Optimizing Retirement Income by Integrating Retirement Plans, IRAs, and Home Equity

A Framework for Evaluating Retirement Income Decisions

Summary Report, Practical Applications, and Technical Discussion

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SPONSORS Committee on Post-Retirement Needs and Risks

Pension Section

Abstract and Overview

I n this report, the authors present a framework of analyses and methods that financial advisers, financial institutions, plan sponsors, and retirees can use to compare and assess strategies for developing lifetime retirement income. We recommend that financial advisers, plan sponsors, and financial institutions use disciplined analyses to demonstrate they are acting in the best interests of their clients who are approaching and entering retirement.

We also recommend that stakeholders use rigorous analyses for supporting retirement income decisions instead of using intuition, a gut feeling, or "winging it." Our analyses project that many middle-income workers will fall short of retirement income goals commonly advocated by financial planners. As a result, retirees will need to make the most effective decisions when deploying their constrained resources. In addition, they may want to consider applying their home equity to supplement their financial resources and Social Security benefits. For many such people, their most important retirement income planning decisions might be when and how to leave the paid workforce, when to claim Social Security benefits, how to manage and reduce living expenses, and whether to deploy home equity.

The authors recommend a portfolio approach for retirement income strategies that integrates Social Security claiming decisions, investing and deploying retirement savings, and utilizing home equity if necessary. Social Security benefits, pensions, annuities, and tenure payments or lines of credit from reverse mortgages can be considered the "bond" or "guaranteed" part of a retirement income portfolio. If retirees achieve sufficient secure income from these sources, our analyses justify investing remaining savings significantly in equities, which are more volatile but have the potential for growth. We acknowledge there can be behavioral constraints regarding this conclusion.

For most middle-income retirees, Social Security is the foundation of retirement income, providing anywhere from half to more than three-fourths of total retirement income. Social Security has several desirable features that, in aggregate, aren't available with any other retirement income solution. As such, optimizing Social Security benefits through delayed claiming is often an important component of a retirement income strategy. Risk-averse retirees should consider drawing from savings in order to optimize Social Security benefits, before purchasing an annuity or investing in bonds. When middle-income retirees optimize Social Security benefits, they might have all the "annuity" income they need, particularly if they reduce their living expenses.

The authors also identified one straightforward strategy that can be reasonably implemented in virtually any IRA or 401(k) plan without purchasing an annuity. This strategy helps retirees delay Social Security benefits as long as possible, uses the IRS required minimum distribution to determine income from savings, and invests in common target date or balanced funds. Using our metrics, this strategy compares favorably to many other strategies that are more complicated.

Financial advisers and institutions may need new business models to implement many of the strategies and retirement income solutions outlined in this report. While the analysis in this report focuses on middle-income retirees, the approach to comparing options and the methodology can also be used for higher-income retirees.

A Guide to Reading This Report

Building retirement income portfolios is a complex yet critical topic for most older workers and retirees, and the advisers, plan sponsors, and financial institutions who assist them. Adequately addressing this task involves complex analyses. As a result, this report is long – the text covers more than 80 pages, and the entire report, including graphs and tables, is over 150 pages.

To address this issue, we structured this report so readers can selectively read according to their interests and capacity for detail, as follows:

- *The "Report Summary" covers the main results and conclusions. We included just enough technical details to help readers understand these results and conclusions.*
- *The "Practical Applications" section discusses issues that should interest retirees and their advisers, plan sponsors, and financial institutions.*
- *The "Technical Discussion" section goes into detail on the results and conclusion of our analyses, and provides supporting documentation for the first two sections of the report, as described above.*
- *The "Figures and Tables" and "Appendices" sections provide additional details on our results, assumptions, and methods.*

We acknowledge that this is not a report that can be read and absorbed quickly in one sitting of an hour or two. Professionals who want to help older workers and retirees make effective decisions about retirement income planning will need to devote many hours to understanding the various issues. This report is one resource that can provide valuable insights and will complement other books and materials that address these critical topics.

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Figures and Tables

Caveats and Disclaimer:

This report is the product of a research project and is not intended to provide advice to any person, plan sponsor, adviser, or financial institution.

The results and conclusions are based on the methods and assumptions used for the analyses. There are other methods and assumptions that are reasonable and could produce different results and conclusions. The results are for defined case studies; individual situations can be significantly different than the case studies.

The analyses consider actuarial, investment, and economic factors, and they do not address behavioral decision-making factors.

