

The Role of Stock-Flow Reasoning in Understanding the Social Security Trust Fund

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Author Note

The research reported herein was derived in whole or in part from research activities performed pursuant to grant RDR18000003 from the US Social Security Administration (SSA) funded as part of the Retirement and Disability Research Consortium. The opinions and conclusions expressed are solely those of the author(s) and do not represent the opinions or policy of SSA, any agency of the Federal Government, or NBER. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of the contents of this report. Reference herein to any specific commercial product, process or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply endorsement, recommendation or favoring by the United States Government or any agency thereof.

Abstract

The financial future of Social Security's trust funds has significant implications for Americans who pay taxes and expect to receive retirement benefits. The funds were created to hold and invest surplus tax revenue not used to pay out benefits, but Social Security has started to use this money to fulfill benefits obligations. The funds are projected to become depleted in 2035, at which point benefits will need to be reduced (in the absence of congressional action). In this research, we draw from the literature on stock-flow reasoning to explore how communication about the trust funds impacts understanding of the situation. In Experiments 1, 2, and 3 we show participants information about the trust funds over time presented as either a *stock* (i.e., balance) or in terms of *flows* (i.e., tax revenue and benefits payments), finding that those who see the flows presentation are significantly less likely to expect benefits to go away completely after depletion. In Experiments 4a and 4b, we show that prompting participants to reflect on the continuity of the inflows (via payroll taxes) significantly reduces this common misunderstanding about the outflows even further, suggesting that drawing attention to specific aspects of dynamic systems may help alleviate difficulties in understanding them. This research contributes both theoretically and practically, advancing the literature on stock-flow reasoning and highlighting a key aspect of communications about the future of Social Security that may contribute to – or be used to remedy – the widespread misconception that benefits will cease after depletion.

For American workers who anticipate receiving Social Security (i.e., Old-Age and Survivors Insurance, or OASI) benefits in retirement, the solvency of the Social Security system is a relevant and pressing concern. In the absence of Congressional action, questions about the solvency of the system generally focus on the status of the Social Security trust funds. The trust funds represent the accumulated surplus resulting from the difference between (a) payroll tax income paid into the system by current workers and employers, and (b) benefits paid out to current beneficiaries. Separate projections exist for the OASI (retirement benefits) trust fund versus the smaller DI (disability insurance) trust fund, but the combined OASDI funds are the focus of most reports. Recent projections are that both the OASI trust fund and the combined trust funds will be depleted by 2035 (Social Security and Medicare Boards of Trustees, 2022). If and when it is depleted, Social Security is expected to be able to pay 75 to 80% of scheduled benefits.

Media coverage of Social Security projections intensifies each year when the Board of Trustees releases its Annual Report documenting updates to the expected depletion date for the trust funds. Communicating the implications of these projections is critical but can lead to misleading inferences. Coverage that asks, “Will Social Security Run Out of Money?” (Paul, 2022) or highlights a “worst-case scenario” (Werschkul, 2021), and politicians who declare that Social Security will go “bankrupt” (Kiely, 2022), can make the actual impact on retirement benefits appear more severe than trust fund insolvency would actually imply. Because media headlines often emphasize the balance running to zero, non-experts may be likely to arrive at the erroneous conclusion that Social Security benefits will dry up too, what we might call a “zero-benefits belief”. Indeed, survey evidence suggests that many prospective retirees are pessimistic about whether they will receive any benefits at all in the future (Turner & Rajnes, 2021).

In this project, we argue that faulty reasoning about the relationship between the trust funds balance and the depletion of benefits may result from a novel form of a “stock-flow” reasoning error – and that careful presentation of information about the funds may help improve this reasoning. After providing a brief overview of the Social Security trust funds and how the workings of the funds can be understood as a dynamic system of stocks and flows, we review prior research on workers’ understanding

of the funds and highlight how stock-flow reasoning errors and inconsistencies may be able to help explain how people think about the funds. Within this framework, our research offers both theoretical and practical contributions: the unique features of the situation of the trust funds and the Social Security system focus our research questions on a theoretically novel type of outcome within the stock-flow literature (i.e., reasoning about outflows), and the significance of the setting highlights important practical implications of our findings.

To begin to explore these research questions, we present three experiments that vary the presentation format of information about the trust funds and examine how these different communications impact understanding. We focus specifically on how stock vs. flow information influences perceptions of what will happen to benefits as a result of depletion, building on work that highlights how small tweaks in the presentation of data and the formulation of questions can affect cognitive representations, understanding, and forecasts (e.g., Hutchinson et al., 2010; Hoffrage et al., 2000; Boz-Yılmaz & Boduroglu, 2024; Fischer & Gonzalez, 2015). We find that compared to respondents presented with flow information (about the funds' income and costs), respondents presented with stock information (about the balance of the funds) are more likely to erroneously hold “zero benefit beliefs” that when the trust fund balance is depleted, benefits will cease altogether. In our final two experiments, we test an intervention that directly prompts participants to reflect on whether the trust funds will continue to receive inflows (i.e., income collected through payroll taxes). These studies find that explicitly drawing attention to the continuation of these inflows can further reduce misconceptions about fund depletion, suggesting that accessibility of system inflows may be an especially important driver of understanding this dynamic system.

The Social Security Trust Funds

When President Franklin D. Roosevelt established the Social Security program in 1935, extra funds (i.e., the difference between payroll contributions and paid benefits) were held in an “Old Age Reserve Account,” which was replaced by the modern OASI trust fund in 1940. The trust fund is overseen by the Board of Trustees, who release an annual report on the fund's health with a (typically) 75-

year projection of taxes and benefits. Even in the fund's early years, the Trustees were concerned about whether the trust fund would be sufficient as the number of eligible workers increased and life expectancy improved (see Hines & Taylor, 2005, and Pattison, 2015, for histories). One key measure from the report, and often the focus of media headlines, is the year the trust fund will be depleted. This date has moved earlier as life expectancy has increased. The 2024 Report estimates this date will occur in 2035. This estimated date is the metric that generates the most sensational headlines about the trust fund.

Stock-Flow Reasoning Problems

The Social Security trust funds are a textbook example of a dynamic system, with inflows (i.e., payroll taxes paid into the system) and outflows (i.e., benefits paid out to beneficiaries) combining over time to determine the level of accumulation (i.e., how much money is held in the trust funds). In the language of system dynamics, the cumulative amount of a resource, like the balance of money in a checking account or the amount of water in a reservoir, is a “stock.” The changes in the amount of a resource over some defined period, like deposits to and withdrawals from a checking account – or water flowing into and out of a reservoir – are the “flows.” Given an initial value of the stock, there is a one-to-one correspondence between the stock and the net flow: the stock is the integral of the net flow, and the net flow is the derivative of the stock. As a result, given either a time series of the stock or a time series of the flows (with a starting or ending value of the stock), the information content is calculably the same. But calculus is difficult. As a result, even though the calculable information is identical, people do not respond to the two representations similarly.

Drawing from research on system dynamics, we argue that a key difficulty in understanding the Social Security trust funds may arise from what researchers have termed a stock-flow reasoning error, which can lead to two related types of problems. First, formal mathematical transformations between stocks and flows are difficult and prone to errors even for highly educated people (e.g., Booth Sweeney & Sterman, 2000; Brunstein et al., 2010; Cronin et al., 2009; Sterman & Booth Sweeney, 2007). This has sometimes been called the *stock-flow failure*. Because stock-flow transformations are so difficult (i.e., integrating a series of flow values or differentiating a series of stock values), people are prone to rely on a

faulty correlation heuristic: they focus too much on the specifics in front of them and wrongly expect the stock trend will tend to match the flow trend, rather than taking a broader view and considering the relationship between the elements (Cronin et al., 2009; Fischer & Gonzalez, 2014). For example, a constant flow into a reservoir followed by a constant flow out of a reservoir leads to a linear increase in the level followed by a linear decrease in the level. Instead, use of the correlation heuristic may lead people to infer that the level of the reservoir suddenly drops when the direction of flow shifts from in to out. Except in rare cases (e.g., no net flows at all, or exponential growth), the two will typically not show the same pattern. Using such a heuristic can lead to both quantitative and qualitative mistakes, resulting in several serious errors like violating the conservation of mass in physical systems.

Second, the presentation of stocks versus flows can lead to qualitatively different evaluations and forecasts – creating *stock-flow inconsistencies*. Whereas the research cited above indicates that people often cannot successfully translate from one format (e.g., stock) to the other (flow), research on stock-flow inconsistencies addresses how evaluations about the past and forecasts about the future depend on the presentation format even when no translation is necessary. In other circumstances, people may act *as if* they were able to successfully carry out complex calculations, even if the likelihood of successfully conducting such calculations is unlikely. These findings regarding stock-flow inconsistencies suggest reasoning about stock-flow problems is not a case of successful as-if reasoning but instead reflects sensitivity to the ways the same data are presented. This is particularly pertinent to our current findings, in which we probe inferences from dynamic systems without eliciting explicit transformations.

Such stock-flow inconsistencies hold for personal finances (Goldstein et al., 2016), evaluations of national employment (Spiller et al., 2020), and risk evaluations upon seeing COVID test data (Reinholtz et al., 2021). As a concrete example, consider employment in the United States in 2009 (as tested in Spiller et al., 2020). During this time, the number of employed people was decreasing from one month to the next, but at a slowing rate. When one considers the number of employed people, the flow is increasing (from a large negative number to a small negative number). But when one considers the stock, the stock is decreasing (due to the negative flow). As a result, when shown the flow and asked about the economy, a

majority of respondents indicated that the economy was getting better. When shown the stock and asked about the economy, a majority of respondents indicated that the economy was getting worse. Presenting the same data in different ways thus led to qualitatively different evaluations. There were corresponding effects on forecasts of what respondents anticipated would happen next.

The literature on stock-flow reasoning failures and inconsistencies shows them to be remarkably robust and replicable. They apply across a wide variety of domains, including: atmospheric accumulation of carbon dioxide (Sterman & Booth Sweeney, 2007; Sterman, 2008); water accumulating in a bathtub (Booth Sweeney & Sterman, 2000; Cronin et al., 2009); weight (Brunstein et al., 2010); people in a store (Cronin et al., 2009; Brunstein et al., 2010); distance between cars (Cronin et al., 2009); product inventory in warehouses (Booth Sweeney & Sterman 2000; Spiller et al., 2020); national employment (Spiller et al., 2020); COVID cases (Reinholtz et al., 2021; Villanova 2022; Harman et al., 2021; Padilla et al., 2022); blood glucose levels and other medical measurements (Brunstein et al., 2010); and perhaps most relevantly for the current investigation, corporate and personal cash flows (Booth Sweeney & Sterman 2000; Newell et al., 2016; Spiller et al., 2020). Such stock-flow failures and inconsistencies can be taken as a “stylized fact,” even among highly educated participants (e.g., medical students and MIT graduate students; Booth Sweeney & Sterman 2000; Brunstein et al., 2010; Cronin et al., 2009; Sterman & Booth Sweeney 2007). Moreover, they hold across multiple presentation formats, including scatterplots, line charts, barcharts, tables, and verbal descriptions (Cronin et al., 2009; Newell et al., 2016; Spiller et al., 2020).

Worker Perceptions of Social Security Trust Fund Status

In a review of several largescale surveys that measure expectations about future retirement benefits, Turner and Rajnes (2021) find evidence of considerable pessimism, with many workers expecting that they will not receive any retirement benefits at all. These authors suggest that current communications that focus on insolvency may be partly to blame and point to the need for targeted informational interventions to help make perceptions more accurate. A small number of prior projects have examined how to better communicate the workings of the trust fund to future beneficiaries.

Under an assumption that worker perceptions about system solvency distract from efforts to reform it, Holahan and Schug (2000) designed a training tool that explains the system to students of economics. Their teaching materials introduce flow charts to track how money flows between payroll taxes from workers, Treasury, and retired beneficiaries. Their approach highlights the impact of the trust fund on the larger system of the economy, and the uses of both private and public investments to build a robust economy. However, they do not report any results of empirical testing to show how successful their approach is at communicating the workings of the trust fund to student audiences, so it is unclear whether the tool can be used to reduce inaccurate inferences about the trust fund among a broader population.

Directly relevant to the current project is a recent effort by Quinby and Wettstein (2021) which considers the impacts of a poor understanding of the trust fund by looking at how variations in newspaper headlines can affect investing and benefit claiming intentions. The authors test the effects of headlines for an otherwise identical article about the projected insolvency of the trust fund and its impact on benefits. Compared to a headline emphasizing a “long-term financing shortfall,” respondents who saw headlines highlighting that revenue will still cover three-fourths of benefits were more likely to report accurate expectations regarding future monthly benefit size. We take this approach a step farther by incorporating existing behavioral science research on understanding of stock-flow models to design better communications about trust fund projections.

Understanding Social Security Trust Funds as a Stock-Flow Reasoning Problem

Stock-flow reasoning problems have meaningful implications for public understanding of the Social Security Trust Funds. Accumulation and decumulation in the trust funds is a textbook stock-flow reasoning problem. Given the direct applicability of the domain and the generalizability of the findings above, it would be highly surprising if people *did* fully understand the implications of accumulation for proper interpretation of what happens when the trust fund is depleted. Yet to our knowledge, the robust finding on such problems with understanding accumulation has not been brought to bear on this critical topic. Moreover, the trust funds also offer an opportunity to study an implication of such stock-flow

reasoning problems that did not receive much attention in prior work – namely, how the presentation of information impacts predictions about what will happen to specific components of the system in the future. In this setting, understanding how prospective retirees reason about the future of benefits (i.e., the system outflows) under the threat of impending depletion (i.e., the stock running out) is of particular interest. Where prior research has documented how various presentations of stocks or flows can affect translations between the two representations and other judgments about the state of the system, it has focused less on how different presentations might affect forecasts about the continuation of future outflows (in this case, the aspect of the system that corresponds to the core function of Social Security: to provide benefits for retirees). This in itself provides a novel and important consequence of stock-flow failures and inconsistencies.

The time course of the trust fund is illustrated both as a stock and as flows in current SSA communications.¹ Some depictions focus on the balance of money in the trust fund (i.e., the stock, which may present a dire picture to consumers in that it shows depletion by 2035) and some show the changes in inflows and outflows over time (i.e., the flows, which may present a more optimistic view by emphasizing that there will still be taxes paid into the system that can be used to pay for benefits obligations). We explore how these different presentations may vary in how accessible they make various aspects of the Social Security system, thus affecting the predictions of prospective retirees. Specifically, communications that make the presence of *inflows* more accessible in the context of a depleting stock may help people realize that *outflows* will continue in the future, while communications that emphasize the stock may lead people to focus on the draining balance and neglect to consider that flows can continue even when the balance is \$0. To use the analogy of a bathtub: when people are shown a bathtub that is rapidly draining and which will soon be empty, the most salient aspect of the system is the fact that the level is falling, not necessarily that the tap might still be on.

¹ E.g., <https://www.ssa.gov/oact/TRSUM/index.html>

Reinforcing this problem – and providing suggestive evidence that journalists may be confusing stocks and flows – is media characterization that does not unambiguously distinguish the balance of the trust funds from the flows of the trust funds. For example, on December 1, 2020 *CNBC* ran a headline “How Social Security invests its money – and why it may run out of cash really soon”; on August 31, 2021 the *New York Times* tweeted: “Social Security will be depleted in 2033, a year earlier than previously projected...”; and on June 2, 2022 *CNBC* ran a headline “Social Security fund will be able to pay benefits one year longer than expected, Treasury says.” Without distinguishing the stock (the trust funds balance) from the flows (taxes collected and benefits paid out), these headlines may suggest to readers that the Social Security system itself (rather than just the trust funds) may be depleted and lead benefits to drop to zero, and suggest the headline writer did not find the distinction sufficiently important to draw attention to.

Indeed, such headlines can affect beliefs about future benefits (Quinby & Wettstein, 2021). This perhaps contributes to widespread uncertainty and possible misunderstanding of the long-term prospects of Social Security retirement benefits: 42% of survey respondents to a Pew Research poll doubt they will receive retirement benefits at all, with younger generations showing more pessimism than those closer to retirement (Parker, Morin, & Horowitz, 2019). Another study found that about three-quarters of respondents were either “not too confident” or “not at all confident” that Social Security would be able to pay them the benefits amount they were supposed to receive and that people saw about a 1 in 6 chance that they would not receive anything (Luttmer & Samwick, 2018; see Turner & Rajnes, 2021 for a review of survey evidence). This pessimism may be due at least in part to a misperception that depletion implies a total end to benefits – Social Security reports that in the absence of Congressional action, 75-80% of benefits would still be payable after depletion (Social Security and Medicare Board of Trustees, 2022).²

Research on stock-flow reasoning problems suggests why people may jump to such extreme zero-benefit conclusions and provides some potential tools to reduce the extent of mistaken inferences

² It is not clear exactly how changes to benefits would be applied (e.g., as an even 20-25% cut across the board, varied cuts based on obligated amount, etc).

regarding the Social Security trust fund. We argue that alternative presentations of the trust funds that deemphasize the trust funds balance and instead focus on the continuity of inflows and outflows may help to lead to more accurate judgments and inferences based on communications. As a further theoretical contribution, we propose a novel intervention that directly targets the accessibility of future flows. This intervention helps to overcome the assumption that depletion implies a complete end to benefits by simply prompting people to reason through their existing understanding of how the system works, without providing any new information. Notably, the literature on such stock-flow problems has found that reasoning errors arising from stock vs. flow presentations are stubbornly persistent, even in the face of simpler presentations, clearer graphs, more familiar contexts, feedback about incorrect initial answers, and incentives to answer correctly (Cronin et al., 2009; Brunstein et al., 2010; Newell et al., 2016). Our intervention takes a different approach to improve reasoning in this setting: rather than targeting the understanding or applications of the mathematical relationships between stocks and flows, we simply direct participants' attention to one aspect of the system (the inflows) that they already know about and, without providing additional information, ask them to think about what would happen to the outflows when the stock is depleted.

