

2 The full set of control variables includes one's general time preference, age, gender, number of children, marital status, race/ethnicity, educational attainment, income, interactions between age and income, employment status, risk aversion, our IQ proxy, and standard measures of financial literacy.

3 These results implicitly assume that our measures of these biases are not correlated with other factors not included in our analysis that also affect retirement savings.

Figure 3
Present Bias, EG Bias and Retirement Savings



Notes: N=1,647. Height of bars represent the average predicted retirement wealth for our sample assuming level of present bias and EG bias is as shown.

assess whether the differences are statistically meaningful. We find that predicted retirement savings are highest when both biases are eliminated, and low when either EG bias or present bias is operating. The difference between the predicted retirement wealth for our sample with neither bias is approximately 45–57 percent higher than that of the other scenarios, and this difference is statistically significant. Our results suggest that there is an interaction between present bias and EG bias, and that having one bias is associated with as much of a reduction in retirement savings as having both biases. This analysis suggests that overall retirement savings would be approximately 44 percent higher if all biases were eliminated. We also estimate that the effect on retirement savings of going from some or both biases to neither bias is approximately six times as large as a one-standard-deviation increase in our IQ proxy. In other words, our results suggest that EG bias and present bias are much more powerful in explaining differences in retirement wealth than IQ.

Findings on Biases and Saving Response to Interventions

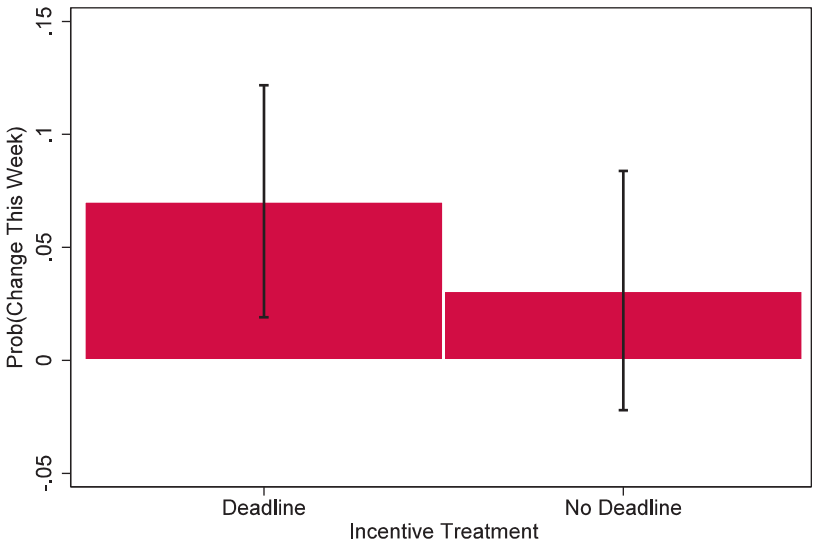
We use our survey to evaluate how individuals respond to different retirement-saving opportunities. To do this, we construct a hypothetical scenario based on an employer introducing a match component to its employer-provided retirement plan, and we randomize two sets of interventions –– Projections and Incentives –– designed to address each bias.

The Projections dimension provides information on the value of the employer match as a projected balance at retirement (Balance Treatment) or as projected annual income in retirement (Income Treatment), based on the contribution amount entered by the respondent using an embedded online planning tool. By providing information about the relationship between current contributions and future values, these treatments are meant to address EG bias as a barrier to saving, as they can help individuals accurately understand the connection between current saving and future payoffs. We compare how individuals in the two treatment groups respond to the match relative to those who were presented the year-end value of the match.

The Incentive dimension provides a hypothetical $50 bonus to individuals if they complete the necessary paperwork within one week (Deadline Treatment) or anytime in the future (No Deadline Treatment).[4] This dimension is meant to address present bias as a barrier to saving by providing incentives to perform tasks sooner rather than delaying them. We compare the timing of individuals' completion of the paperwork required for the change in the two

4 Per ERISA guidelines, we communicate to individuals that they may elect not to change their contributions on the paperwork. This ensures we are not directly incentivizing contributions with our treatments, rather, that we are simply explaining the process necessary to make a change.

Figure 4
Effect of Incentive Treatment on Timing Response to New Employer Match



Notes: N=1,647. Height of bars represent the average effect of Deadline and No Deadline treatment relative to the control treatment for our sample.

treatments with that of individuals in the control condition, which provided no monetary incentive.

The Effect of Incentive Interventions on Timing

Figure 4 shows the effects of the Incentive Treatments, Deadline and No Deadline, separately. Each panel reports the effect of the treatment on the individual's likelihood of indicating they would make a change within the week, along with a 95 percent confidence interval to assess whether the effect is statistically meaningful. The results are shown relative to the control group, which was given no extra incentive for completing the paperwork.