This project focuses on strategies that can be used to produce lifetime streams of retirement income. It does not present a comprehensive model of financial security in retirement.

The model, accompanying documentation, and methodologies contained herein do not represent an official position, statement, or endorsement on behalf of the Society of Actuaries or its members, nor should the material be construed to do so. This report is the product of a research effort commissioned by the Society of Actuaries to add to the library of resource tools for the evaluation of retirement income decisions and to further knowledge in that area. The material is neither intended to preclude the use of other methodologies for this evaluation for any purpose nor provide a statement or position on the use, application, or preferability of other methodologies as compared to the methodology described herein.

Section 1: Acknowledgments

The Stanford Center on Longevity would like to thank the Society of Actuaries' Pension Section Council and Committee on Post-Retirement Needs and Risks for their role in envisioning this project and providing guidance and support to conduct the research, quantitative analyses, and writing of this paper.

The Society of Actuaries' Committee on Post-Retirement Needs and Risks formed a Project Oversight Group that also provided invaluable guidance and review throughout the project. Here is a list of its members:

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This project continues the work of prior projects that were collaborations between the Stanford Center on Longevity and the SOA Committee on Post-Retirement Needs and Risks. This current project and the reports below represent a significant body of work on generating retirement income. They are intended to be a resource for plan sponsors, financial advisers, and financial institutions to help them develop processes, tools, and services to help older workers retire with financial security.

Optimizing Retirement Income Portfolios in Defined Contribution Retirement Plans: A Framework for Building Retirement Income Portfolios, by Dr. Wade Pfau, Joe Tomlinson, and Steve Vernon. May 2016.

- *http://longevity.stanford.edu/blog/2015/07/14/optimal-retirement-income-solutions-in-defined-contribution-retirement-plans/*

Foundations in Research for Regulatory Guidelines on the Design & Operation of Retirement Income Solutions in DC Plans, by Steve Vernon. September 2014.

- *http://longevity.stanford.edu/blog/2014/09/02/foundations-in-research-for-regulatory-guidelines-on-the-design-and-operation-of-retirement-income-solutions-in-dc-plans/*

The Next Evolution in Defined Contribution Retirement Plans: A Guide for DC Plan Sponsors to Implementing Retirement Income Programs, by Steve Vernon. September 2013.

- *http://longevity.stanford.edu/blog/2013/10/10/soa_scl/*

Section 2: Background and Project Scope

I t will be critical for many older middle-income American workers to effectively deploy *all* their retirement resources that have significant value, including accounts in defined contribution retirement plans, IRAs, and home equity. For example, at the end of 2016, the total amount of savings that resided in IRAs was $7.9 trillion while the amount held in employer-sponsored DC retirement plans was $7 trillion.[1] Also, for many households, the value of home equity exceeds the amount of retirement savings held inside or outside employer-sponsored DC retirement plans.[2]

The potential inadequacy of retirement resources for many older workers has been well documented.[3,4] As a result, workers and their advisers will need systematic methods for helping them decide when they can afford to retire, how much they can spend in retirement, and how to best deploy their modest financial resources.

> Many middle-income American workers have modest retirement savings. It's critical they effectively deploy **all** their retirement resources that have significant value.

This project follows up our prior project, *Optimizing Retirement Income in Defined Contribution Retirement Plans*,[5] which focused on solutions that employers could offer to their older workers for deploying in-plan accounts. This project analyzes out-of-plan retirement income solutions that can be applied to the money held in IRAs and other retirement vehicles that operate outside of employer-sponsored retirement plans. In addition, we will explore how home equity can be used to generate retirement income and enhance retirement security.

This project used most of the analyses and framework from the prior project in order to be consistent and facilitate comparison of results of both projects. This project built on the prior project by introducing new metrics to analyze and compare retirement income solutions.

2.1 Target Audience and Ultimate Beneficiaries

The target audience for this report includes financial professionals who design retirement income solutions for insurers, investment companies, and retirement plan sponsors as well as financial advisers who develop solutions for their individual clients. The primary group under consideration of our analyses are middle-income workers and retirees who will be relying primarily on Social Security, savings, and possibly home equity to finance their retirement.