In understanding why this intervention might work in improving reasoning about the Social Security system, we build on work that suggests changing the accessibility of prior knowledge can affect the extent to which that information is used to make choices or draw conclusions (e.g., Feldman & Lynch, 1988; Johnson et al., 2007; Weber et al., 2007). Within the context of Social Security funding, workers' paychecks reliably include automatic deductions for the payroll taxes that fund the Social Security system, so most people are likely aware of their own contributions to the system's inflows. However, even if people understand the connection between these deductions and the benefits paid to retirees, they may not have actively considered whether they will continue paying these taxes in the future once the trust funds are depleted. Thus, the belief that benefits payouts will cease after depletion may result from the information that is accessible (e.g., trust fund depletion) without incorporating the information that is implied but not readily accessible (e.g., expected continuation of payroll taxes). If people already

understand that inflows (taxes) connect to outflows (benefits), making the continuity of those taxes more accessible may affect their perceptions of what will happen to benefits after the trust funds run out of money.

To test these ideas, we experimentally vary the presentation format and observe how key assessments and inferences differ depending on the presentation format and the accessibility of various aspects of the Social Security system. We expect that presenting relative inflows and outflows may lead to better-calibrated benefit expectations, which are important for beneficiaries, whereas presenting stocks may lead to better-calibrated forecasts of when the trust fund will reach zero, an important milestone for policymakers. We also test an intervention that prompts participants to think about whether the Social Security system will continue to receive income. We hypothesize that such reflection will reduce misunderstanding about what happens to benefits by enabling the insight that inflows will not stop when the funds are depleted. This intervention further supports the proposed role of stock-flow reasoning errors.

Overview of Experiments

We conducted five experiments to test these research questions.³ Experiment 1 was designed to test our main hypotheses using graphs that we designed to cleanly manipulate whether participants saw the OASDI trust funds' balance or income and costs over time. Experiment 2 tested closer replicas of SSA visuals about the trust funds that used different metrics and examined whether a third type of graph that showed payable benefits would further improve understanding. Experiment 3 tested an additional type of presentation – net flows – and ruled out an important alternative explanation regarding the mechanism. Finally, Experiments 4a and 4b tested whether drawing participants' attention to the fact that payroll taxes would still be collected after depletion would reduce misperceptions about benefits going away after depletion, providing both a potential intervention as well as evidence regarding process.

Transparency and Openness

³ We received approval for this research from [University] Institutional Review Board.

For each experiment, we recruited participants from Amazon's Mechanical Turk (AMT) and used CloudResearch to set additional eligibility requirements for each study. We restricted our samples to adults located in the United States with 100+ approved HITs, an approval rating of 95% or above, and who had not completed any prior studies run for this specific project. All study designs and analyses were preregistered on AsPredicted.org prior to data collection,⁴ and any additional data exclusions are described where applicable.⁵ We report results for all preregistered key measures in the sections below. Full model results are reported in Appendix 4. We used R version 4.0.0 for analyses. All raw data, analysis code, and research materials are available in our Research Box,⁶ and main manipulations and measures are reproduced in Appendix 5. The two pilot studies reported in Appendices 1 and 2 (respectively) and the five experiments reported in the main text represent all data we collected regarding the relation between stock-flow reasoning and the Social Security trust funds.

Experiment 1

In Experiment 1 we sought to test the effect of stock vs. flow stimuli based on data and presentations of those data used in the 2022 Trustees Reports and related communications. We focused on measures of objective understanding as our key dependent variables.

Materials and Procedure

Drawing on a pilot study,⁷ we aimed to recruit 1,000 participants from AMT to take this survey. 1,044 unique participants started the survey, and after preregistered exclusions, our sample for analysis

⁴ All preregistrations are available in our Research Box:

https://researchbox.org/1172&PEER_REVIEW_passcode=GQYVKB

⁵ For each experiment, we include participants who completed the study once in our analyses. Due to the mechanics of Qualtrics, it was possible for subjects to enter the study multiple times (i.e., after failing an initial screener, participants could try again). As a result, our raw data files include a small number of instances of the same workers entering multiple times. In Experiments 1, 2, 3, and 4a, none of these participants completed the full study more than once so they are all included in analyses. In Experiment 4b, one participant completed the study twice; only the first response from this participant is retained for analyses.

⁶ See this link for Research Box: https://researchbox.org/1172&PEER_REVIEW_passcode=GQYVKB

⁷ A brief summary of results from this pilot study ($N = 403$) are available in Appendix 1.

consisted of 1,001 participants who completed the study ($M_{age} = 41.96$, $SD_{age} = 13.16^8$; 48% female).

First, participants read the following brief description about the OASDI trust funds:

The Social Security Administration uses accounts called “trust funds” to store income that’s collected through Social Security taxes and then eventually uses that money to pay out benefits. The OASI Trust Fund pays retirement and survivors benefits and the DI Trust Fund pays disability benefits, but the two are often referred to together as the OASDI Trust Funds. At the end of the year in 2021, the OASDI trust funds held \$2.85 trillion in total.

Social Security uses the OASDI trust funds to make benefits payments and pay administrative expenses. The trust funds receive income through two sources: tax revenue collected from workers and interest that comes from the investment of the money in US Government securities. In 2021, Social Security’s total income from both of these sources was \$56 billion lower than its total costs (benefits payments plus administrative expenses). This was the first time in many years that total income was lower than total costs. Social Security predicts that in future years, total income will continue to be lower than total costs. Because of this continued projected deficit, the trust funds balance is projected to reach \$0 at some time in 2035.

On the same page as the above description, participants were randomly assigned to see an accompanying graph that showed either the balance (*stock condition*, $n = 508$) or total income and expenditures (*flows condition*, $n = 493$) of the trust funds for the period 1994 through 2034. Historical data were shown on both graphs with solid lines, while projected data were represented with a dotted line. Both graphs reported the respective metrics in trillions of dollars.⁹ These graphs are shown in Figure 1 below.

Next, we asked participants four key objective understanding questions: (1) when total costs did/will begin to exceed income (with a dropdown where participants could select any year from 1994 to 2050 or Never); (2) when the trust funds did/will become depleted (with a dropdown where participants could select any year from 1994 to 2050 or Never); (3) what will happen to benefits if trust funds are depleted (a multiple choice question with options for no benefits, smaller benefits, the same amount of benefits, or larger benefits); and (4) after depletion, what the monthly retirement benefits amount would be for someone currently expecting \$1,000/month (an open text box; asked only of participants who

⁸ In all studies, we asked participants for their year of birth (as Social Security rules regarding retirement are based on this). Age calculations are made as if participants were born on July 1.

⁹ The description was based on the 2022 Trustees Report, and the data were taken from the 2022 Supplemental Single-Year Tables (specifically, Table VI.G8 available at <https://www.ssa.gov/oact/TR/2022/lr6g8.html>).

selected either the smaller benefits or larger benefits option for the prior question). The order of the first two questions (when costs began to exceed income and when the trust funds would become depleted) was randomized across participants. We include this as a factor in statistical analyses reported below.

Importantly, whereas both key dates were explicitly mentioned in the text of the description, what would happen to benefits was not discussed, meaning that answering these latter questions required participants to make inferences regarding the outflow that went beyond the data that was explicitly provided. After this section, participants wrote a media headline about the trust funds¹⁰, responded to questions about their own eligibility for benefits, and provided demographic information. The final page of the survey provided links to further resources about the trust funds and benefits calculations. Key measures used for all studies are shown in Table 1 and are reproduced in full in Appendix 5 (the full survey materials are available in our Research Box).

¹⁰ We included this measure in Experiments 1, 2, and 4a to explore whether the different presentations led to systematically different “headlines” about the trust funds (i.e., calling out different aspects of the situation). A team of 3 research assistants coded these responses. There were no clearly interpretable patterns across conditions, so we do not discuss further. These data are available from the researchers upon request.

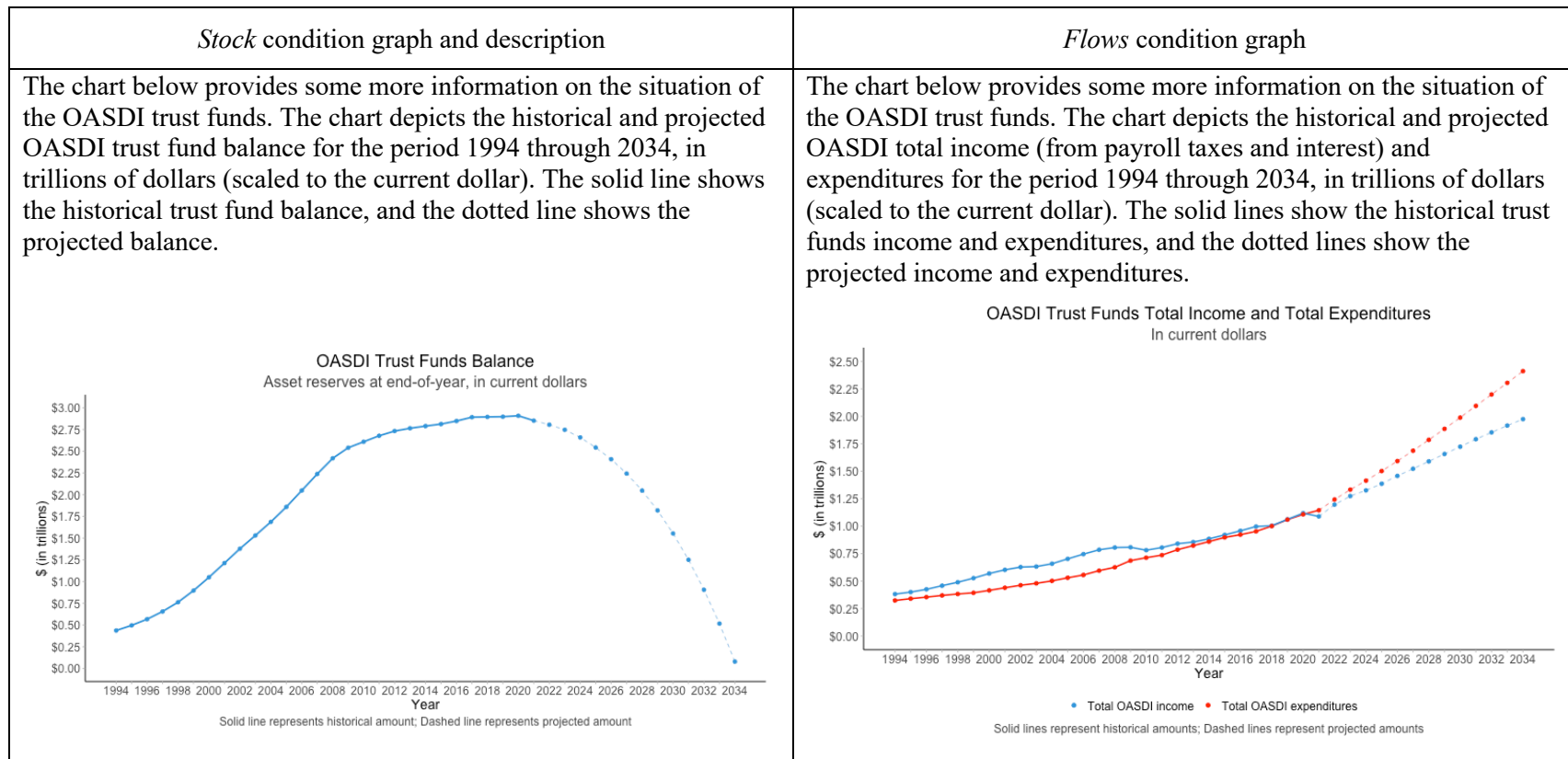
Figure 1. Experiment 1 graph stimuli (with introductory text)

Table 1. Key measures for all experiments

| Question description | Sample question text and answer options ¹ | Correct Answer for Analyses |
|------------------------------|--|--|
| Costs exceed income date | <p>According to your understanding, in what year did or will the Social Security OASDI trust funds' total costs begin to exceed total income?</p> <p>[Dropdown] 1994... 2050; Never</p> | <p>Experiments 1, 3, 4a, 4b: 2021 (+/- 1 year)</p> <p>Experiment 2: 2010 (+/- 1 year)</p> |
| Depletion date | <p>According to your understanding, in what year did or will the Social Security OASDI trust funds become depleted? In other words, in what year did or will the trust funds run out of money?</p> <p>[Dropdown] 1994... 2050; Never</p> | <p>Experiments 1, 2, 4a, 4b: 2035 (+/- 1 year)</p> <p>Experiment 3: 2034 (+/- 1 year)</p> |
| What happens to benefits | <p>Assuming the government does not take any action to increase the amount of income that Social Security collects based on tax revenues – in your view, what is most likely to happen to Social Security benefits if the trust funds are depleted?</p> <p>If you aren't sure, please select the option that reflects your best guess.</p> <p>[Multiple choice (select one)]</p> <ul style="list-style-type: none"> • Social Security will no longer be able to pay out benefits • Social Security benefits will still get paid out and will be a smaller amount • Social Security benefits will still get paid out and will be the same amount • Social Security benefits will still get paid out and will be a larger amount | Social Security benefits will still get paid out and will be a smaller amount |
| Benefits amount ² | <p>You just indicated that Social Security benefits will most likely still get paid out and will be a different amount if the trust funds are depleted.</p> <p>Again, assuming the government does not take any action to increase the amount of income that Social Security collects based on tax revenues – for someone whose benefits are currently projected to be \$1,000 per month, what monthly amount might they expect after depletion of the trust funds?</p> <p>\$(text box).00 per month</p> | <p>Analyzed as a mean</p> <p>(SSA projections imply the correct answer is around \$750-800).</p> |

Notes. ¹ These are the exact questions used in most studies. Experiments 2 and 3 had small differences in the question text and correct answers based on what was shown in the graph and/or updated information from the Trustees. See Appendix 5 for full materials and questions from each study. ² This question was only asked of participants who responded “Social Security benefits will still get paid out and will be a smaller amount” or “Social Security benefits will still get paid out and will be a larger amount” to the prior what happens to benefits question. Per our preregistrations, answers to this question were imputed for participants who chose the other two answer options for the prior question, and we exclude participants who wrote an answer above \$2,000.

Results

As specified in our preregistration, we coded answers to the first three objective understanding questions according to accuracy (see Table 2 for the breakdown of answers to each question by condition for Experiments 1, 2, and 3).¹¹ To analyze differences in accuracy by condition, we conducted three separate logistic regressions using contrast-coded predictors (-1, 1) for condition, order of the first two questions, and their interaction. There was no significant difference across conditions in accuracy in answers to the question about when costs began to exceed income ($b = 0.00$, $z = -0.01$, $p > .99$), though a larger proportion of participants in the stock condition (80%) correctly identified when the funds were projected to become depleted, compared to the flow condition (72%; $b = 0.21$, $z = 2.87$, $p = .004$). Those in the stock condition were more likely to answer that benefits would completely go away (i.e., hold “zero-benefit beliefs”) as a result of depletion (64%), compared to the flow condition (56%; $b = 0.17$, $z = 2.62$, $p = .009$).

Following our preregistration, we analyzed the fourth question (about the benefits amount someone expecting \$1,000/month would get after depletion) as a continuous variable. This question was only asked of those who indicated in the prior question that benefits would be smaller or larger; we treat those who indicated that benefits would go away completely as giving an answer of \$0 to this question and those who indicated that benefits would stay the same as giving an answer of \$1,000. As preregistered, we also exclude participants who wrote in an answer above \$2,000. The average amount

¹¹ For all studies, missing answers due to a participant failing to answer a question are marked as missing but are included in the base for calculating the proportion of correct answers. These participants are excluded from regression analyses.

given by those who answered this question was \$641.40 ($SD = \237.79), but across the entire sample (i.e., using our imputed values), the mean is \$276.07 ($SD = \375.45). Using the same predictors specified above, we conducted a regression to analyze differences across condition. As expected, the average benefits amount is significantly lower for those in the stock condition ($M_{stock} = \$239$, $SD_{stock} = \$356$) compared to those in the flow condition ($M_{flows} = \$314$, $SD_{flows} = \$391$; $b = -37.00$, $t(996) = -3.13$, $p = .002$). To put these numbers into context, based on the projections in the 2022 Trustees Report, for every \$1,000 in scheduled benefits, trust funds income post-depletion would be sufficient to pay \$750 to \$800, suggesting both groups underestimate the implied amount on average.

We randomized the order of the first two questions that participants answered such that some participants saw the question about when depletion would happen first while others saw the question about when costs began to exceed income first. While this factor was included to counterbalance stimuli and was not of theoretical interest, results indicated that question order did have a significant impact on accuracy for the question about when costs began to exceed income ($b = 0.22$, $z = 2.92$, $p < .001$). Specifically, those who saw this question first were less likely to answer it correctly (51%) than those who saw the question about the depletion date first (61%). We did not have a specific theoretical expectation for this result but return to it in the General Discussion.

Discussion

Using comparable stock and flows graphs based on Social Security data, the results from this study show that different ways of showing trust funds information over time can significantly impact important facets of understanding. Specifically, we found that people shown a stock graph that displayed the trust fund balance over time (making particularly salient the decline to zero around 2035) were more accurate in their understanding of when depletion is projected to happen. This is in line with the existing literature on stock-flow reasoning – and notable given that this date was explicitly provided in the text description for both conditions. However, while the stock condition boosted accuracy on this question, those who saw the stock graph were *less* accurate in translating this information into an understanding of what impact trust fund depletion is projected to have on benefits.

