The Role of Time Preferences and Exponential-Growth Bias in Retirement Savings

Gopi Shah Goda
Stanford University and NBER

Colleen Flaherty Manchester
University of Minnesota

Matthew R. Levy
London School of Economics

Aaron J. Sojourner
University of Minnesota and IZA

Joshua Tasoff
Claremont Graduate University

17th Annual Joint Meeting of the Retirement Research Consortium

August 6-7, 2015
Washington, D.C.

The NBER Retirement Research Center, the Center for Retirement Research at Boston College (CRR), and the University of Michigan Retirement Research Center (MRRC) gratefully acknowledge financial support from the Social Security Administration (SSA) for this conference. The authors acknowledge financial support for this study provided by the TIAA-CREF Institute, the Pension Research Council/Boettner Center of the Wharton School at the University of Pennsylvania, the U.S. Social Security Administration through grant number RRC08098400-07 to the National Bureau of Economic Research as part of the SSA Retirement Research Consortium, and the National Institute on Aging of the National Institutes of Health under grant number R01AG020717. The findings and conclusions are solely those of the authors and do not represent the views of SSA, any agency of the federal government, the NBER Retirement Research Center, CRR, MRRC, or any institutions with which the authors are affiliated.

In aggregate, individual retirement savings are reaching unprecedented levels, totaling about $25 trillion. Yet there is considerable variation in retirement wealth across individuals even after taking into account background characteristics, such as age, income, and education. Because changes in the employer-provided pension landscape now require millions of Americans to rely more on their individual savings to finance retirement, understanding what factors contribute to differences in retirement-wealth accumulation and whether individuals are saving inadequately for retirement is a critical policy concern. If psychological biases play a strong role in driving individuals' decisions, their choices may not be optimal. This study focuses on illuminating the role of two potential biases.

First, individuals may have "present-biased preferences," which is the tendency to exhibit patience when contemplating tradeoffs between future periods, but impatience when making tradeoffs between the present and the future. A time-consistent individual will make a plan and follow through. In contrast, a present-biased individual makes a plan but may procrastinate, continually pushing 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.

Second, individuals may exhibit exponential-growth (EG) bias, the tendency to underestimate the exponential growth of an asset's value over time due to neglecting compound interest. Making informed, retirement-saving decisions requires grappling with the complex calculations required to assess whether current saving decisions are on-path to achieve one's desired standard of living in work and in retirement. A central piece of the calculation is compound interest, or the interest earned on previously earned interest that has been added to the principal. Misunderstanding this creates a cognitive barrier to optimal saving. A growing body of literature suggests that EG bias is prevalent among Americans and is correlated with lower levels of wealth accumulation and higher levels of debt. However, prior research has not uncovered whether EG bias independently drives wealth, or whether general cognitive ability or financial knowledge drive both. Theoretically, EG bias affects desired savings levels and present bias affects motivation and, thus, they may operate through separate channels. 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 EG bias

and present bias at the individual level in a broad sample of the U.S. population. We measure the prevalence of these biases and present new evidence that connects these biases to accumulated retirement wealth.

Description of Study Data

Our study collected data via online surveys administered to participants in two representative U.S. samples: the American Life Panel hosted by RAND Corporation, and the Understanding America Study run by University of Southern California. Both provide computer and Internet services as needed to reach segments of the population without such access. We have a host of background information on panelists, such as age, gender, employment status, income, and education, as well as self-reported retirement wealth in individual accounts.

In our study, each individual's time preference has two components: a standard discount rate that captures the stable way they discount later versus earlier consumption and a variable that captures the degree of present-bias, how much extra weight the person places on consumption in the present relative to all future periods. We measure these by asking a series of questions about how individuals value receiving various amounts of money over different time horizons. For example, "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 the same payments if received in 12 months relative to 24 months display characteristics of present bias.

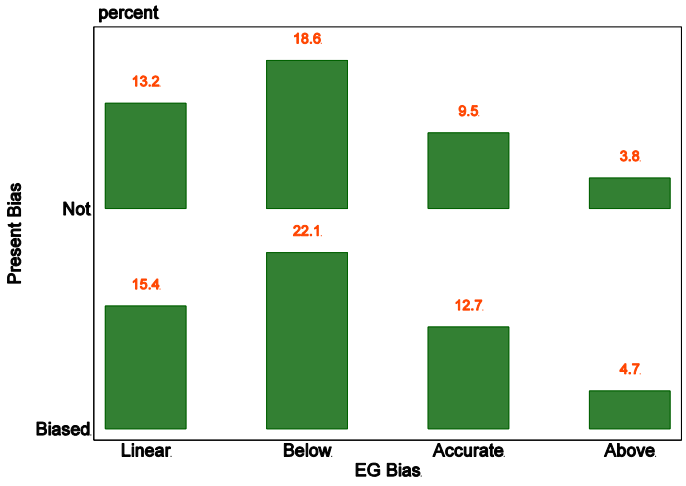
We measure the presence of EG bias using individuals' responses to questions about the future value of an asset given various assumptions on the interest rate and time horizon. For example, individuals were asked: "An asset has an initial value of $100 and grows at an interest rate of 10 percent each period. What is the value of the asset after 20 periods?" EG bias is assessed based on the accuracy of the respondents' answers. To increase the realism and relevance of the measures for high-stakes retirement decisions, individuals would earn more money for more-accurate answers. Calculators and other forms of help were neither explicitly forbidden nor suggested. Respondents were told they could use whatever approaches they preferred to answer the questions.