Previous generations of these workers may have participated in traditional defined benefit plans that required fewer decisions and less financial acumen from these workers and retirees compared to those in today's defined contribution world. Surveys conducted by the Society of Actuaries[6] reveal that the "retirement planning" undertaken by many of these older workers and retirees has been to determine their streams of retirement income from Social Security and their pension plan, and then manage and reduce their living expenses accordingly. While this process may not be ideal from the perspective of financial planners and actuaries, nevertheless it reflects the realities of middle-income workers and retirees who may not have access to skilled, unbiased financial planners.

The primary group under consideration for this project is middle-income workers and retirees who don't have access to skilled, unbiased advisers, and who need to "pensionize" their IRAs and DC retirement plans..

Accordingly, a primary goal for this project is to help older middle-income workers and retirees "pensionize" their savings in IRAs, defined contribution retirement plans, and possibly home equity. For this purpose, we define "middle-income" as people who have between $100,000 and $1 million in retirement savings. The analyses and methods may also be useful for higher-income workers and retirees who have savings of more than $1 million as well as for their advisers, who will be designing retirement income solutions for their clients.

2.2 Project Goals

The primary goal of this project is to develop metrics and analyses that help analysts devise effective retirement income solutions for clients in retail settings and participants in employer-sponsored retirement plans. We also aim to gain insights into the characteristics of various retirement income solutions and the circumstances under which a specific solution might be appropriate. We want to facilitate development of reliable, lifetime retirement income from savings and other financial resources that exist outside of employer-sponsored retirement plans.

We do not present "user ready" solutions. Instead, we present methods, analyses, and observations to help plan sponsors, financial institutions, and advisers develop tools and services to help middle-income workers. This might include in-plan design features, evaluation tools, and mass-customized retirement income solutions. Advisers can also use the methods presented here to design customized solutions for their high net-worth clients, considering their unique goals and circumstances.

The project addresses a dichotomy that commonly exists in the financial planning world. Professionals with expertise in investing tend to favor investing solutions that generate retirement income, while professionals with expertise in insurance products tend to favor annuities. Both types of professionals might not consider or advise their clients regarding other financial resources such as home equity and reverse mortgages. This project analyzes solutions that integrate these different points of view. Such solutions may better meet varying retirement income goals that may conflict with each other and can best be addressed with a calculated tradeoff. These solutions may also produce better long-term results than the short-term cash-flow "planning" that many older workers and retirees employ without professional guidance.

Recent regulations promulgated by the U.S. Department of Labor (DOL) under the Obama Administration would require advisers to act as fiduciaries when giving guidance on retirement solutions. An important feature of these regulations is that they require advisers to provide advice and guidance that is in the best interests of their clients. At the time of the writing of this report, the DOL had announced a delay of the implementation of these rules until mid-2019, while they will conduct a review of certain features of these rules.

Regardless of their ultimate form, the DOL regulations address serious concerns about the manner in which retirement income solutions are designed and delivered. The regulations have sparked intense debate and interest in how financial institutions and advisers can act in the best interests of their clients. This project describes analyses and results that can help financial advisers address these objectives during their clients' retirement phase.

A key goal of this project is to suggest a framework that administrators of IRAs and DC retirement plans can consider to "mass customize" solutions that middle-income workers and their advisers can readily implement.

The specific goals of this project are to:

- Understand the characteristics of various retirement income solutions and how they meet common retirement goals, some of which may conflict with each other.
- Identify retirement income solutions that can be offered through an employer-sponsored DC plan or through an IRA on a financial institution's platform on a "mass customization" basis. The focus will be on retirement income solutions that are readily available in the current marketplace.
- Assess the impact on the amount of estimated retirement income of financial performance. For annuities, we compare low-cost solutions to high-cost solutions. For systematic withdrawal plans (SWPs) using invested assets, we assess the impact of net investment performance relative to indices. Key reasons for differences in net investment performance for SWPs include asset deployment decisions, asset allocation decisions, poor timing decisions, and the level of fees assessed against the accounts.
- Illustrate the types of analyses that actuaries, financial institutions, and advisers might use to assess and compare potential retirement income solutions for retirees.
- Explore possible uses of home equity to generate retirement income and meet other planning goals.

The analyses and solutions presented here do not represent a comprehensive model of financial security in retirement. For example, we do not directly address common retirement risks such as medical and long-term care expenses other than how the strategies for generating retirement income might acknowledge these risks and coordinate with risk-mitigation strategies. Fully addressing the risk of medical and long-term care expenses is beyond the scope of this project.