Table 2. Summary table of results for main preregistered dependent variables for Experiments 1, 2, and 3

| Measure ¹ | Experiment 1 (N = 1,001) | | Experiment 2 (N = 1,503) | | | Experiment 3 (N = 1,501) | | |
|--|-----------------------------|----------------|-----------------------------|----------------|-------------------|-----------------------------|----------------|----------------|
| | Stock | Flows | Stock | Plain Flows | Enhanced Flows | Stock | Flows | Net Flows |
| Date questions (% correct) ² | | | | | | | | |
| Costs exceed income date | 56% | 56% | 47% | 46% | 43% | 54% | 54% | 53% |
| Depletion date | 80% | 72% | 74% | 71% | 73% | 75% | 70% | 70% |
| What happens to benefits question (% choosing each option) | | | | | | | | |
| Benefits go away completely ³ | 64% | 56% | 61% | 54% | 54% | 60% | 54% | 52% |
| Paid, smaller amount ⁴ | 31% | 36% | 30% | 37% | 38% | 34% | 35% | 40% |
| Paid, the same amount | 4% | 7% | 8% | 7% | 7% | 5% | 9% | 8% |
| Paid, larger amount | 1% | 1% | 0% | 1% | 1% | 1% | 2% | 0% |
| Benefits amount question ⁵ (mean (SD)) | \$239 (356) | \$314 (391) | \$264 (373) | \$318 (390) | \$321 (396) | \$270 (373) | \$337 (399) | \$323 (385) |

Notes. ¹Missing answers due to a participant failing to answer a question are marked as missing but are included in the denominator for calculating the proportion of correct answers. These participants are excluded from regression analyses. ²Following our preregistration, answers are coded as correct if the participant entered a date within +/- 1 year of the correct answer. ³Whether or not participants choose this zero-benefits belief option is a key dependent variable across all studies. ⁴This is the correct answer implied by current projections. ⁵Following our preregistration, responses above \$2,000 are excluded from calculations. The correct value is projected to be approximately \$750-800.

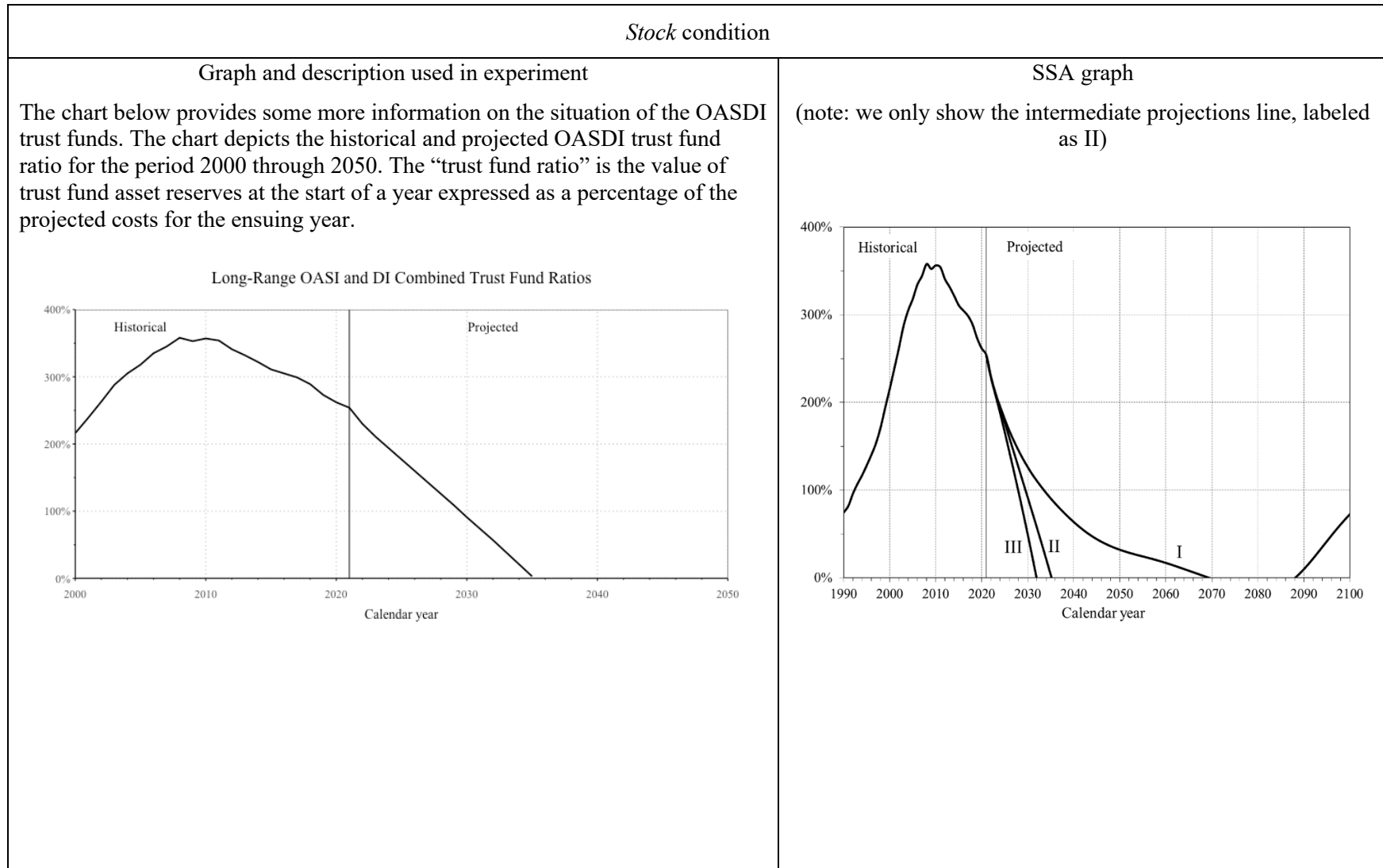
Experiment 2

Experiment 2 was designed for two main purposes. First, we sought to investigate whether our main findings would replicate with materials more closely based on those typically included in Trustees Reports, shifting from our stimuli in Experiment 1 that were generated to ensure formal equivalence across conditions. Second, we added a third “enhanced flows” condition, also based on existing SSA communications, that showed the same information on income and costs along with information on “payable benefits.” We included this condition to explore whether this additional information on payable benefits would further enhance understanding by making it clear when and how benefits would be

impacted. Finally, this study also probes the robustness of the effect found in Experiment 1 by using graphs that show a similar overall story but with different metrics and different axes.

Materials and Procedure

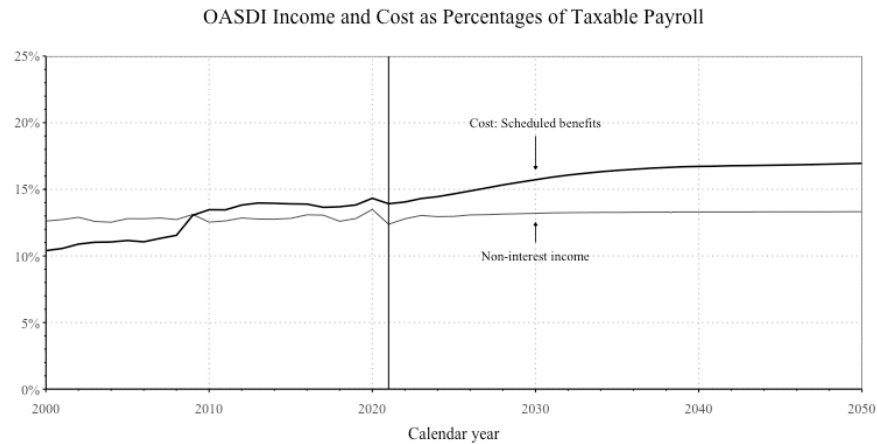
A total of 1,578 unique workers from AMT started the survey, and our sample for analysis included 1,503 participants who completed the study ($M_{age} = 40.90$, $SD_{age} = 12.91$; 52% female). The structure of the survey was very similar to that of Experiment 1: participants saw a description and graph related to the trust funds, answered several objective understanding questions, and ended by answering questions about eligibility and demographics. The key changes in this study came in the data displays and content of the description. Participants were randomly assigned to see one of three graphs displaying information about the combined OASDI trust funds for the period 2000-2050: a *stock* graph that showed the trust fund ratios (balance as a percentage of projected costs for the ensuing year; $n = 500$), a *plain flows* graph that showed non-interest income and cost (scheduled benefits) as percentages of taxable payroll ($n = 502$), and an *enhanced flows* graph that built on the plain flows graph by including a line for expenditures (payable benefits; $n = 501$). We designed these graphs to mimic graphs from the Trustees Report as closely as possible, though we did constrain the x-axis to show the same date range across conditions to be consistent (see Figure 2 for our graphs and the SSA graphs we based them on). Since these stimuli were closely based on the graphs included in Trustees Reports, which use data on non-interest income (rather than total income, as we used in Experiment 1), we updated the description to include key dates and other information for this metric (specifically, the date for when costs began to exceed non-interest income is 2010; see Research Box for full materials).

Figure 2. Stimuli for Experiment 2, with comparison to SSA graphs

Plain flows condition

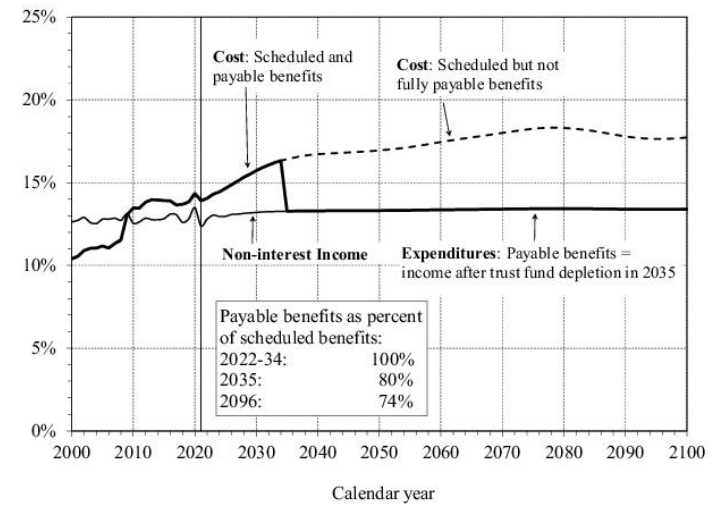
Graph and description used in experiment

The chart below provides some more information on the situation of the OASDI trust funds. The chart depicts the historical and projected year-by-year relationship between OASDI income (excluding interest) and cost (including scheduled benefits) for the period 2000 through 2050. The figure shows all values as percentages of taxable payroll.



SSA version

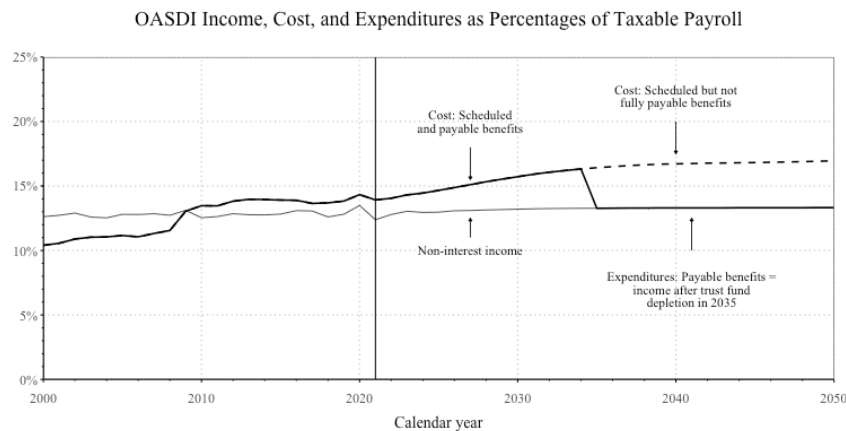
(note: version used in experiment does not include line for payable benefits)



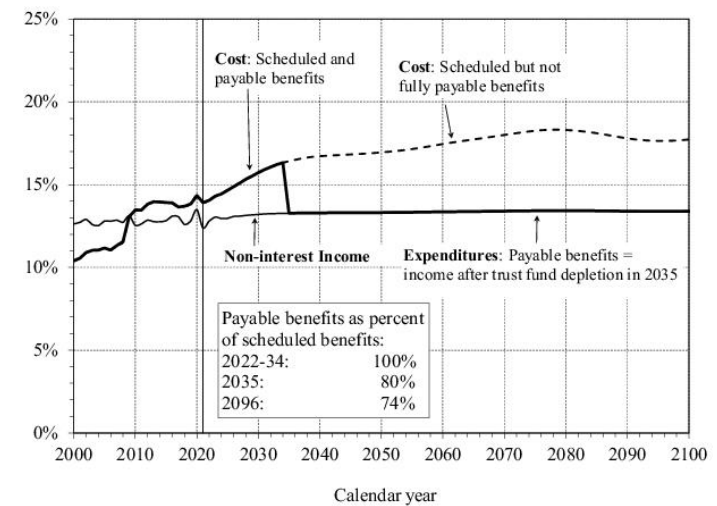
Enhanced flows condition

Graph and description used in experiment

The chart below provides some more information on the situation of the OASDI trust funds. The chart depicts the historical and projected year-by-year relationship between OASDI income (excluding interest), cost (including scheduled benefits), and expenditures (including payable benefits) for the period 2000 through 2050. The figure shows all values as percentages of taxable payroll.



SSA version



Note. Source for SSA graphs: https://www.ssa.gov/oact/TR/2022/II_D_project.html#105057

Results

As in Experiment 1, we preregistered that we would recode the objective understanding questions for accuracy and focus on proportions of answers reflecting beliefs that benefits will go away after depletion. Based on the three conditions in our design, we used the plain flows condition as the reference group and created two dummy coded predictors to capture the effect of condition (stock vs. plain flows: 1 if stock condition, 0 otherwise; enhanced vs. plain flows: 1 if enhanced flows condition, 0 otherwise). As in Experiment 1, we randomized the order of the two questions about when costs began to exceed income and when depletion would happen and included a contrast-coded predictor (-1, 1) for order and all interactions in all analyses. Again, there were no significant differences across conditions for accuracy on the question about when costs began to exceed (non-interest) income (stock vs. plain flows: $b = 0.00$, $z = 0.00$, $p > .99$; enhanced vs. plain flows: $b = -0.16$, $z = -1.21$, $p = .22$).¹² In contrast with our other experiments, there were no significant differences for the question about when depletion would happen (stock vs. plain flows: $b = 0.15$, $z = 1.08$, $p = .28$; enhanced vs. plain flows: $b = 0.12$, $z = 0.87$, $p = .38$), though the direction of the difference between the stock and two flows conditions is consistent with what we find in other studies.

We replicated the main results about understanding what would happen to benefits: participants in the stock condition were more likely to choose the wrong answer about benefits going away completely (i.e., hold zero-benefits beliefs) than those in the plain flows condition (61% vs. 54%; $b = 0.29$, $z = 2.22$, $p = .027$). Contrary to our expectations, however, the enhanced flows condition did not provide a further reduction in inaccuracy on this question, as the difference between the plain flows and enhanced flows condition was negligible and not significant (both 54%; $b = -0.01$, $z = -0.04$, $p = .96$).

¹² There was, however, a significant interaction between the dummy code for stock vs. plain flows and question order ($b = 0.37$, $z = 2.90$, $p = .004$). In particular, individuals were more accurate answering the question about when income began to exceed costs when the depletion question was first in the stock condition but more accurate when the income question was first in the plain flow condition. This interaction does not appear consistently in the other studies, and we do not have a specific theoretical explanation for it.

We also analyzed the question about the amount of the expected benefits after depletion using the same method as Experiment 1. Among those who answered this question, the average amount entered was \$626 ($SD = \240); looking at the whole sample the average was \$300 ($SD = \387). Replicating Experiment 1, those in the stock condition ($M_{stock} = \$264$, $SD_{stock} = \$373$) thought benefits would be significantly lower than those in the plain flows condition ($M_{plain\ flows} = \$318$, $SD_{plain\ flows} = \$390$; $b = -52.66$, $t(1495) = -2.15$, $p = .032$). However, the difference between the plain flows and enhanced flows condition was not significant ($M_{enhanced\ flows} = \$321$, $SD_{enhanced\ flows} = \$396$; $b = 3.79$, $t(1495) = 0.15$, $p = .88$), providing further support for the conclusion that the mere inclusion of the “payable benefits” line did not necessarily improve understanding.

Discussion

In contrast to the prior study, neither question about dates showed any significant differences. More importantly, though, this study provides further evidence of the “stickiness” of the misconception that when the trust funds become depleted, benefits will fully disappear. Building on the previous study, we expected and found that the flows condition mitigates this misunderstanding relative to the stock condition – though more than half of participants across all conditions still thought this would be the case. Contrary to our expectations, the results from this study also suggest that including an explicit depiction of “payable benefits” in the enhanced flow condition does not provide any additional benefit for understanding.

Experiment 3

We conducted Experiment 3 to explore the effect of an additional variation on presentation of information about the trust funds. Specifically, this experiment tested the same stock and flow presentations from Experiment 1 against a new condition that showed participants a graph of the net flows (i.e., the difference between income and expenditures over time). While Social Security does not typically report trust funds data in this way, inclusion of this condition in this experiment is useful for two main reasons. First, the pattern of net flows charted over time is visually similar to that of the stock graph in that it shows the net flows declining over time (see Figure 3). Past work on stock-flow reasoning errors

has pointed to the correlation heuristic as an explanation for errors in translations between stocks and flows. According to a correlation heuristic explanation, people erroneously think the trend of the stock should match the trend of the net flows. If our results were due to the correlation heuristic, we might expect a net flows presentation to result in a pattern similar to what we see in the stock condition. This is because both graphs show generally negative trends for the future (see Figure 3), whereas the flows condition shows costs and income increasing over time. On the other hand, if the net flows condition results look more like the flows condition, this would suggest that there is something unique about getting participants to think about the flows of the system and how they work together to determine benefits. Second, to address a potential alternative explanation, this experiment included one additional question about participants' baseline understanding of how the Social Security system works. We also made two small text updates – one to make the conditions more informationally equivalent and the other to the question about what happens in benefits. These changes are described in more detail in the following section, and the full materials are available in Appendix 5 and in our Research Box.