Finally, we also measure individuals' degree of self-awareness about these biases. We

measure people's overconfidence in their exponential estimation by allowing people to choose to get earnings based on the EG bias questions discussed above or a fixed sum of money. People did not yet know their performance on the questions. We classify people as overconfident if they preferred the performance pay to fixed pay larger even for fixed payments that were greater than their true performance payment.

Finding: the biases are prevalent and independent

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 four categories of EG bias and one of two categories of present bias, for a total of eight possible combinations of EG bias and present bias. The figure 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 69 percent of the sample either underestimates ("Below") or neglects ("Linear") compound interest. Approximately 22 percent correctly perceive exponential growth ("Accurate"). A small portion (9%) of the sample perceives returns to be greater than exponential ("Above"). Importantly, having one bias is not related to having the other bias, as shown by the similar pattern of EG bias across those with and without present bias.



Finding: each bias is associated with lower retirement wealth

We relate these biases to individuals' report of their accumulated retirement savings.

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 when isolating how retirement savings differs for those with EG bias and/or present bias. We also control for financial literacy (measured by three questions about risk diversification, inflation, and interest rates), general cognitive ability (measured by five questions from an IQ exam), risk preferences (measured using respondent's choice of coin-flip lotteries) and one's general preference for making tradeoffs in future dates.[1] We then use our model to predict retirement wealth based on differences in EG bias and present bias to determine the role of these biases in retirement saving decisions.[2]

Being present bias leads to $24,934 less in predicted retirement wealth relative to someone who makes consistent tradeoffs, approximately 19% of average retirement savings.[3] For EG bias, those with accurate understanding have $27,375 more in predicted retirement wealth relative to those who neglect compounding (Linear), equivalent to 20% of average savings. By way of comparison, the predicted effect of each bias is larger than the effect of cognitive ability as captured by our IQ measure. In predicting retirement savings, our findings do not reveal evidence of an interaction between present bias and EG bias. Instead, each bias appears to separately relate to retirement savings.

For whom are these biases more important for explaining retirement wealth? We find that the relationship between EG bias and retirement savings is stronger for individuals who earn higher income, who have a college degree, and who are the financial decision maker in the household. We also find that present bias has a stronger relationship with retirement wealth for those who do not have access to, or are not enrolled, in an employer-provided plan.

If individuals are aware of their biases, they may be able to deal with them by seeking advice or tools that help them commit to saving. Indeed, we find that among individuals with the same level of EG bias, those who are more overconfident in their ability to understand exponential growth have significantly lower retirement-savings levels.

Finally, we also administer a hypothetical retirement-saving scenario to evaluate how the

[1] 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, state of residence, risk aversion, cognitive ability, and a standard measure of financial literacy.
[2] These results implicitly assume that our measures of these biases are not correlated with other factors that affect retirement savings that are not included in our analysis.
[3] Average retirement savings for the sample is $132,926.

saving behavior of individuals in our sample would respond depending on whether they receive an intervention meant to "undo" each bias. 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 receipt of two sets of interventions in our sample: retirement-income projections to address EG bias and incentives to plan to address present bias. We find evidence consistent with the treatments having larger effects among individuals with higher levels of bias than among individuals with lower levels of bias, further supporting the idea that these biases drive behavior.

Conclusions

This study provides important findings on 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, and use interventions designed to mitigate these biases to provide further evidence for the relationship.

These biases are pervasive: 90 percent of the sample demonstrated one or both biases. Our evidence reveals that these biases are distinct in that having one does not increase one's likelihood of having the other. In addition, each bias has an important, and independent, relationship to retirement savings. Interpreted causally, our estimates imply that individuals would have 8 percent higher savings if both biases were eliminated. When we correct for the possibility that our measures of individuals' biases contain random noise, the estimated relationships are much stronger, implying that eliminating both sources of bias would lead individuals to have 53 percent higher savings.

We find that efforts to target those with EG bias through timely information are moderately effective. 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 mitigate EG bias to some extent.

While this study addresses important previously unresolved questions, a key limitation is its use of hypothetical choices when attempting to mitigate these biases. Future research would benefit from coupling direct measurement of the biases with a rich set of interventions to using actual retirement contribution and saving decisions.