2.3 Organization of the Project and Report

We divided the project into three subprojects:

- Subproject A: Quantitatively assess the impact of performance for different financial solutions.
- Subproject B: Introduce metrics for assessing retirement income solutions.
- Subproject C: Utilize reverse mortgages to provide additional retirement income security from home equity.

This "Summary Report" discusses the main results and conclusions from our analyses, as well as the implications for various audience members. The "Practical Applications" section discusses implications for retirees and their advisers, plan sponsors, and financial institutions. The companion "Technical Discussion" provides a detailed discussion of the analyses: both the results and the underlying methodology. The "Figures and Tables" section displays the results of our analyses. Appendices A through D document the assumptions and methods used in this project.

For a description of various retirement income solutions and a glossary of terms, please see our prior report, *The Next Evolution in Defined Contribution Retirement Plans: A Guide for DC Plan Sponsors to Implementing Retirement Income Programs*. It's available at: *http://longevity.stanford.edu/blog/2013/10/10/soa_scl/*

Section 3: Subproject A: Assessing the Impact of Performance for Financial Solutions

This subproject assesses the impact of investment performance on retirement savings on the total amount of retirement income retirees may receive over their lifetime. Included in the analysis are the impact of utilizing both commonly available investments and annuities. We developed analyses to help retirees and their advisers make decisions on how best to deploy their retirement savings and how to coordinate that decision with their strategy for claiming Social Security benefits.

3.1 Summary of Analyses

We prepared stochastic forecasts of the annual amounts of total retirement income expected from Social Security and generated by savings for three hypothetical retirees, as well as forecasts of the amounts of savings that can be accessed during retirement. The three hypothetical retirees are:

- Retiree #1: Single female age 65 with $250,000 in savings
- Retiree #2: Married couple, both age 65, with $400,000 in savings
- Retiree #3: Married couple, both age 65, with $1,000,000 in savings

Our forecasts analyzed various strategies to deploy savings in retirement, including:

- Investing assets with various systematic withdrawal plans (SWPs), including endowment methods with annual withdrawal percentages of 3%, 5%, and 7%, and the IRS required minimum distribution (RMD),
- Purchasing various types of annuities, including single premium immediate annuities (SPIAs), guaranteed lifetime withdrawal benefits (GLWBs), and fixed index annuities (FIAs), and
- Using savings to delay starting Social Security income.

We developed two sets of retirement income solutions – "high-performing solutions" and "low-performing solutions."

- High-performing investing solutions assumed returns that are 50 basis points less than index returns, while low-performing investing solutions assumed returns that are 150 basis points less than index returns.
- High-performing annuity solutions reflected institutional/competitive pricing and features, whereas low-performing annuity solutions represented retail pricing and features.

We assumed a stochastic range of investment returns and inflation that reflect the current low-interest environment, with the following real arithmetic mean annual rates:
- Equities: 5.1%
- Bonds: 0.3%
- Inflation: 2.1%

We acknowledge that other assumptions may be reasonable and would produce different results from our analyses, including the relative advantages of various retirement income strategies.

We used an efficient frontier to analyze the tradeoff between expected income and expected accessible wealth (liquidity). Accessible wealth is the amount of savings that a retiree can access to address emergencies or change the method they use to generate retirement income. Some retirement income strategies increase the amount of income a retiree can expect to receive over their retirement but decrease the amount of savings that a retiree can access throughout retirement. Examples of these strategies include certain annuities and using savings to optimize Social Security benefits.

In this case, older workers and retirees will want to make an informed tradeoff between these two goals (expected income vs. liquidity). It's important to acknowledge the limitations of accessible wealth: If savings are accessed and spent, it's not available to generate retirement income. Perhaps the real value of accessible wealth is the peace of mind a retiree might have by being able to access savings; our goal is to help them determine the expected reduction in income they're willing to accept for this peace of mind.

As measured in this project, accessible wealth should not be confused with legacy values, which may be important to some retirees but not to others. Subprojects B and C incorporate measures of legacy values.

Appendices A through D of this report provide details on the hypothetical retirees and describe our methods and assumptions, the specific retirement income solutions we analyzed and relevant assumptions, and the differences between high-performing and low-performing solutions. Section 12 of the accompanying "Technical Discussion" contains a more detailed discussion of our assumptions and methods for Subproject A.