Materials and Procedure

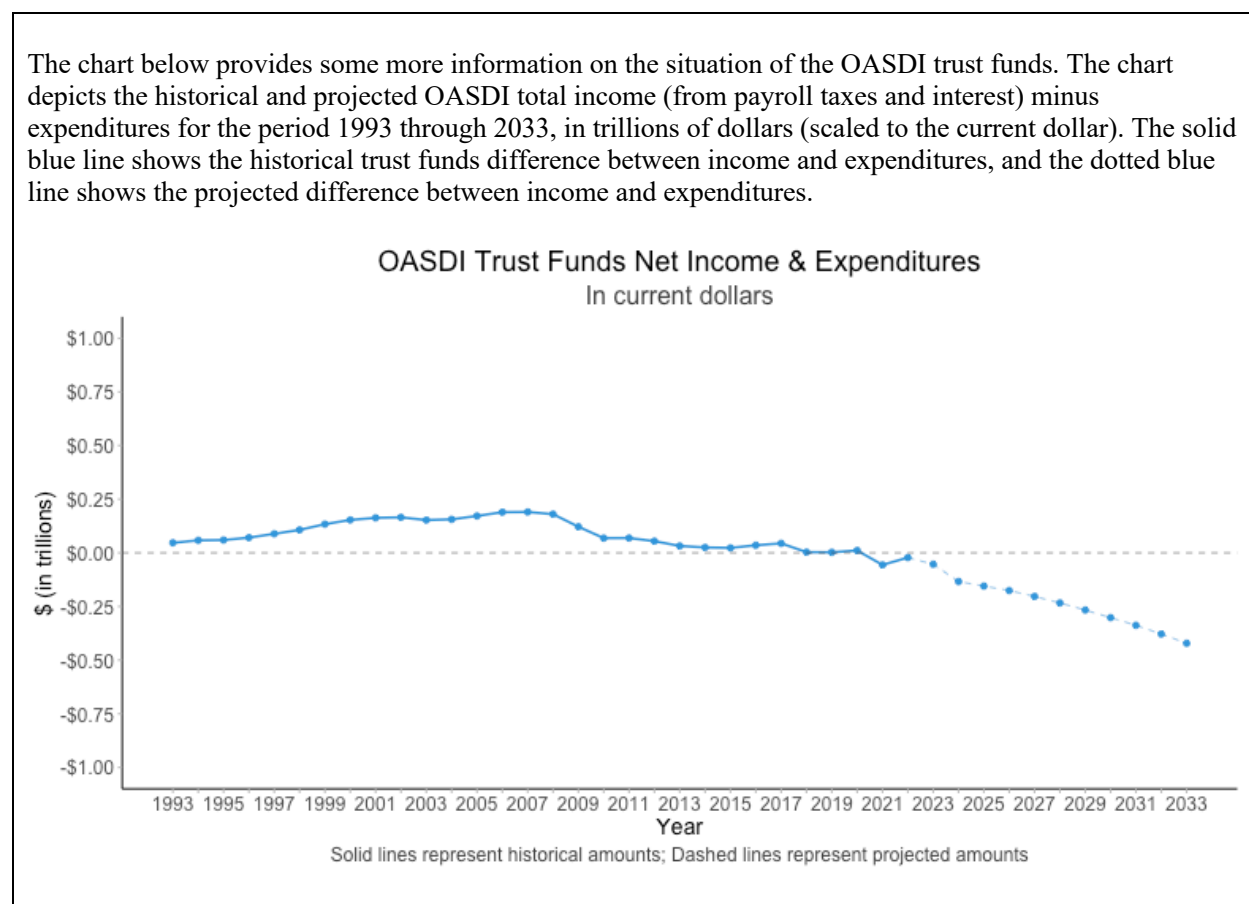
A total of 1,620 unique workers from AMT started the survey, of whom 1,501 completed the study ($M_{age} = 41.90$, $SD_{age} = 12.39$; 53% female). The survey followed the same structure as prior experiments. First, participants read a description of the trust funds (updated as described below) and were randomly assigned to see a stock graph, a flows graph, or a net flows graph. The stock and flows graphs were the same as in Experiment 1 (with updated numbers based on the most recent Trustees Report¹³), and the net flows graph is shown in Figure 3 ($n_{stock} = 509$, $n_{flows} = 496$, $n_{netflows} = 496$). Next, participants answered the same four dependent variable questions (with a slight update to the benefits question as noted above) and then responded to a new question about their mental model of the Social

¹³ This study was conducted after the release of the 2023 Trustees Report. The description and graphs were all updated to reflect the most recent datapoints and projections. The key difference is that the depletion date projected in this report is 2034.

Security system. The survey concluded with questions about participants' eligibility for Social Security and demographic characteristics.

The new question about mental models of the Social Security system allows us to test an important alternative explanation. Given the complexity of the Social Security system, it is possible that some participants have a fundamental misunderstanding of how the system works. Specifically, some people may not realize that current tax revenue is used to pay *current* beneficiaries (i.e., a “pay-as-you-go” kind of system), instead thinking that the system is more like a government-held individual savings account (such that an individual's payments into the system are literally deposited into an account and paid back to them once they retire). If at least some participants have this misconception, it is possible that manipulations focused on the flows simply correct this misunderstanding. In doing so, relatively more participants faced with flows may understand that future benefits are paid by future taxes, leading to a correct inference that as future taxes will continue, so will future benefits, whereas relatively more participants faced with the stock may (mis)understand that future benefits are paid by previous taxes, leading to an erroneous inference that once the trust funds are depleted, the funds to pay benefits have been exhausted. In other words, this alternative explanation hinges on stock vs. flows presentations differentially helping participants understand the fact that current inflows are related to current outflows. This is in contrast to the focal explanation that presenting flows simply makes inflows more accessible, allowing participants to use *what they already know* about the link between taxes and benefits to reason about the continuity of those flows after depletion. To address this possibility, we included a question after our main dependent variables that asked participants to report their understanding of Social Security as a pay-as-you-go system vs. an individual savings account model.¹⁴ We examined whether answers to this question differed by condition and/or were associated with perceptions about what happens to benefits.

¹⁴ Prior to running this experiment, we conducted a small pilot study to test this question. See Appendix 2 for a brief summary of this pilot and its results.

Figure 3. Net flows and graph used in Experiment 3

As previewed above, we also made two other small changes in this study. First, we added one additional sentence to the trust funds description shown to all participants. This sentence provided participants with information about the current level of inflows and outflows as of the most recent Trustees Report, ensuring formal equivalence across conditions. The second change was to the key outcome question about what happens to benefits after depletion. For this question, we added a sentence to ensure that participants knew they should be answering about retirement benefits *in general* (rather than about their own retirement benefits). The full materials are available in Appendix 5. As is evident in the results reported below, even with these changes, participants in this study provide answers that are very similar to what we observe in other studies.

Results

Like prior studies, about half of participants (53%) correctly identified that costs began to exceed total income in 2021, almost three-fourths (72%) correctly identified the depletion date, and approximately one-third (36%) correctly answered that benefits would still be paid out in smaller amounts after depletion. For the new question about understanding of how the Social Security system works, 77% of participants correctly identified that the system is pay-as-you-go.

Following our preregistration, we used dummy coded predictors for condition (with the net flows condition as the reference category) to test how the net flows condition compared to the stock and flows condition on our key outcomes. We also conducted follow-up analyses using the flows condition as the reference category. As in prior studies, we randomized the order of the first two objective knowledge questions about key dates, so all models include a contrast-coded predictor for order (-1, 1) that controls for this factor and all interactions between factors. Appendix 4 shows the full model results for all analyses.

Replicating Experiments 1 and 2, there are no significant differences across conditions for the question about when costs began to exceed income (stock vs. net flows: $b = 0.05$, $z = 0.40$, $p = .69$; flows vs. net flows: $b = 0.05$, $z = 0.37$, $p = .71$), though we do find that those who saw this question *after* answering the depletion question were more likely to answer accurately ($b = 0.26$, $z = 2.84$, $p = .005$). In line with Experiment 1, those in the stock condition are more likely to correctly identify the projected depletion date (75%) compared to those in the net flows condition (70%; $b = 0.28$, $z = 1.99$, $p = .047$) and those in the flows condition (70%; $b = 0.30$, $z = 2.09$, $p = .037$).

For our main outcome question about what happens to benefits after depletion, fewer participants in the net flows condition choose the answer about benefits going away completely (53%), compared to the stock condition (stock: 60%; $b = 0.29$, $z = 2.26$, $p = .024$). The difference between the net flows and flows condition is not significant (flows: 54%; $b = 0.06$, $z = 0.13$, $p = .66$), and the difference between the stock and flows condition is marginally significant and directionally consistent with other studies ($b = 0.23$, $z = 1.81$, $p = .07$). Table 2 provides the full breakdown of answers to this question by condition.

The pattern of results is similar for the question about the amount of benefits that would still be payable. Among those who answered this question, the average amount written in was \$634.17 ($SD = \244.22); using our preregistered approach to impute values based on answers to the prior question, the overall average was \$309.63 ($SD = \386.56). Looking at this by condition, the average amount in net flows condition ($M_{net\ flows} = \$323.05$, $SD_{net\ flows} = \$373.25$) is not significantly different from the flows condition ($M_{flows} = \$337.18$, $SD_{flows} = \$398.58$; $b = 14.23$, $t(1493) = 0.58$, $p = .56$). The average benefits amount in the stock condition ($M_{stock} = \$269.55$, $SD_{stock} = \$373.25$) is significantly lower than in both the net flows and flows conditions (vs. net flows: $b = -52.47$, $t(1493) = -2.15$, $p = .032$; vs. flows: $b = -66.71$, $t(1493) = -2.74$, $p = .006$).

We now turn to the question about how participants think Social Security works, summarized in Tables 3 and 4 below. Participants in the stock condition are directionally less likely to choose the correct answer (i.e., that it works as a pay-as-you-go system, 74%) relative to the net flows condition (78%; $b = -0.20$, $z = -1.37$, $p = .17$) and marginally less likely to relative to the flows condition (79%, $b = -0.28$, $z = -1.84$, $p = .066$). However, additional analyses suggest that an alternative explanation based on this finding cannot account for our results regarding the effect of presentation on beliefs about what happens to benefits. Limiting our analysis to only participants with the correct mental model (the majority of our sample), we still see that those in the stock condition are relatively more likely to say that benefits will go away completely (stock: 62%; flows: 54%; net flows 56%; stock vs. net flows: $b = 0.23$, $z = 1.55$, $p = .12$; stock vs. flows: $b = 0.32$, $z = 2.17$, $p = .03$). It does not appear that the flows condition reduces misperceptions regarding benefits by differentially correcting a misunderstanding that Social Security works like an individual's savings account. Instead, we contend the flows conditions is helping participants better *use* their knowledge about how the system works to form predictions.¹⁵

¹⁵ We also looked at whether those with the incorrect mental model (i.e., who think that Social Security works like an individual savings account) were more likely to think that benefits would go away completely after depletion. In fact, we find the opposite: across our whole sample, those with the incorrect mental model are significantly less likely to have this misperception (49% vs. 57%; $b = 0.34$, $z = 2.75$, $p = .006$). Inspecting the full set of results, it appears this is accompanied by an across-the-board increase in the proportion of responses indicating benefits will be paid at the same level. While this is a post hoc interpretation, this suggests that the misconception that Social

Table 3. Mental Models of Social Security

| | Overall Proportions | By Presentation Condition | | |
|------------------------|---------------------|---------------------------|-------|-----------|
| | | Stock | Flows | Net Flows |
| Correct Mental Model | 77% | 74% | 79% | 78% |
| Incorrect Mental Model | 23% | 26% | 21% | 22% |

Table 4. Mental Models of Social Security and Benefits Beliefs

| Presentation Condition | Correct Mental Model | | | Incorrect Mental Model | | |
|---|----------------------|-------|-----------|------------------------|-------|-----------|
| | Stock | Flows | Net Flows | Stock | Flows | Net Flows |
| What happens to benefits question (% choosing each option) ¹ | | | | | | |
| Benefits go away completely ² | 62% | 54% | 56% | 53% | 53% | 39% |
| Paid, smaller amount ³ | 33% | 37% | 38% | 35% | 29% | 49% |
| Paid, the same amount | 4% | 8% | 6% | 9% | 13% | 14% |
| Paid, larger amount | 1% | 1% | 0% | 2% | 1% | 1% |

Notes. ¹Missing answers due to a participant failing to answer a question are marked as missing but are included in the denominator for calculating the proportion of correct answers. These participants are excluded from regression analyses. ²Whether or not participants choose this zero-benefits-beliefs answer option is a key dependent variable across all studies. ³This is the correct answer.

Discussion

Experiment 3 contributes three takeaways. First, we confirm that our results do not change when those in the stock condition have information about current levels of income and expenditures (which, theoretically, should help them reason through why the stock is being depleted and what that means for future benefits) or when we make it more explicit that our main question about what will happen to benefits is asking about benefits in general. Second, we rule out an alternative explanation – namely, that the flows condition simply corrects a misunderstanding regarding their model of how Social Security works rather than helping people draw the correct implications from the correct (within reason) model. Finally, the fact that the net flows condition generates a pattern of results that closely mirrors that of the

Security operates as an individual savings account may be associated with the inference “...and therefore my funds are protected.”

flows condition also suggests that there is something unique about the accessibility of flows (vs. the overall downward trend apparent in both the stock and the net flows condition). The next two studies take this insight a step further by testing an explicit prompt to consider expectations about future inflows.

Experiments 4a and 4b

While the flows and net flows manipulations used thus far significantly decreased the extent to which participants thought benefits would go away completely, levels of misunderstanding remained consistently high – over half of participants in these conditions still exhibited zero-benefits beliefs. Experiments 4a and 4b were designed to test a stronger manipulation that encourages participants to reason through what would happen to the inflows and outflows when the trust funds become depleted. This manipulation was inspired by Benjamin Franklin’s famous utterance that “nothing is certain except death and taxes” (Sparks, 1856, p. 410). Specifically, the intervention asks participants to consider whether Social Security will continue collecting taxes (in line with Benjamin Franklin, a large majority say “yes”) and if so, what that money will be used for.¹⁶ Experiment 4a provided an initial test of this novel intervention, and Experiment 4b served as a higher-power replication of both the intervention effect from Experiment 4a and the stock-flow effect from Experiments 1, 2, and 3. As the procedure and analyses are almost identical for the two studies, we describe them together below.

Materials and Procedure

Our ending samples included 1,001 participants (out of 1,044 who started the study) from AMT for Experiment 4a ($M_{age} = 41.17$, $SD_{age} = 12.59$; 52% female) and 2,001 participants (out of 2,126 who started the study) from AMT for Experiment 4b ($M_{age} = 41.00$, $SD_{age} = 12.78$; 55% female). The beginning of the survey was identical to previous studies, where participants read a description of the trust funds accompanied by a stock or flow diagram (the same description and graphs as in Experiment 1; 4a: $n_{Stock} = 499$ and $n_{Flows} = 502$; 4b: $n_{Stock} = 1,005$ and $n_{Flows} = 996$) and then answered two questions (in random order) about when costs began to exceed income and when depletion was projected to happen.

¹⁶ See Appendix 3 for a brief summary of an analysis looking at what participants write in at this question.

The key addition in these studies was the addition of two self-reflection questions: first, a yes/no question that asked if participants thought Social Security would continue to collect payroll taxes after depletion, and second, an open-ended question that asked participants about what they thought Social Security would do with the money if payroll taxes continued to be collected. These questions did not provide participants with any new information. Instead, the questions merely asked participants to consider for themselves the consequences of whatever they already knew about Social Security as a pay-as-you go system. Crucially, participants were randomly assigned to answer these questions as an intervention that came either before or after the questions about what would happen to benefits as a result of depletion.¹⁷ We refer to participants who saw the intervention before the questions about benefits as being in the treatment condition (4a: $n = 491$; 4b: $n = 998$) and those who saw the intervention after as being in the control condition (4a: $n = 510$; 4b: $n = 1,003$). Thus, these studies used a 2 (presentation: *stock* vs. *flow*) by 2 (intervention: *treatment* vs. *control*) design. The remainder of the surveys were the same as Experiments 1 and 2.¹⁸

Results

We used regression analyses with contrast-coded predictors (-1, 1) to test the impact of presentation condition and intervention condition. As in previous studies, we also randomized the order of the first two objective knowledge questions about key dates, so all models include a contrast-coded predictor for order (-1, 1) that controls for this factor (we discuss findings related to this at the end of this section). Our models also include all two- and three-way interactions between factors. However, since none of these interactions are significant, we do not report on them below (see Appendix 4 for full model results). Following our preregistrations, we focus on stock-flow presentation effects only for the two date questions and both presentation and intervention effects for the questions about what happens to benefits.

¹⁷ Of note, across all experiments (including these), this question already tells participants to “assum[e] the government does not take any action to increase the amount of income that Social Security collects based on tax revenues,” which draws attention to the flows and could even imply that taxes will continue.

¹⁸ The only exception is that Experiment 4b did not include the question that asked participants to write a headline about the future of Social Security.