The results indicate that the Deadline Treatment resulted in a 7 percent increase in the number of individuals who reported they would respond within one week, relative to the control group. This effect corresponds to a 9 percent increase in the number of individuals who state they will complete the paperwork within one week, and this increase is statistically significant. On the other hand, the No Deadline Treatment resulted in a 3 percent increase in response, which was not significantly different from the group offered no incentive. These results indicate that imposing deadlines influences when people plan to act, and can increase the percentage of people who take advantage of new retirement savings opportunities that increase their returns to saving.

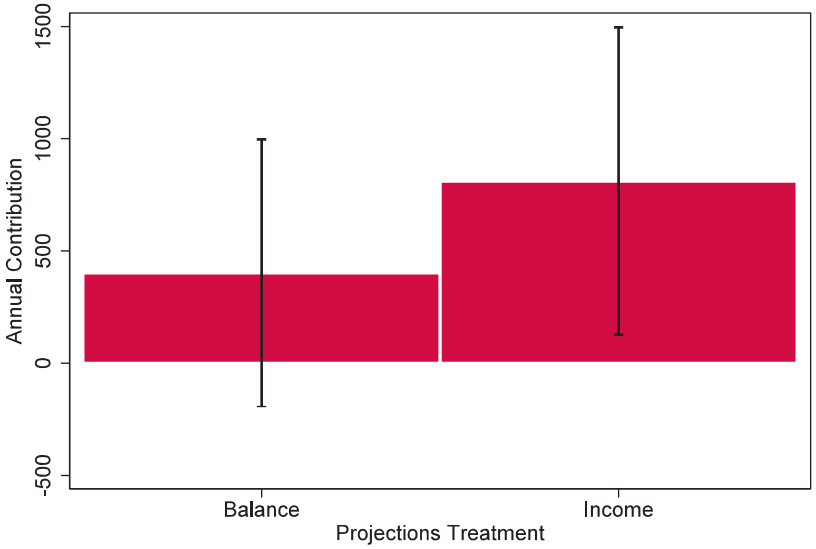
The Effect of Projection Interventions on Contribution Amount

Figure 5 reports the effect of the two Projection Treatments, Balance and Income, on the change in hypothetical retirement contributions under the employer match, relative to the no-match scenario. The results are compared to the control group, which saw only the year-end value of the contributions and match. The results show that the Balance Treatment increased the response to the match by approximately $400 annually; however, the effect is not statistically different from the control group. In contrast, the Income Treatment increased the response to the match by approximately $811 per year, and this is statistically different from the control group. This increase is economically large, as it represents approximately 77 percent of the response to the new hypothetical match displayed by the control group. Importantly, this type of informational treatment is much less costly relative to providing an employer match of $0.50 for every dollar contributed.

Conclusions

This study provides important insights as to the prevalence and influence of cognitive and motivational barriers to retirement savings. In particular, we measure the presence of EG bias and present bias, relate them to retirement savings behavior,

Figure 5
Effect of Projections Treatment on Contribution Response to New Employer Match



Notes: N=1,647. Height of bars represent the average effect of Balance and Income treatment relative to the control treatment for our sample.

and assess how treatments designed to mitigate these biases affect response to hypothetical opportunities for saving within an employer-provided retirement plan.

These biases are pervasive: Nearly 92 percent of the sample had one or both biases. Evidence suggests that these biases are distinct in that having one does not increase one's likelihood of having the other. In addition, these biases have an important effect on retirement savings. Our estimates suggest that overall retirement wealth would be approximately 44 percent higher if both EG bias and present bias were eliminated.

In response to our hypothetical opportunity for retirement savings, introducing an incentive for completing the paperwork affects the timing of contribution changes. When the incentive comes with a deadline, the response is statistically significant relative to a control group that did not receive a deadline. However, an incentive with no deadline leads to a smaller response that is not statistically different from the control group. This suggests that government, employer, or investment companiescould offer individuals an incentive to go through the planning process in the near term. Providing deadlines may nudge people enough to overcome the procrastination that leads them to perpetually delay tackling the retirement planning and decision-making process.

For our treatments involving projections, we find that individuals increase their contributions by more under the match scenario when shown future projections of their annual contributions relative to when they only see the year-end value. These findings suggest that the recently proposed Lifetime Income Disclosure Act (113th Congress, H.R. 2171), which would require plan administers to distribute income disclosures that project the annual income supported by an individual's current savings and contribution rate, may raise retirement savings.

While this study has numerous strengths, a key limitation is its use of hypothetical contribution amounts when evaluating response to our interventions designed to target EG bias and present bias. Future research would benefit from applying this rich set of treatments to evaluate actual contribution and saving decisions.

Works Cited

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