3.2 The Critical Importance of Social Security benefits

It's important for the target group of this report – workers and retirees with less than $1 million in savings – to understand Social Security's critical role in their retirement security. Social Security retirement income has several valuable features:

- It's paid for the rest of the retiree's life, helping address longevity risk.
- It's not subject to capital market risk, helping address investment risk and sequence of returns risk.
- It's increased by the Consumer Price Index (CPI), helping address inflation risk.
- Part or all of Social Security income is exempt from federal income tax, helping address taxation risk.
- Social Security benefits are paid automatically (and often electronically), helping address the risk of cognitive decline, fraud, and making mistakes.

Social Security benefits represent the most effective and efficient way to deliver retirement income to middle-income retirees. It's critical that workers understand how to optimize their value, often by delaying the start of benefits as long as possible.

No other method of generating retirement income includes all these desirable features, so Social Security benefits represent a unique, valuable resource. This is one reason it's important for middle-income retirees to optimize the value of their Social Security benefits.

Historically, Social Security has been considered a secure source of retirement income from an entity that cannot go bankrupt. However, we need to acknowledge that in today's climate, Social Security benefits might be subject to political risk. There is a possibility, however remote, that our leaders will not be able to reconcile the current funding challenges of the program and that future benefits may be reduced. Retirees and their advisers will want to consider whether this possibility might influence their claiming decisions.

For virtually all the target group of this report, Social Security will generate at least 50% of their total retirement income and often as much as 85% or more of total retirement income, depending on whether they optimize the value of their Social Security benefits through their claiming strategy. As such, the characteristics of the total retirement income portfolio will reflect the desirable features described above.

As a result, it's critical that older workers understand how to maximize their Social Security benefits. The graph below extracts a subset of analyses from Figure 6, which shows the percent of initial retirement income for Retiree #1 that's represented by Social Security benefits for five different retirement income solutions. In all these cases, the retiree optimizes Social Security benefit by delaying the start of benefits until age 70. For this retiree, the graphs below show that Social Security represents 79% to 86% of the total initial retirement income, and the desirable features of Social Security dominate the characteristics of the total retirement income portfolio.

Retiree #1: The desirable characteristics of Social Security dominate the total retirement income portfolio when benefits are delayed until age 70
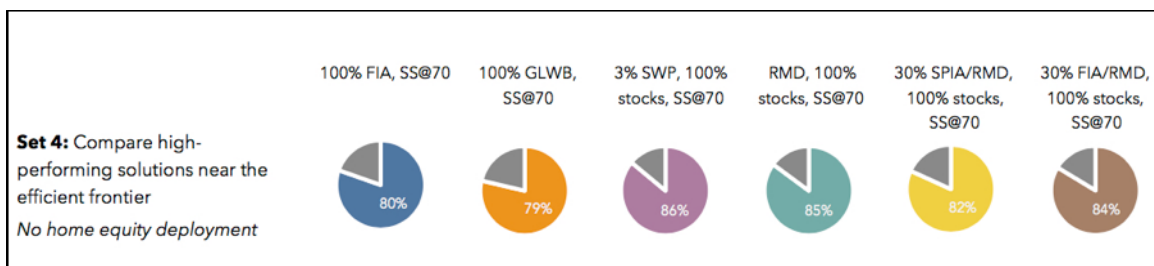
3.3 The Tradeoff Between Income and Accessible Wealth

The amount of retirement income generated from savings can be impacted by performance of retirement income approaches through:

- Asset use decisions, such as whether to use savings to enable a strategy that optimizes Social Security benefits, and allocation between invested assets and annuities,
- Asset allocation decisions, which is the mix of stocks and bonds in invested assets,
- Investment timing decisions, including selling stocks when the market is down,
- The level of fees charged for the management of retirement savings, and
- Annuity product features, including transaction charges and the competitiveness of insurance company pricing.

Our analyses confirm conclusions from our prior report, *Optimizing Retirement Income in Defined Contribution Retirement Plans*,[5] which support building a diversified portfolio of retirement income. With this approach, retirees would devote a portion of their savings to building a floor of guaranteed, lifetime income from optimized Social Security benefits and annuities (also recognizing the value of pensions when available). They would then invest the remainder of savings and adopt a thoughtful systematic withdrawal plan to generate retirement income.