Table 4. Summary table of results for all preregistered dependent variables for Experiments 4a and 4b

| Measure ¹ | Experiment 4a (<i>N</i> = 1,001) | | | | Experiment 4b (<i>N</i> = 2,002) | | | |
|--|--------------------------------------|-------------|-------------|-------------|--------------------------------------|-------------|-------------|-------------|
| | Treatment | | Control | | Treatment | | Control | |
| | Stock | Flows | Stock | Flows | Stock | Flows | Stock | Flows |
| Date questions (% correct) ² | | | | | | | | |
| Costs exceed income date | 54% | 56% | 59% | 55% | 52% | 56% | 56% | 51% |
| Depletion date | 79% | 73% | 80% | 74% | 78% | 69% | 78% | 68% |
| What happens to benefits question (% choosing each option) | | | | | | | | |
| Benefits go away completely ³ | 44% | 43% | 68% | 65% | 42% | 36% | 66% | 58% |
| Paid, smaller amount ⁴ | 45% | 48% | 29% | 31% | 46% | 51% | 26% | 33% |
| Paid, the same amount | 10% | 8% | 2% | 3% | 10% | 11% | 7% | 8% |
| Paid, larger amount | 1% | 1% | 1% | 0% | 3% | 2% | 2% | 2% |
| Benefits amount question ⁵ (mean (SD)) | \$361 (387) | \$349 (383) | \$214 (346) | \$242 (351) | \$391 (405) | \$417 (401) | \$235 (374) | \$296 (393) |

Note. ¹ Missing answers due to a participant failing to answer a question are marked as missing but are included in the denominator for calculating the proportion of correct answers. These participants are excluded from regression analyses. ² Following our preregistration, answers are coded as correct if the participant entered a date within +/- 1 year of the correct answer. ³ Whether or not participants choose this zero-benefits-beliefs answer option is a key dependent variable across all studies. ⁴ This is the correct answer. ⁵ Following our preregistration, responses above \$2,000 are excluded from calculations. The correct value is estimated to be approximately \$750-800. ⁶ While we do not observe a significant main effect of stock vs. flows in this experiment, we do see directional evidence of a stock-flow difference on the key DV about what happens to benefits within the control condition.

As in previous studies, we did not see a significant main effect of presentation on accuracy in identifying when costs began to exceed income (4a: $b = 0.04$, $z = 0.61$, $p = .54$; 4b: $b = 0.01$, $z = 0.15$, $p = .88$). We did, however, replicate Experiment 1's finding that significantly more participants in the stock condition (4a: 79%; 4b: 78%) correctly identified the projected depletion date, compared to the flow condition (4a: 74%, $b = 0.17$, $z = 2.21$, $p = .027$; 4b: 69%, $b = 0.24$, $z = 4.66$, $p < .001$). The effect of intervention condition was non-significant for both of these dependent variables (4a income vs. costs: $b = 0.06$, $z = 0.90$, $p = .37$; 4b income vs. costs: $b = -0.01$, $z = -0.28$, $p = .78$; 4a depletion: $b = 0.03$, $z = 0.35$,

$p = .73$; 4b depletion: $b = -0.02$, $z = 0.43$, $p = .67$), as expected given that everyone responded to these questions before the intervention.

Table 4 shows the breakdown of answers to the multiple-choice question about what happens to benefits for each experimental condition across both studies. Analyses focused on the zero-benefits beliefs answer (i.e., that benefits will go away completely) reveal that the main effect of presentation condition was not significant in Experiment 4a ($b = 0.04$, $z = 0.59$, $p = .56$). However, this effect was significant in Experiment 4b, replicating earlier findings that those in the stock condition were more likely to choose the answer option that benefits would go away completely (54% vs. 47%; $b = 0.14$, $z = 3.10$, $p = .002$).¹⁹

The main effect of the intervention condition on answers to the question about what happens to benefits is significant and quite large in both studies. Participants in the treatment condition who were asked to reflect on what would happen to the inflow of payroll taxes before this question were significantly less likely to choose the zero-benefits beliefs answer option (4a: 43%; 4b: 39%) compared to those in the control condition who saw the intervention questions later (4a: 66%, $b = 0.48$, $z = 7.29$, $p < .001$; 4b: 62%, $b = 0.46$, $z = 10.02$, $p < .001$). A secondary, non-preregistered analysis focused on the correct answer revealed that participants in the treatment condition who answered the intervention questions first were more likely than those in the control condition to indicate that benefits would still be paid out at a smaller amount (4a: 47% vs. 30%, $b = -0.36$, $z = -5.40$, $p < .001$; 4b: 48% vs. 29%, $b = -0.41$, $z = -8.70$, $p < .001$).

In both studies, the interactions between the presentation and intervention factors are not statistically significant (both p 's $> .5$), which could suggest that the intervention that draws attention to

¹⁹ The simple effect of stock vs. flow in the control condition for Experiment 4a ($n = 510$) is directionally consistent with the stock-flow effect observed in other studies, with 68% in the stock condition choosing the wrong answer (vs. 65% in the flows condition). The simple effect in the treatment condition ($n = 491$) is directionally smaller, with 44% in the stock condition choosing the wrong answer (vs. 43% in the flow condition). The simple effects within the control and treatment conditions for Experiment 4b are in the expected direction, and similar in magnitude to prior studies: in the control condition ($n = 1,003$), 66% chose the wrong answer in the stock condition (vs. 58% in the flows condition); in the treatment condition ($n = 998$), 42% chose the wrong answer in the stock condition (vs. 36% in the flows condition).

the continuity of inflows is operating through a different channel than the graphs showing historical and projected flows. We may lack the statistical power to detect an interaction (especially with a binary outcome variable; the simple effect is directionally a bit smaller in the intervention conditions).

Additionally, the lack of an interaction need not be inconsistent with the flows presentations and the intervention both relying on the mechanism of accessibility of flows. The flows graphs may indirectly increase the broader tendency to reflect on inflows and outflows, and the intervention may increase the tendency to reflect on flows in a more direct and targeted manner. It is possible these effects may be additive.

Turning to the benefits amount question, the overall patterns of results are similar to previous studies. Among those who answered the question, the average amount written in was \$592 ($SD = \260) in Experiment 4a and \$606 ($SD = \291) in Experiment 4b; using imputed values based on our preregistered approach, the overall average was \$291 ($SD = \372) in Experiment 4a and \$335 ($SD = \400) in Experiment 4b. The main effect of stock-flow presentation was not significant in Experiment 4a ($b = -4.01$, $t(992) = -0.34$, $p = .73$) but was significant in Experiment 4b such that participants in the flow condition expected significantly higher monthly benefits ($M_{Flow} = \$359$, $SD_{Flow} = \$402$) than those in the stock condition ($M_{Stock} = \$311$, $SD_{Stock} = \$397$; $b = -21.26$, $t(1992) = -2.41$, $p = .016$). In both studies the effect of the intervention condition was significant such that participants in the treatment condition who saw the intervention questions first estimated significantly higher benefits amounts after trust fund depletion (4a: $M_{Treatment} = \$355$, $SD_{Treatment} = \$385$; 4b: $M_{Treatment} = \$404$, $SD_{Treatment} = \$403$), compared to those in the control condition who saw the intervention questions later (4a: $M_{Control} = \$229$, $SD_{Control} = \$349$, $b = -64.04$, $t(992) = -5.49$, $p < .001$; 4b: $M_{Control} = \$265$, $SD_{Control} = \$385$; $b = -68.98$, $t(1992) = -7.83$, $p < .001$). While still below the levels of what Social Security projections suggest could still be paid out (about \$750-800), the mean amounts in the treatment condition are closer to realistic projections than in the flows conditions from prior studies.

Finally, as in our other experiments, we randomized the order in which we asked the first two objective knowledge questions about when costs began to exceed income and when depletion is projected

to occur. Results in this study suggest a strong order effect on accuracy for both of these questions.

Replicating our finding in Experiment 1, those who saw the question about the date when costs exceeded income first were less likely to answer correctly (4a: 47%; 4b: 50%) than those who saw that question second (4a: 64%, $b = 0.35$, $z = 5.41$, $p < .001$; 4b: 58%, $b = 0.16$, $z = 3.61$, $p < .001$). In Experiment 4a only, we also find a significant effect of order on accuracy for the depletion date question such that participants who answered this question first were more likely to answer correctly (80%) than those who answered the question about income and costs first (73%; $b = 0.18$, $z = 2.38$, $p = .017$). This was not replicated in Experiment 4b ($b = 0.04$, $z = 0.81$, $p = .42$). However, there was a significant order effect in Experiment 4b on the question about what happens to benefits such that participants who saw the depletion date question second were less likely to choose the correct answer option about partial benefits being possible after depletion (41% vs. 36%; $b = -0.09$, $z = -1.98$, $p = .048$). We report the full results of all models in Appendix 4 and return to potential interpretations in the General Discussion.

Discussion

In this pair of studies, we tested an intervention that drew participants' attention directly to the state of the inflows into the trust funds, asking them to consider whether Social Security would continue to collect payroll taxes after depletion and how that tax revenue would be used. Notably, a very large majority – 90% of the sample in Experiment 4a and 89% in Experiment 4b – believed that Social Security would continue to receive these inflows, suggesting this specific aspect of Social Security policy is well understood. Importantly, however, those asked to reflect on this *before* answering a question about what would happen to benefits as a result of depletion were both less likely to think benefits would go away completely and more likely to choose the correct answer that partial benefits would still be paid out. Thus, this intervention, designed specifically to prompt participants to reflect on the fact that the trust funds would continue to receive inflows (i.e., income from payroll taxes), was successful in combatting zero-benefits beliefs, the widely held misperception that Social Security benefits (i.e., outflows) will dry up when the trust funds do.

General Discussion

The Social Security trust funds hold and invest the surplus from payments that have been made into the system after benefits have been paid out. Because current projections suggest that the trust funds will be depleted by 2035, it is critical that researchers and policymakers alike determine how best to communicate information about the situation to constituents and beneficiaries. Yet, media headlines often emphasize how the trust funds will run dry, dwindling down to a balance of \$0, leading many everyday consumers to erroneously arrive at the conclusion that benefit payouts will dry up too. In this paper, we argue that one reason for these problematic interpretations is due to stock-flow reasoning errors: converting between stocks (the trust funds balance) and flows (the taxes paid in and benefits paid out over time) can be a difficult task to undertake.

In five preregistered experiments, we tested whether differences in inferences regarding the Social Security trust funds arose based on reasoning about stocks versus flows. Namely, results from Experiments 1, 3, 4a, and 4b suggest that presenting the information as a stock leads to higher accuracy regarding *when* depletion of the trust funds will occur; while this effect is not significant in Experiment 2, the direction of the difference is consistent. This is notable given the fact that all participants, regardless of condition, read a description that included the correct depletion date. But as shown in our stimuli (see Figure 1 and Figure 2), the stock graph made clear that the balance would be running down to zero around 2035.

Our main results, however, center on inferences about what will happen to benefits after depletion. Experiment 1 found that relative to those in the flows condition, more respondents in the stock condition thought that benefits would go away completely. In Experiment 2, we used different stimuli that more closely resembled information presented in the Trustees reports, again finding that framing information in terms of flows reduced the proportion of respondents who think benefits will go away completely after depletion. We also tested an enhanced presentation format, in which we explicitly showed participants a line that represented payable benefits, with the purpose of highlighting when depletion occurs as well as what happens to benefits after that point. Responses to our central outcome

variables were no different in this condition than they were in the standard flows condition, indicating just how difficult it may be to fully de-bias consumer perceptions of the SSA trust funds even with more explicit information. Experiment 3 tested an additional type of presentation – net flows (i.e., income minus expenditures) – to clarify the mechanism by which the flows presentations may be operating. Participants who saw this new graph responded similarly to those shown the component flows (i.e., income and cost separately), suggesting that drawing participant attention to the flows at all may explain better reasoning about what happens to benefits. This study also ruled out an important alternative explanation, illustrating that the difference in benefits beliefs across conditions cannot be explained by differential *correction* of an incorrect mental model of how the system works.

Flows presentations, however, are not a panacea: more than half of those in the flows conditions across Experiments 1, 2, and 3 still hold zero-benefits beliefs. To this end, Experiments 4a and 4b test an intervention aimed at further reducing the misconception that benefits stop completely when the trust funds become depleted and provide supportive process evidence about why this misunderstanding is so prevalent. This intervention was simple: we asked two targeted questions that asked participants to explicitly consider whether the funds' inflows (income from payroll taxes) would continue post-depletion, and if so, what that revenue would be used for. Despite its simplicity, the intervention of asking these questions before (vs. after) the questions about what happens to benefits resulted in a large reduction in the number of people who thought benefits would go away completely. While there may be ways to improve understanding even further, the results of this study point to this kind of targeted reflection being a promising technique for harnessing citizen beliefs about the continuity of taxes to reinforce expectations for the continuity of benefits. It is also informative about the psychological process by indicating that participants may be capable of the necessary stock-flow reasoning when they reflect upon how the parts of the system fit together – but that they may merely be unlikely to engage in it spontaneously unless otherwise prompted (e.g., by the intervention questions). This may provide a promising avenue for improving qualitative stock-flow reasoning problems more generally, which have previously proven stubbornly resistant to accuracy interventions (e.g., Cronin et al., 2009).

Unexpectedly, in Experiments 1, 3, 4a, and 4b (though not Experiment 2), we also found that participants were more likely to correctly report the year in which costs began to exceed revenues when they did so after reporting when the trust fund would be depleted. Revealingly, among participants who did not enter the correct date for when costs started exceeding income, a majority entered the depletion date instead. This suggests that when encountering the question regarding flows after the question regarding stocks, respondents were more likely to properly distinguish between the two representations. In contrast, when encountering the question regarding flows first, they may not distinguish the two metrics and instead answer with respect to the stock.

Taken together, our results hold both theoretical and practical importance. First, we extend existing research on stock-flow reasoning problems into this new, important domain. Furthermore, this new setting provides an opportunity to test the effect of stock vs. flow presentations on a new type of outcome: a projection about what will happen to a component of the system in the future (i.e., the outflows or benefits payments). We find that presentation of stocks vs. flows changes predictions of what happens to outflows, arguably the most important aspect of this system for prospective retirees who are expecting benefits. This effect may be attributed to focusing on the continuity of the inflow, further emphasizing the critical role of considering the dynamics of the system as a whole when forecasting into the future. Similar dependent variables may be of interest to other situations involving accumulation, such as the drawdown of greenhouse gasses from the atmosphere. Finally, from a practical perspective, they suggest that framing trust funds information in terms of flows or prompting participants to consider their existing knowledge of the system may help overcome misconceptions.

Constraints on Generality

This investigation has its limitations. First, our studies were conducted solely on Amazon's Mechanical Turk. Findings using online convenience samples like Amazon Mechanical Turk are strongly correlated with findings using (typically much more expensive) probability samples (Coppock, Leeper, & Mullinix, 2018; Mullinix et al., 2015; Peyton, Huber, & Coppock, 2021; Snowberg & Yariv, 2021), especially when using screeners such as the CloudResearch approved pool we used (Litman, Robinson, &

Abberbock, 2017; Peer et al., 2021). Second, the focus of this research was a policy outcome directly relevant for prospective retirees in the United States, though we expect that the stock-flow reasoning insights resulting from this paper should apply across contexts involving accumulation and hope that future research will test this. Third, our studies did not include incentive-compatible outcomes or consequential choices and so it is possible that incentives could have enhanced accuracy (although unless they also would have reduced the difference between conditions, they would not pose a threat to our estimate of the effect of stock vs. flow presentation or the effect of our intervention; prior research suggests enhanced motivation is not sufficient; e.g., Cronin et al., 2009). Finally, even though we attempted to generate stimuli that closely resembled material used by Social Security, our materials were written to be more accessible and understandable than the status quo. It is possible that differences between conditions would be muted were we to use actual SSA materials.

Future Directions and Conclusion

Despite these limitations, the results are promising and offer opportunities for future research. Specifically, more work is needed to better understand how to further improve de-biasing attempts. We reason that it may be difficult to alter perceptions about the trust funds precisely because the stock framing of the trust funds is so strongly ingrained. Indeed, media headlines themselves may reinforce a focus on stocks rather than flows (cf. Jerit & Barabas, 2006). Further, because stock-flow reasoning is so difficult, future interventions may need to be more involved and/or occur over multiple time points rather than the single-shot interventions we employed in these studies (e.g., further-reinforced “enhanced flow” intervention in Experiment 2 or the reflection intervention in Experiments 4a and 4b). Finally, future work may benefit from studying not just perceptions of benefit payouts, but also downstream consequences such as claiming intentions (e.g., Quinby & Wettstein, 2021), retirement savings behavior (e.g., Delavande and Rohwedder, 2011), and support for changes to SSA policies regarding taxes and benefits.

Policy decisions about the Social Security trust funds affect members of the public on many levels. Many workers incorporate expected OASI benefits into their retirement planning, meaning

changes to taxes and benefits calculations or amounts may have wide-ranging consequences for prospective retirees. It is important that the public fully understands the situation in order to make informed decisions – both for their own retirement planning and in forming policy preferences. This work contributes to a deeper understanding of how communication about this complex policy topic can influence public understanding and discourse.

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Appendix 1

Key Results from Stock/Flow Pilot Study

The purpose of the pilot study was to test our stimuli, refine our key dependent variables for assessing understanding, and explore additional measures that might be related to stock-flow reasoning about the trust funds. This pilot study was also preregistered on AsPredicted.²⁰

We recruited 410 unique participants from Amazon's Mechanical Turk (AMT) to take part in this study, of whom 403 passed the screener and completed the full study ($M_{age} = 38.73$, $SD_{age} = 11.07$; 38% female). The content of measures and manipulations can be found in our Research Box.²¹

In the first section of the survey, we asked participants about their pre-existing knowledge about the future of Social Security's finances and gathered both open-ended answers about this and information on where participants learned this information. After this, participants read a brief description about the OASDI trust funds and were randomly assigned to see an accompanying graph that showed either the balance (*stock* condition, $n = 204$) or income and expenditures (*flows* condition, $n = 199$) of the trust funds for the period 1993 through 2033²². Next, participants answered a number of objective understanding questions about the trust funds, including questions about key dates (when total income began to exceed total costs and when the funds are projected to be depleted) and key features of the situation (whether current total income is enough to pay for yearly obligations and what will happen to benefits after depletion). While answering these questions, participants had the option to click a button that would allow them to see the description and graph (though participants were not informed this would be possible when they first saw the information). After this section, we asked a number of questions to assess related policy attitudes, expectations for the economy, subjective reactions, and subjective understanding of the information. The final sections of the survey asked about participants' own eligibility for retirement benefits and collected other demographic information. The results reported here focus on the objective understanding questions, as these are the questions most central to our research objectives and that are used (in modified forms) in the main studies.