There's often a quantifiable tradeoff between the amount of average income and the amount of accessible wealth (liquidity) expected throughout retirement. Retirees with modest financial resources will want to consider strategies that increase monthly income to meet basic living expenses vs. the perceived value of liquidity. They will also want to distinguish between true liquidity (assets that can be spent without reducing retirement income, such as funds set aside for emergencies) and allocation liquidity (peace of mind provided by the flexibility to change the method of generating income in the future).[7]

Figures 1 and 2 (available at the back of the report) display the tradeoff between expected income and liquidity. Each symbol (dot, cross, etc.) represents a specific retirement income solution. The vertical axis plots average real annual income expected over the retirement period for each specific approach, weighted for survivorship throughout retirement. The horizontal axis plots average real wealth that's accessible for each solution, also weighted for survivorship throughout retirement.

The ideal place on the graph for a specific approach would be the upper right hand corner, which would maximize both expected income and accessible wealth. However, the graph shows there is a tradeoff between these two goals. The efficient frontier is the line that represents the solutions projecting the highest amount of income for given levels of accessible wealth.

Figure 1 shows results for all three hypothetical retirees, assuming they retire at age 65 and start Social Security at age 65, and illustrates both high- and low-performing solutions. Figure 2 shows the same set of graphs but it assumes retirees start Social Security at age 70. For Figure 2, we assumed that a portion of retirement savings would be used between ages 65 and 70 to enable delaying the start of Social Security benefits.

3.4 Using Retirement Savings to Optimize the Value of Social Security

Using savings to enable delaying Social Security benefits increases total retirement incomes (including Social Security) for the test cases in this study by amounts ranging from 6% to 18% for low-performing solutions, and from 3% to 15% for high-performing solutions. Using this delay strategy, however, decreases accessible wealth by amounts ranging from 18% to 45%. This is one example of the tradeoff between income and liquidity.

Risk-averse retirees who would otherwise consider purchasing low-performing annuities and fixed income investments should consider first using their savings to enable delaying the start of Social Security benefits. The increase in Social Security benefits that is achieved by delaying benefits can be viewed as "purchasing an annuity from Social Security" at a very favorable rate. (Social Security income forgone during the delay is akin to the annuity purchase price, and additional income received is analogous to annuity income.)

There are two reasons why delaying Social Security benefits in today's environment can be financially advantageous for retirees. First, Social Security's current delayed retirement credits were designed when interest rates were higher and life expectancies were shorter, compared to today. In addition, Social Security added an automatic adjustment of benefits to address inflation. The adjustment factors for delayed retirement would be less generous if they reflected these two factors.

Because of the large proportion of total retirement income provided by Social Security, middle-income retirees might achieve sufficient guaranteed income just by using their savings to enable delaying the start of Social Security benefits; they may not need to purchase an annuity at all.

Once a retiree achieves a basic level of guaranteed income from Social Security and annuities, our analyses justify investing a significant percentage of remaining savings in stocks, because of the high portion of total retirement income represented by Social Security. In essence, Social Security represents the "bond" portion of a retirement income portfolio, and the allocation to this more secure form of income is well over 50%.

3.5 Assessing High-Performing vs. Low-Performing Solutions

The relative differential performance between high-performing and low-performing approaches decreases when savings are used to delay the start of Social Security benefits. The reason is that more assets are deployed efficiently by delaying Social Security.

When compared to low-performing solutions, high-performing solutions tend to increase average accessible wealth throughout retirement more than they increase average total income. The reason is that much of the total retirement income is provided by Social Security, which doesn't impact accessible wealth.

3.6 Patterns of Retirement Income and Accessible Wealth Are Also Important

In addition to the efficient frontier analyses, we prepared graphs that show the progression of income and accessible wealth for 30 years of retirement for selected retirement income solutions. These analyses show whether total retirement income can be expected to keep pace with inflation. For the solutions we analyzed, the solutions using the IRS Required Minimum Distribution (RMD) and fixed index annuities (FIAs) did the best job of keeping up with inflation.

These analyses also compare how quickly remaining savings are spent, and demonstrate the "pay me now or pay me later" concept. Retirement income solutions with a high withdrawal percentage – 7% – spend down savings more quickly than a 3% withdrawal rate. See Section 12.3 for more details on the progression of income and accessible wealth.

Section 12 of the "Technical Discussion" provides a detailed explanation of our analyses and results for Subproject A. Figures 1, 2, and 3 show graphs that display the results.

Section 4: Subproject B: Metrics for Assessing Retirement Income Solutions

The efficient frontier analyses outlined in Subproject A illustrate the tradeoff between expected average income and average accessible wealth (liquidity). However, there are more considerations for selecting retirement income strategies, including whether income can be expected to keep up with inflation, the level of bequests, the downside volatility in income, and the chance that income will fall below a minimum threshold and the resulting magnitude of the shortfall.