Results by condition, including significance tests, are reported in Table A1 below. Note that the results are directionally consistent with the two main results we find across our main experiments – that the stock presentation leads to greater accuracy on the depletion date question and a higher rate of choosing the zero-benefits beliefs answer for the question about what happens to benefits.

²⁰ See https://aspredicted.org/MW1_B7K. Note: our preregistration contained a small error. Specifically, there was one yes/no question that preceded the question about when depletion would happen. This yes/no question asked if the trust funds would become depleted (correct answer: yes), and only those who answered this question correctly were asked the next question about when depletion would happen. Almost all participants (98%) correctly answered the yes/no question about whether depletion would happen.

²¹ Research Box available here: https://researchbox.org/1172&PEER_REVIEW_passcode=GQYVKB

²² The description was based on the 2021 Trustees Report, and the data were taken from the 2021 Supplemental Single-Year Tables (specifically, Table VI.G8 available at <https://www.ssa.gov/oact/TR/2021/lr6g8.html>). Of note, the 2022 Trustees Report was released while this survey was in-field. The data and projections from the 2022 Trustees Report are used for all other studies.

Table A1. Pilot study results summary

| Answer ¹ | Experimental Condition | | Significance Test |
|--|------------------------|----------------------|--|
| | Stock | Flows | |
| Current income enough to cover benefits? (% correct) | 74% | 81% | $b = -0.21, z = -1.75, p = .08$ |
| Will the funds become depleted? (% correct) | 99% | 97% | $b = 0.57, z = 1.39, p = .16$ |
| Date questions (% correct) ² | | | |
| Depletion date | 94% | 88% | $b = 0.28, z = 1.35, p = .18$ |
| Costs exceed income date | 61% | 69% | $b = -0.15, z = -1.40, p = .16$ |
| What happens to benefits question (% choosing each option) | | | |
| Benefits go away completely ³ | 67% | 58% | $b = 0.18, z = 1.73, p = .08$ |
| Paid, smaller amount ⁴ | 28% | 28% | |
| Paid, the same amount | 4% | 11% | |
| Paid, larger amount | 1% | 3% | |
| Benefits amount question (mean (SD)) ⁵ | \$203.73 (326.15) | \$286.17 (389.51) | $b = -41.22, t(392) = -2.28, p = .023$ |

Note. ¹ Missing answers due to a participant failing to answer a question are marked as missing but are included in the base for calculating the proportion of correct answers. These participants are excluded from regression analyses. ² Following to our preregistration, answers are coded as correct if the participant entered a date within +/- 1 year of the correct answer. ³ Whether or not participants choose this zero-benefits beliefs answer option is a key dependent variable across all studies. ⁴ This is the correct answer. ⁵ In our preregistration we specified that we would also mark answers within +/- \$50 of \$780 as correct (in addition to analyzing as a mean). In keeping with our main studies, we report the mean and standard deviation of the amounts here.

Appendix 2

Key Results from Mental Models Pilot Study

The purpose of this pilot study was to understand existing lay “mental models” of the workings of the Social Security system and pre-test a multiple choice question to measure participant understanding of the system.

We recruited 108 unique participants from AMT, 101 of who passed the screener and completed the whole study ($M_{age} = 40.4$, $SD_{age} = 11.8$; 47% female). The questions included in this study can be found in our Research Box.²³ This survey did not include any experimental manipulations and did not provide participants with any information about the trust funds.

The first question in the survey asked participants to type an answer to the following questions: (1) “How does Social Security collect money to pay for retirement benefits?” and (2) “How does Social Security use that money it collects?” After this, we asked participants a multiple-choice question about which of two statements more closely aligned with their understanding of how Social Security works. Next, participants were asked multiple choice questions about their understanding of the current situation of Social Security’s financial reserves (i.e., the stock), its financial inputs and outputs (i.e., the flows), and what is most likely to happen to benefits in the future.²⁴ The survey concluded with questions about participants’ eligibility for Social Security, claiming status, and demographic information. See Table A2 below for response frequencies for each of the substantive multiple choice questions.

One finding of note in the table below is that we observe a much lower frequency of zero-benefits beliefs in this sample (20%) than in other experiments. We can see two potential reasons that could contribute to this. First, this study did not provide participants with any information about the trust funds before asking these questions, meaning the impending depletion of the trust funds may not have been top-of-mind (or even known) while filling out the survey. Second, this question about the future of benefits always came after the question about how the system works. The majority of participants were able to correctly identify that the system is pay-as-you-go, suggesting that the asking of this question first could operate similarly to the intervention tested in Experiments 4a and 4b (making inflows more accessible by drawing attention to how current taxes pay for current benefits).

²³ Research Box available here: https://researchbox.org/1172&PEER_REVIEW_passcode=GQYVKB

²⁴ After the first 20 participants completed the study, we updated the survey slightly to randomize the answer options for these multiple choice questions and randomized the order of the stock and flows questions.

Table A2. Mental Models Pilot Study Summary Results

| Question & Answer Options | N | Proportion |
|--|----|------------|
| Which of the following descriptions more closely aligns with your understanding of how Social Security works? | | |
| Social Security works like an individual savings account - workers pay into the system and their money is saved until they retire | 32 | 32% |
| Social Security works like a pay-as-you-go system - workers pay into the system and their money is used to pay current retirees (correct) | 63 | 62% |
| Neither: (please explain) | 6 | 6% |
| According to your understanding, which of the following best represents the current situation of Social Security's financial reserves? | | |
| Social Security financial reserves are becoming depleted (correct) | 68 | 67% |
| Social Security financial reserves are approximately stable | 27 | 27% |
| Social Security financial reserves are growing | 6 | 6% |
| According to your understanding, which of the following best represents the current situation of Social Security's financial inputs and outputs? | | |
| Social Security brings in LESS revenue than needed to pay benefits in a given year (i.e., running at a deficit) (correct) | 60 | 59% |
| Social Security brings in about the same in revenue as what is needed to pay benefits in a given year | 29 | 29% |
| Social Security brings in MORE revenue than needed to pay benefits in a given year (i.e., running at a surplus) | 12 | 12% |
| Assuming the government does not take any action to change the Social Security system – in your view, what is most likely to happen to Social Security benefits in the future? | | |
| <i>Note: we aren't asking about your benefits, rather Social Security benefits in general. If you aren't sure, please select the option that reflects your best guess.</i> | | |
| Benefits go away completely | 20 | 20% |
| Paid, smaller amount (correct) | 61 | 60% |
| Paid, the same amount | 13 | 13% |
| Paid, larger amount | 7 | 7% |

Appendix 3

Coding Results from Studies 4a and 4b

A team of 3 research assistants coded a sample of 300 responses ($n = 100$ from Study 4a, and $n = 200$ from Study 4b) to the second question in our intervention. This question asked participants to write in how they thought Social Security would use any payroll taxes collected after the depletion date. The research assistants coded the open-ended text to assess whether the participant indicated the money would go towards paying out benefits (yes/no). We briefly discuss the results of this below, reporting frequencies based on how a majority of the research assistants categorized each response.

Among participants in the treatment group (who responded to these intervention questions *before* the multiple choice question about what happens to benefits), about half (52%) wrote that they thought the money would be used to pay benefits. Of those in the treatment condition, a larger proportion of participants who mentioned benefits in their open-ended response reported that at least some benefits would continue at the multiple choice question (75%; compared to 47% of participants whose open-ended responses did not mention benefits). In the control condition (where participants responded to the intervention question *after* the multiple choice question), 42% wrote in an answer about paying out benefits. Of those in the control group, 48% of participants who mentioned benefits in their response also indicated that some benefits would be paid at the multiple choice question, while only 27% of those who did not mention benefits reported that some benefits would be paid. The finding that those who saw the intervention question first and who wrote in benefits were most likely to indicate that benefits would still be paid (at the multiple choice question) roughly aligns with our proposed mechanism.²⁵

²⁵ These data are available from the researchers upon request.

Appendix 4

Full Model Results

Experiment 1

| | <i>Dependent variable:</i> | | | |
|----------------------------|--|--|--|---|
| | Costs vs. income date (correct) (1) | Depletion date (correct) (2) | What happens to benefits (zero-benefits) (3) | Benefits amounts (in dollars) (4) |
| Flows vs. Stock | -0.0004 (0.064) p = 0.996 | 0.214** (0.075) p = 0.005 | 0.170** (0.065) p = 0.009 | -36.996** (11.836) p = 0.002 |
| Order | 0.217*** (0.064) p = 0.001 | 0.027 (0.075) p = 0.716 | -0.020 (0.065) p = 0.755 | 5.174 (11.836) p = 0.663 |
| Flows vs. Stock * Order | -0.036 (0.064) p = 0.577 | -0.064 (0.075) p = 0.391 | 0.058 (0.065) p = 0.370 | -5.968 (11.836) p = 0.615 |
| Constant | 0.235*** (0.064) p = 0.0003 | 1.155*** (0.075) p = 0.000 | 0.414*** (0.065) p = 0.000 | 276.395*** (11.836) p = 0.000 |
| Model type | Logistic | Logistic | Logistic | OLS |
| DV Coding | 1 = 2021 +/- 1 year; 0 = all other answers | 1 = 2035 +/- 1 year; 0 = all other answers | 1 = benefits go away completely; 0 = all other answers | Written or imputed dollar amount |
| Observations | 1,001 | 1,000 | 1,001 | 1,000 |

Note:

* $p < .05$; ** $p < .01$; *** $p < 0.001$

Experiment 2

| | <i>Dependent variable:</i> | | | |
|--|--|--|--|---|
| | Costs vs. income date (correct) (1) | Depletion date (correct) (2) | What happens to benefits (zero-benefits) (3) | Benefits amounts (in dollars) (4) |
| Plain Flows vs. Stock | 0.0004 (0.128) p = 0.998 | 0.152 (0.142) p = 0.283 | 0.285* (0.129) p = 0.027 | -52.657* (24.495) p = 0.032 |
| Plain Flows vs. Enhanced Flows | -0.155 (0.128) p = 0.225 | 0.124 (0.142) p = 0.384 | -0.006 (0.127) p = 0.965 | 3.787 (24.470) p = 0.878 |
| Order | -0.044 (0.090) p = 0.627 | -0.032 (0.099) p = 0.748 | -0.164 (0.090) p = 0.070 | 20.072 (17.317) p = 0.247 |
| Plain Flows vs. Stock * Order | 0.370** (0.128) p = 0.004 | 0.095 (0.142) p = 0.504 | 0.164 (0.129) p = 0.202 | -11.416 (24.495) p = 0.642 |
| Plain Flows vs. Enhanced Flows * Order | 0.207 (0.128) p = 0.106 | 0.252 (0.142) p = 0.076 | 0.257* (0.127) p = 0.044 | -23.652 (24.470) p = 0.334 |
| Constant | -0.137 (0.090) p = 0.127 | 0.893*** (0.099) p = 0.000 | 0.179* (0.090) p = 0.048 | 316.720*** (17.317) p = 0.000 |
| Model type | Logistic | Logistic | Logistic | OLS |
| DV Coding | 1 = 2010 +/- 1 year; 0 = all other answers | 1 = 2035 +/- 1 year; 0 = all other answers | 1 = benefits go away completely; 0 = all other answers | Written or imputed dollar amount |
| Observations | 1,499 | 1,502 | 1,503 | 1,501 |

*Note:** $p < .05$; ** $p < .01$; *** $p < 0.001$

Experiment 3

| | <i>Dependent variable:</i> | | | |
|--------------------------------|--|--|--|--|
| | Costs vs. income date (correct) | Depletion date (correct) | What happens to benefits (zero-benefits) | Benefits amounts (in dollars) |
| | (1) | (2) | (3) | (4) |
| Stock vs. Net Flows | 0.051 (0.130) p = 0.690 | 0.280* (0.140) p = 0.048 | 0.290* (0.130) p = 0.025 | -52.000* (24.000) p = 0.032 |
| Flows vs. Net Flows | 0.048 (0.130) p = 0.710 | -0.016 (0.140) p = 0.910 | 0.056 (0.130) p = 0.660 | 14.000 (24.000) p = 0.560 |
| Order | 0.260** (0.091) p = 0.005 | 0.054 (0.098) p = 0.580 | -0.120 (0.090) p = 0.200 | 26.000 (17.000) p = 0.130 |
| Stock vs. Net Flows * Order | -0.098 (0.130) p = 0.440 | 0.045 (0.140) p = 0.760 | 0.064 (0.130) p = 0.620 | -19.000 (24.000) p = 0.430 |
| Flows vs. Net Flows * Order | 0.090 (0.130) p = 0.480 | 0.200 (0.140) p = 0.160 | 0.030 (0.130) p = 0.810 | -7.400 (24.000) p = 0.760 |
| Constant | 0.110 (0.091) p = 0.230 | 0.850*** (0.098) p = 0.000 | 0.100 (0.090) p = 0.270 | 322.000*** (17.000) p = 0.000 |
| Model type | Logistic | Logistic | Logistic | OLS |
| DV Coding | 1 = 2021 +/- 1 year; 0 = all other answers | 1 = 2034 +/- 1 year; 0 = all other answers | 1 = benefits go away completely; 0 = all other answers | Written or imputed dollar amount |
| Observations | 1,499 | 1,502 | 1,503 | 1,501 |

*Note:** $p < .05$; ** $p < .01$; *** $p < 0.001$

Experiment 4a

| | <i>Dependent variable:</i> | | | | |
|---|--|--|---|---|--|
| | Costs vs. income date (correct) | Depletion date (correct) | What happens to benefits (zero- benefits) | What happens to benefits (smaller benefits) | Benefits amounts (in dollars) |
| | (1) | (2) | (3) | (4) | (5) |
| Flows vs. Stock | 0.040 (0.065) p = 0.540 | 0.168* (0.076) p = 0.028 | 0.039 (0.066) p = 0.557 | -0.054 (0.067) p = 0.416 | -4.005 (11.659) p = 0.732 |
| Treatment vs. Control | 0.056 (0.065) p = 0.394 | 0.026 (0.076) p = 0.729 | 0.479*** (0.066) p = 0.000 | -0.360*** (0.067) p = 0.00000 | -64.044*** (11.659) p = 0.00000 |
| Order | 0.359*** (0.065) p = 0.00000 | 0.181* (0.076) p = 0.018 | 0.020 (0.066) p = 0.766 | -0.014 (0.067) p = 0.836 | 0.366 (11.659) p = 0.975 |
| Flows vs. Stock * Treatment vs. Control | 0.070 (0.065) p = 0.286 | -0.010 (0.076) p = 0.892 | 0.016 (0.066) p = 0.811 | 0.001 (0.067) p = 0.993 | -9.498 (11.659) p = 0.416 |
| Flows vs. Stock * Order | 0.084 (0.065) p = 0.199 | -0.011 (0.076) p = 0.886 | 0.034 (0.066) p = 0.609 | -0.078 (0.067) p = 0.241 | -4.218 (11.659) p = 0.718 |
| Treatment vs. Control * Order | 0.060 (0.065) p = 0.355 | 0.077 (0.076) p = 0.310 | -0.073 (0.066) p = 0.266 | 0.102 (0.067) p = 0.128 | 9.865 (11.659) p = 0.398 |
| Flows vs. Stock * Treatment vs. Control * Order | -0.086 (0.065) p = 0.190 | 0.039 (0.076) p = 0.608 | 0.014 (0.066) p = 0.828 | 0.014 (0.067) p = 0.839 | -3.264 (11.659) p = 0.780 |
| Constant | 0.252*** (0.065) p = 0.0002 | 1.201*** (0.076) p = 0.000 | 0.203** (0.066) p = 0.003 | -0.497*** (0.067) p = 0.000 | 291.506*** (11.659) p = 0.000 |
| Model type | Logistic | Logistic | Logistic | Logistic | OLS |
| DV Coding | 1 = 2021 +/- 1 year; 0 = all other answers | 1 = 2035 +/- 1 year; 0 = all other answers | 1 = benefits go away completely; 0 = all other answers | 1 = smaller benefits; 0 = all other answers | Written or imputed dollar amount |
| Observations | 997 | 999 | 1,000 | 1,000 | 1,000 |

*Note:** $p < .05$; ** $p < .01$; *** $p < .001$

Experiment 4b

| | <i>Dependent variable:</i> | | | | |
|----------------------------------|--|--|---|--|--|
| | Costs vs. income date (correct) | Depletion date (correct) | What happens to benefits (zero- benefits) | What happens to benefits (smaller benefits) | Benefits amounts (in dollars) |
| | (1) | (2) | (3) | (4) | (5) |
| Flows vs. Stock | 0.006 (0.045) p = 0.895 | 0.241*** (0.051) p = 0.00001 | 0.144** (0.046) p = 0.002 | -0.141** (0.047) p = 0.003 | -21.630* (8.807) p = 0.015 |
| Treatment vs. Control | -0.014 (0.045) p = 0.765 | -0.020 (0.051) p = 0.701 | 0.463*** (0.046) p = 0.000 | -0.413*** (0.047) p = 0.000 | -69.348*** (8.807) p = 0.000 |
| Order | 0.164*** (0.045) p = 0.0003 | 0.039 (0.051) p = 0.448 | 0.003 (0.046) p = 0.951 | -0.094* (0.047) p = 0.048 | 12.700 (8.807) p = 0.150 |
| Flows vs. Stock * | 0.081 (0.045) p = 0.075 | 0.018 (0.051) p = 0.727 | 0.026 (0.046) p = 0.578 | -0.030 (0.047) p = 0.521 | -8.503 (8.807) p = 0.335 |
| Treatment vs. Control | | | | | |
| Flows vs. Stock * | 0.053 (0.045) p = 0.243 | -0.025 (0.051) p = 0.628 | 0.006 (0.046) p = 0.894 | 0.022 (0.047) p = 0.643 | -5.736 (8.807) p = 0.515 |
| Order | | | | | |
| Treatment vs. Control * Order | -0.018 (0.045) p = 0.686 | -0.065 (0.051) p = 0.208 | -0.003 (0.046) p = 0.946 | 0.015 (0.047) p = 0.754 | -7.400 (8.807) p = 0.401 |
| Flows vs. Stock * | -0.106* (0.045) p = 0.019 | -0.078 (0.051) p = 0.130 | -0.045 (0.046) p = 0.325 | 0.034 (0.047) p = 0.471 | 7.815 (8.807) p = 0.375 |
| Treatment vs. Control * Order | | | | | |
| Constant | 0.149*** (0.045) p = 0.001 | 1.023*** (0.051) p = 0.000 | 0.021 (0.046) p = 0.652 | -0.482*** (0.047) p = 0.000 | 334.784*** (8.807) p = 0.000 |
| Model type | Logistic | Logistic | Logistic | Logistic | OLS |
| DV Coding | 1 = 2021 +/- 1 year; 0 = all other answers | 1 = 2035 +/- 1 year; 0 = all other answers | 1 = benefits go away completely; 0 = all other answers | 1 = smaller benefits; 0 = all other answers | Written or imputed dollar amount |
| Observations | 1,998 | 1,999 | 2,000 | 2,000 | 1,999 |

*Note:** $p < .05$; ** $p < .01$; *** $p < .001$

Appendix 5

This appendix includes the key experimental manipulations and measures for all studies. Full materials are available in Research Box at https://researchbox.org/1172&PEER_REVIEW_passcode=GQYVKB

Experiment 1 Materials

Trust funds descriptions [seen by everyone]

Introduction

On the next page, we'll be showing you some information about the Social Security Old-Age and Survivors Insurance (OASI) and Disability Insurance (DI) trust funds (also known as the OASDI trust funds), based on the 2022 Trustees Report from the Social Security Administration (SSA). Even if you have seen information about this topic before, please make sure to read carefully as the next part of the survey will involve answering some questions about what you read.

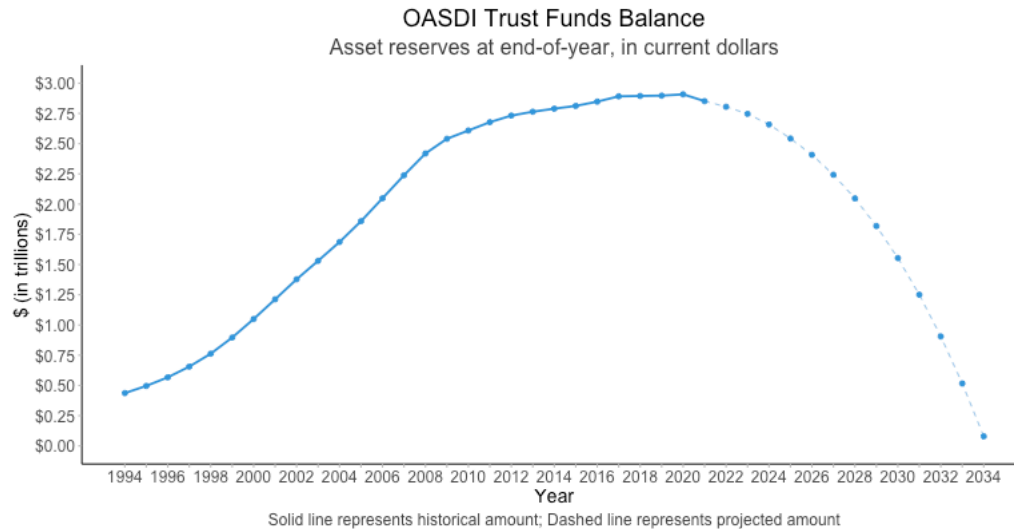
Description

The Social Security Administration uses accounts called “trust funds” to store income that’s collected through Social Security taxes and then eventually uses that money to pay out benefits. The OASI Trust Fund pays retirement and survivors benefits and the DI Trust Fund pays disability benefits, but the two are often referred to together as the OASDI Trust Funds. At the end of the year in 2021, the OASDI trust funds held \$2.85 trillion in total.

Social Security uses the OASDI trust funds to make benefits payments and pay administrative expenses. The trust funds receive income through two sources: tax revenue collected from workers and interest that comes from the investment of the money in US Government securities. In 2021, Social Security's total income from both of these sources was \$56 billion lower than its total costs (benefits payments plus administrative expenses). This was the first time in many years that total income was lower than total costs. Social Security predicts that in future years, total income will continue to be lower than total costs. Because of this continued projected deficit, the trust funds balance is projected to reach \$0 at some time in 2035.

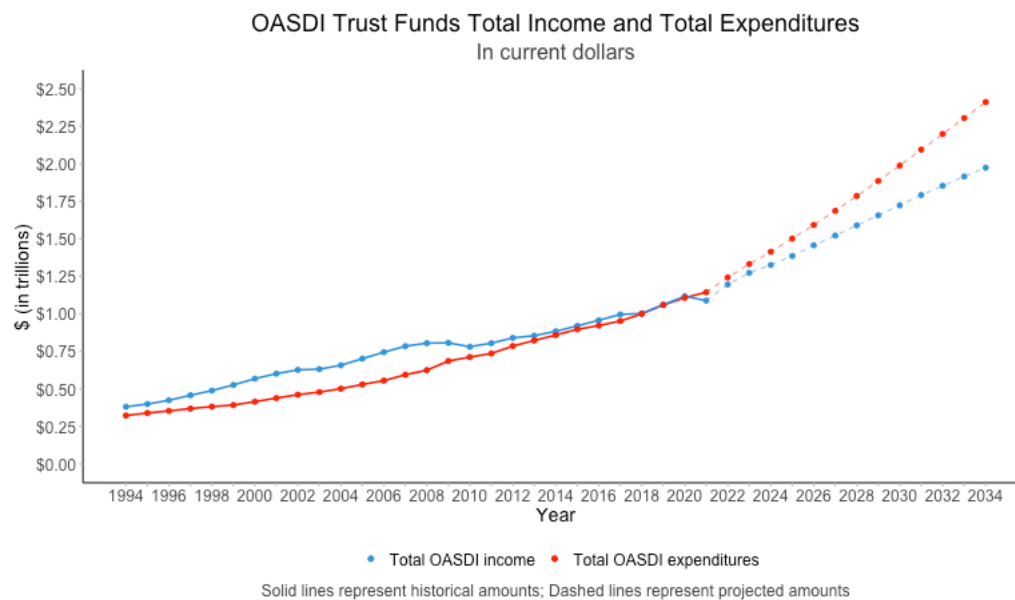
Stock condition

The chart below provides some more information on the situation of the OASDI trust funds. The chart depicts the historical and projected OASDI trust fund balance for the period 1994 through 2034, in trillions of dollars (scaled to the current dollar). The solid line shows the historical trust fund balance, and the dotted line shows the projected balance.



Flows condition

The chart below provides some more information on the situation of the OASDI trust funds. The chart depicts the historical and projected OASDI total income (from payroll taxes and interest) and expenditures for the period 1994 through 2034, in trillions of dollars (scaled to the current dollar). The solid lines show the historical trust funds income and expenditures, and the dotted lines show the projected income and expenditures.



Key outcome measures **[order of Q1 and Q2 randomized]**

Question Introduction

Now we'd like to ask you a few questions about your understanding of and reactions to the information you just saw.

For the questions in this section, please answer them with the assumption that no changes are made to the Social Security system regarding taxes or how benefits are calculated.

Q1. Date: costs exceed income

According to your understanding, in what year did or will the Social Security OASDI trust funds' total costs begin to exceed total income?

If you don't think total costs have ever or will ever exceed total income, you can select the "Never" option at the bottom of the dropdown.

▼ 1994 (1994) ... 2050 (2050); Never (-99)

Q2. Date: depletion

According to your understanding, in what year did or will the Social Security OASDI trust funds become depleted? In other words, in what year did or will the trust funds run out of money?

If you don't think the trust funds have ever or will ever be depleted, you can select the "Never" option at the bottom of the dropdown.

▼ 1994 (1994) ... 2050 (2050); Never (-99)

Q3. What happens to benefits (multiple-choice)

Assuming the government does not take any action to increase the amount of income that Social Security collects based on tax revenues – in your view, what is most likely to happen to Social Security benefits if the trust funds are depleted?

If you aren't sure, please select the option that reflects your best guess.

- Social Security will no longer be able to pay out benefits (1)
- Social Security benefits will still get paid out and will be a smaller amount (2)
- Social Security benefits will still get paid out and will be the same amount (3)
- Social Security benefits will still get paid out and will be a larger amount (4)

Q4. Benefits amount [only asked of those who chose Social Security benefits will still get paid out and will be a smaller/larger amount above]

You just indicated that Social Security benefits will most likely still get paid out and will be a different amount if the trust funds are depleted.

Again, assuming the government does not take any action to increase the amount of income that Social Security collects based on tax revenues – for someone whose benefits are currently projected to be \$1,000 per month, what monthly amount might they expect after depletion of the trust funds?

\$(text box).00 per month

Experiment 2 Materials

Trust funds descriptions [seen by everyone]

Introduction

On the next page, we'll be showing you some information about the Social Security Old-Age and Survivors Insurance (OASI) and Disability Insurance (DI) trust funds (also known as the OASDI trust funds), based on the 2022 Trustees Report from the Social Security Administration (SSA). Even if you have seen information about this topic before, please make sure to read carefully as the next part of the survey will involve answering some questions about what you read.

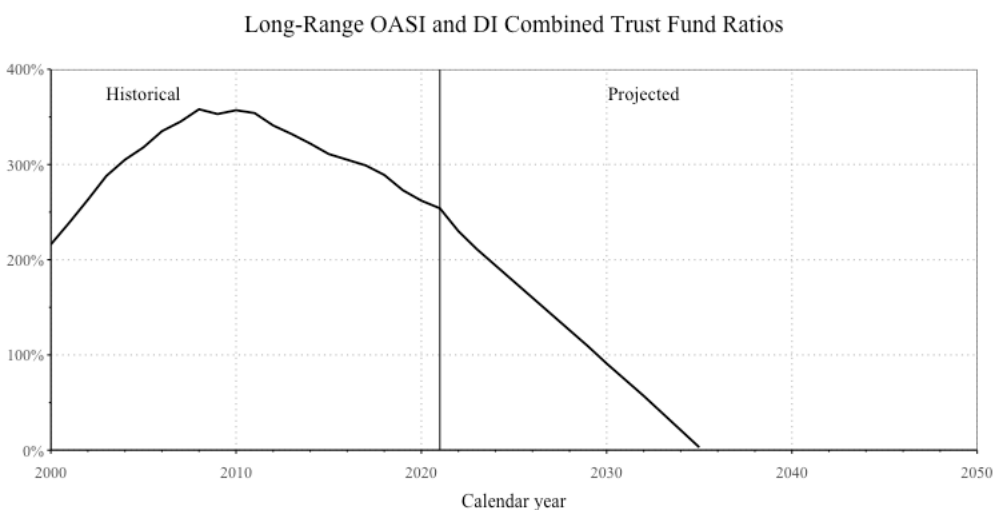
Description

The Social Security Administration uses accounts called “trust funds” to store income that’s collected through Social Security taxes and then eventually uses that money to pay out benefits. The OASI Trust Fund pays retirement and survivors benefits and the DI Trust Fund pays disability benefits, but the two are often referred to together as the OASDI Trust Funds. At the end of the year in 2021, the OASDI trust funds held \$2.85 trillion in total.

Social Security uses the OASDI trust funds to make benefits payments and pay administrative expenses. The trust funds receive income through two sources: tax revenue collected from workers and interest that comes from the investment of the money in US Government securities. In 2010, Social Security's non-interest income (i.e., income from taxes) was \$49 billion lower than its total costs (benefits payments plus administrative expenses). This was the first time in many years that non-interest income was lower than total costs. Non-interest income has continued to be lower than total costs since then, and Social Security predicts that this will be the case in future years. Because of this continued projected deficit, the trust funds balance is projected to reach \$0 at some time in 2035.

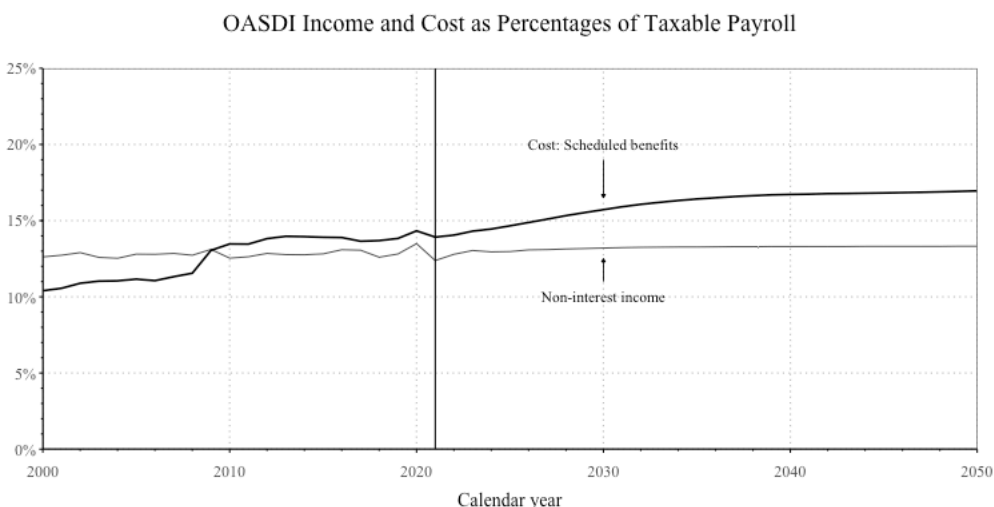
Stock condition

The chart below provides some more information on the situation of the OASDI trust funds. The chart depicts the historical and projected OASDI trust fund ratio for the period 2000 through 2050. The "trust fund ratio" is the value of trust fund asset reserves at the start of a year expressed as a percentage of the projected costs for the ensuing year.



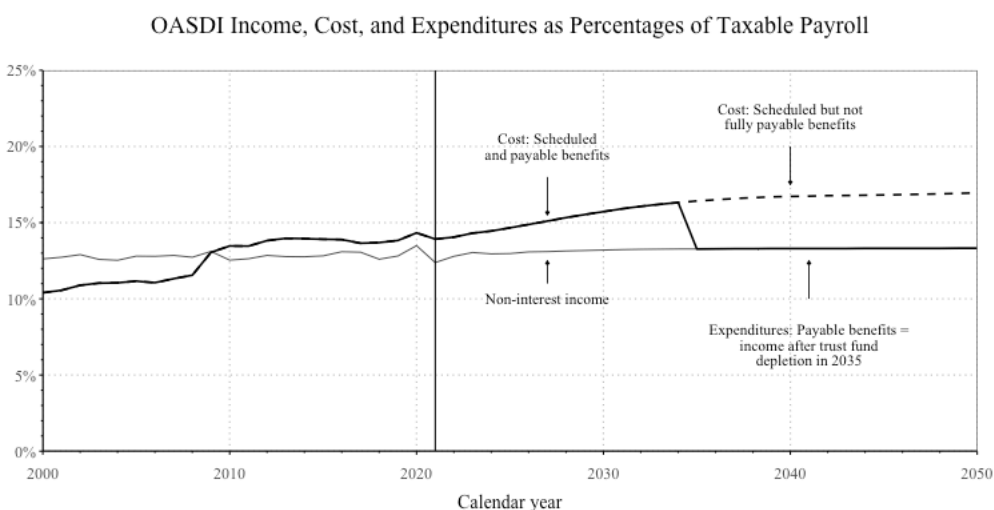
Plain flows condition

The chart below provides some more information on the situation of the OASDI trust funds. The chart depicts the historical and projected year-by-year relationship between OASDI income (excluding interest) and cost (including scheduled benefits) for the period 2000 through 2050. The figure shows all values as percentages of taxable payroll.



Enhanced flows condition

The chart below provides some more information on the situation of the OASDI trust funds. The chart depicts the historical and projected year-by-year relationship between OASDI income (excluding interest), cost (including scheduled benefits), and expenditures (including payable benefits) for the period 2000 through 2050. The figure shows all values as percentages of taxable payroll.



Key outcome measures [order of Q1 and Q2 randomized]

Question Introduction

Now we'd like to ask you a few questions about your understanding of and reactions to the information you just saw.

For the questions in this section, please answer them with the assumption that no changes are made to the Social Security system regarding taxes or how benefits are calculated.

Q1. Date: costs exceed income

According to your understanding, in what year did or will the Social Security OASDI trust funds' total costs begin to exceed non-interest income?

If you don't think total costs have ever or will ever exceed non-interest income, you can select the "Never" option at the bottom of the dropdown.

▼ 2000 (2000) ... 2050 (2050); Never (-99)

Q2. Date: depletion

According to your understanding, in what year did or will the Social Security OASDI trust funds become depleted? In other words, in what year did or will the trust funds run out of money?

If you don't think the trust funds have ever or will ever be depleted, you can select the "Never" option at the bottom of the dropdown.

▼ 2000 (2000) ... 2050 (2050); Never (-99)

Q3. What happens to benefits (multiple-choice)

Assuming the government does not take any action to increase the amount of income that Social Security collects based on tax revenues – in your view, what is most likely to happen to Social Security benefits if the trust funds are depleted?

If you aren't sure, please select the option that reflects your best guess.

- Social Security will no longer be able to pay out benefits (1)
- Social Security benefits will still get paid out and will be a smaller amount (2)
- Social Security benefits will still get paid out and will be the same amount (3)
- Social Security benefits will still get paid out and will be a larger amount (4)

Q4. Benefits amount [only asked of those who chose Social Security benefits will still get paid out and will be a smaller/larger amount above]

You just indicated that Social Security benefits will most likely still get paid out and will be a different amount if the trust funds are depleted.

Again, assuming the government does not take any action to increase the amount of income that Social Security collects based on tax revenues – for someone whose benefits are currently projected to be \$1,000 per month, what monthly amount might they expect after depletion of the trust funds?

\$(text box).00 per month

Experiment 3 Materials

Trust funds descriptions [seen by everyone]

Introduction

On the next page, we'll be showing you some information about the Social Security Old-Age and Survivors Insurance (OASI) and Disability Insurance (DI) trust funds (also known as the OASDI trust funds), based on the 2023 Trustees Report from the Social Security Administration (SSA). Even if you have seen information about this topic before, please make sure to read carefully as the next part of the survey will involve answering some questions about what you read.

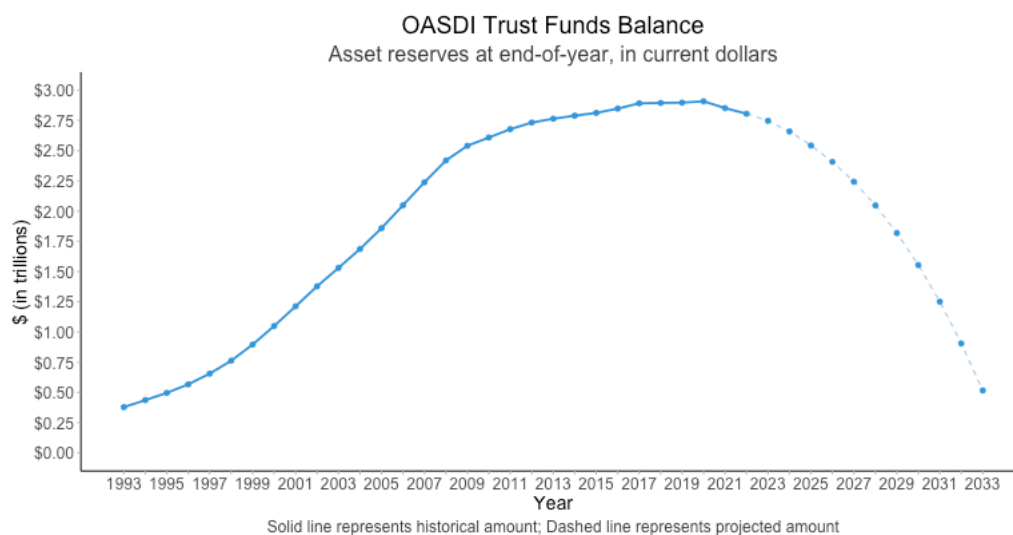
Description

The Social Security Administration uses accounts called “trust funds” to store income that’s collected through Social Security taxes and then eventually uses that money to pay out benefits. The OASI Trust Fund pays retirement and survivors benefits and the DI Trust Fund pays disability benefits, but the two are often referred to together as the OASDI Trust Funds. At the end of the year in 2022, the OASDI trust funds held \$2.83 trillion in total.

Social Security uses the OASDI trust funds to make benefits payments and pay administrative expenses. The trust funds receive income through two sources: tax revenue collected from workers and interest that comes from the investment of the money in US Government securities. In 2022, Social Security's total income from both of these sources was \$1.222 trillion, and its total costs (benefits payments plus administrative expenses) were \$1.244 trillion, meaning total income was \$22 billion lower than total costs. The last three years, starting in 2021, have been the first time in many decades that total income was lower than total costs. Social Security predicts that in future years, total income will continue to be lower than total costs. Because of this continued projected deficit, the trust funds balance is projected to reach \$0 at some time in 2034.

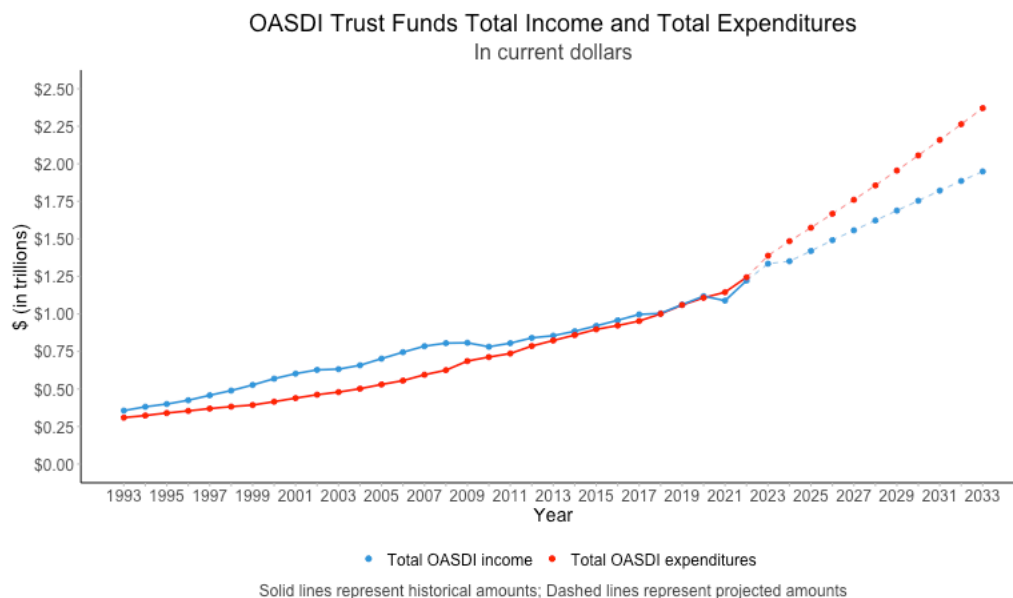
Stock condition

The chart below provides some more information on the situation of the OASDI trust funds. The chart depicts the historical and projected OASDI trust fund balance for the period 1993 through 2033, in trillions of dollars (scaled to the current dollar). The solid line shows the historical trust fund balance, and the dotted line shows the projected balance.

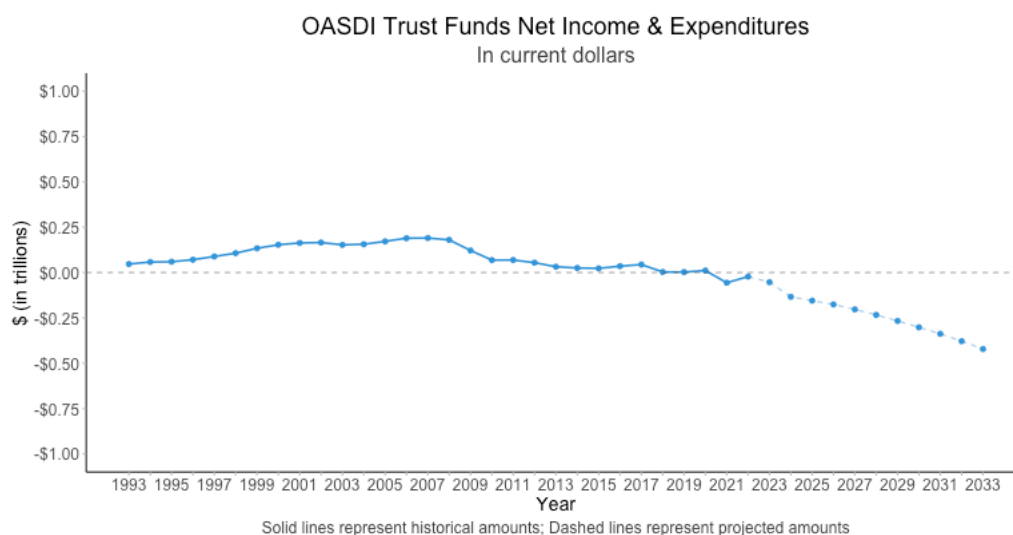


Flows condition

The chart below provides some more information on the situation of the OASDI trust funds. The chart depicts the historical and projected OASDI total income (from payroll taxes and interest) and expenditures for the period 1993 through 2033, in trillions of dollars (scaled to the current dollar). The solid lines show the historical trust funds income and expenditures, and the dotted lines show the projected income and expenditures.

**Net flows condition**

The chart below provides some more information on the situation of the OASDI trust funds. The chart depicts the historical and projected OASDI total income (from payroll taxes and interest) minus expenditures for the period 1993 through 2033, in trillions of dollars (scaled to the current dollar). The solid blue line shows the historical trust funds difference between income and expenditures, and the dotted blue line shows the projected difference between income and expenditures.



Key outcome measures
[order of Q1 and Q2 randomized]

Question Introduction

Now we'd like to ask you a few questions about your understanding of and reactions to the information you just saw.

For the questions in this section, please answer them with the assumption that no changes are made to the Social Security system regarding taxes or how benefits are calculated.

Q1. Date: costs exceed income

According to your understanding, in what year did or will the Social Security OASDI trust funds' total costs begin to exceed non-interest income?

If you don't think total costs have ever or will ever exceed non-interest income, you can select the "Never" option at the bottom of the dropdown.

▼ 1993 (1993) ... 2051 or after (2051); Never (-99)

Q2. Date: depletion

According to your understanding, in what year did or will the Social Security OASDI trust funds become depleted? In other words, in what year did or will the trust funds run out of money?

If you don't think the trust funds have ever or will ever be depleted, you can select the "Never" option at the bottom of the dropdown.

▼ 2000 (2000) ... 2051 or after (2051); Never (-99)

Q3. What happens to benefits (multiple-choice)

Assuming the government does not take any action to increase the amount of income that Social Security collects based on tax revenues – in your view, what is most likely to happen to Social Security benefits if the trust funds are depleted?

Note: we aren't asking about your benefits, rather Social Security benefits in general. If you aren't sure, please select the option that reflects your best guess.

- Social Security will no longer be able to pay out benefits (1)
- Social Security benefits will still get paid out and will be a smaller amount (2)
- Social Security benefits will still get paid out and will be the same amount (3)
- Social Security benefits will still get paid out and will be a larger amount (4)

Q4. Benefits amount [only asked of those who chose Social Security benefits will still get paid out and will be a smaller/larger amount above]

You just indicated that Social Security benefits will most likely still get paid out and will be a different amount if the trust funds are depleted.

Again, assuming the government does not take any action to increase the amount of income that Social

Security collects based on tax revenues – for someone whose benefits are currently projected to be \$1,000 per month, what monthly amount might they expect after depletion of the trust funds?

\$[text box].00 per month

Mental Model of Social Security

Which of the following descriptions more closely aligns with your understanding of how Social Security works?

- Social Security works like an individual savings account - workers pay into the system and their money is saved until they retire (1)
- Social Security works like a pay-as-you-go system - workers pay into the system and their money is used to pay current retirees (2)
- Neither: (please explain) (4)

Experiments 4a & 4b Materials

Trust funds descriptions [seen by everyone]

Introduction

On the next page, we'll be showing you some information about the Social Security Old-Age and Survivors Insurance (OASI) and Disability Insurance (DI) trust funds (also known as the OASDI trust funds), based on the 2022 Trustees Report from the Social Security Administration (SSA). Even if you have seen information about this topic before, please make sure to read carefully as the next part of the survey will involve answering some questions about what you read.

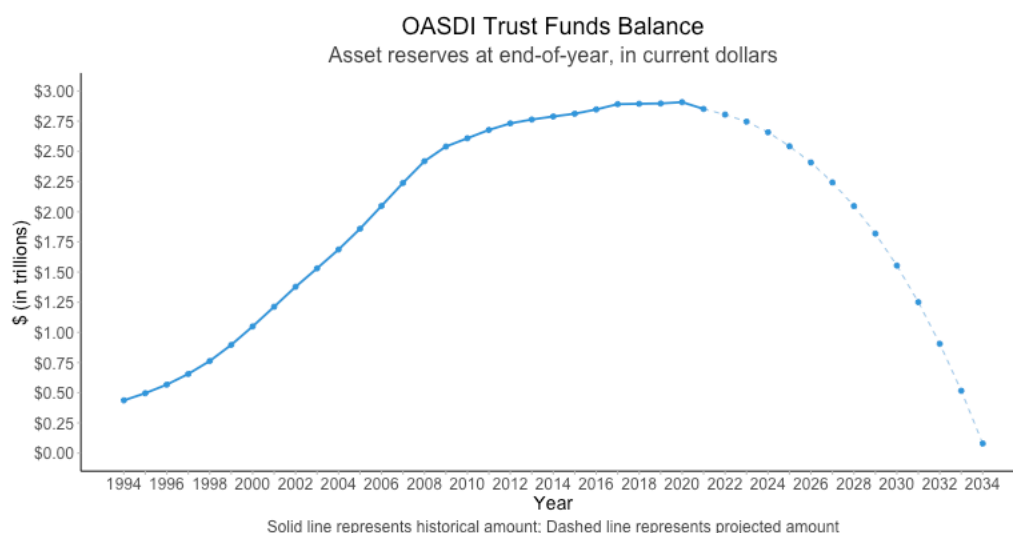
Description

The Social Security Administration uses accounts called “trust funds” to store income that’s collected through Social Security taxes and then eventually uses that money to pay out benefits. The OASI Trust Fund pays retirement and survivors benefits and the DI Trust Fund pays disability benefits, but the two are often referred to together as the OASDI Trust Funds. At the end of the year in 2021, the OASDI trust funds held \$2.85 trillion in total.

Social Security uses the OASDI trust funds to make benefits payments and pay administrative expenses. The trust funds receive income through two sources: tax revenue collected from workers and interest that comes from the investment of the money in US Government securities. In 2021, Social Security's total income from both of these sources was \$56 billion lower than its total costs (benefits payments plus administrative expenses). This was the first time in many years that total income was lower than total costs. Social Security predicts that in future years, total income will continue to be lower than total costs. Because of this continued projected deficit, the trust funds balance is projected to reach \$0 at some time in 2035.

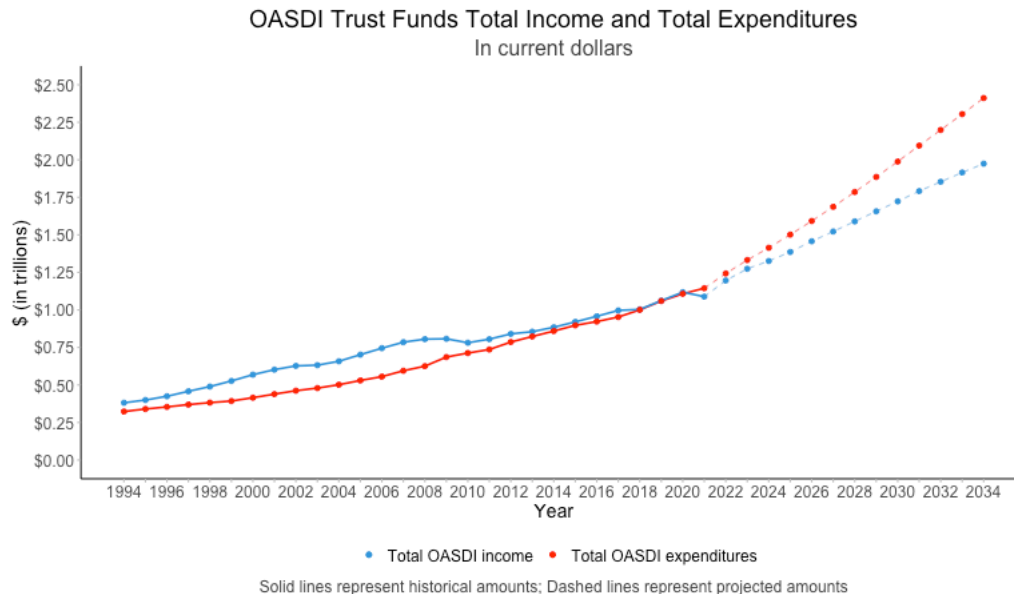
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Key outcome measures [order of Q1 and Q2 randomized]

Question Introduction

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For the questions in this section, please answer them with the assumption that no changes are made to the Social Security system regarding taxes or how benefits are calculated.

Q1. Date: costs exceed income

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If you don't think total costs have ever or will ever exceed total income, you can select the "Never" option at the bottom of the dropdown.

▼ 1994 (1994) ... 2050 (2050); Never (-99)

Q2. Date: depletion

According to your understanding, in what year did or will the Social Security OASDI trust funds become depleted? In other words, in what year did or will the trust funds run out of money?

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Assuming the government does not take any action to increase the amount of income that Social Security collects based on tax revenues – in your view, what is most likely to happen to Social Security benefits if the trust funds are depleted?

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Intervention Questions

[participants randomly assigned to answer these questions either before or after questions Q3 and Q4 above]

Q1. Income/Inflows Reflection

Most of the money that goes into the OASDI trust funds comes from a dedicated payroll tax. Employees and employers each pay 6.2% of wages up to the taxable maximum of \$147,000 (in 2022).

Assuming that Congress doesn't change the Social Security system of taxation, do you expect Social Security to continue to collect payroll taxes from workers and employees if the trust funds are depleted?

- Yes, Social Security will continue to collect payroll taxes (1)
- No, Social Security will not continue to collect payroll taxes (2)

Q2. Outflows Reflection

If the trust funds are depleted and if Social Security continues to collect payroll taxes, how do you expect those payroll taxes to be used?

[text box]