4.1 Metrics to Assess Retirement Income Strategies

Subproject B develops a more robust set of metrics to analyze and compare different retirement income strategies, and displays the results graphically in a dashboard. We analyzed a set of eight retirement income metrics, as follows:

1. Average annual real retirement income from the specific solution expected throughout retirement, including Social Security.
2. Expected direction of retirement income: Is income expected to keep pace with inflation or fall behind?
3. Average real accessible wealth expected throughout retirement, weighted by the probability of surviving to each future age.
4. Expected direction of accessible wealth: Is accessible wealth expected to decrease or grow throughout retirement?
5. Average real bequest at death. This is the average amount of real remaining savings projected at each age throughout retirement, weighted by the probability of dying at each future age.
6. Undesirable volatility. This measures the average annual decrease in total retirement income when such a decrease occurs, due to poor investment performance or excess inflation. As such, this measures the potential need to reduce spending in a future year. This helps retirees understand the "comfort margin" they might have with their budget for living expenses. Note that such decreases can be offset by past or future increases in income.
7. Probability of plan failure: What are the chances that total retirement income will fall below a specified minimum threshold?
8. Magnitude of plan failure: What are the projected magnitudes of failure?

These metrics have not been tested for consumer understanding and reactions, which could be an area for future research.

Note that the bequest measure described above only considers bequests funded by retirement savings. Other possible sources of bequests include life insurance, home equity, assets not considered retirement savings such as businesses, and personal assets.

Section 13 contains a more detailed description of our metrics.

4.2 Additional Support for Using Savings to Enable Optimizing Social Security

We used the above set of metrics to analyze a subset of retirement income solutions that we analyzed in Subproject A. The analyses confirm some of the results of Subproject A, namely the advantages of using savings to defer Social Security benefits, particularly for risk-averse retirees.

Additional findings include:

- For the middle-income retirees in our analyses, Social Security benefits typically provide about 70% to 85% of total retirement income from financial resources, depending on the age at which retirees start Social Security benefits and how they deploy their savings to generate retirement income. As a result, the characteristics of Social Security benefits tend to dominate the results of the metrics that assess retirement income, and these metric amounts do not vary widely between different retirement income solutions.
- There are significant differences, however, in the metrics that assess accessible wealth and bequests. These metrics show better results for:
    - investing solutions compared to annuity solutions,
    - solutions that don't use savings to optimize Social Security benefits compared to solutions that use savings to optimize Social Security benefits, and
    - high-performing solutions compared to low-performing solutions.
- In some cases, the increased Social Security benefits achieved by delaying the start of benefits may be all the guaranteed income that a middle-income retiree needs, and the retiree may not need additional guaranteed income through the purchase of an annuity. For example, if retirees significantly reduce their regular living expenses, including by paying off their mortgage or because they no longer have child-raising expenses, they may not need to purchase an annuity.
- Once Social Security benefits have been optimized, the analyses can justify significant allocation of remaining savings to equities.
- For retirees who are comfortable investing 100% of their remaining savings in stocks, using a portion of savings to enable delaying Social Security benefits reduces the risk of downside volatility and probability, and magnitude of shortfalls. The "cost" of the delay strategy is reduced amounts of accessible wealth and bequests.

Section 13 contains a more detailed discussion of the results of our analyses. Table 1 contains the values of these metrics focusing exclusively on financial resources, and Figure 4 displays the values in a dashboard. The graphs in Figure 4 compare the metrics for various retirement income solutions. Specifically, Figure 4 shows that when a middle-income retiree delays Social Security until age 70, there are not significant differences in the metrics that assess retirement income between the different retirement income solutions.

When Social Security represents a high proportion of a retiree's total retirement income portfolio, most of the total retirement income portfolio realizes the desirable characteristics of Social Security benefits, such as protection against longevity risk, inflation risk, investment risk, and cognitive risk.

4.3 A Potential Retirement Income Strategy That Middle-Income Workers Can Implement from any IRA or 401(k) Plan

A strategy that enables delaying Social Security until age 70 and uses the IRS required minimum distribution (RMD) to calculate income from savings produces a reasonable tradeoff among various retirement income goals for middle-income retirees. This strategy has a significant advantage: It can be readily implemented from virtually any IRA or 401(k) plan without purchasing an annuity (which many plan sponsors are hesitant to offer and many retirees are reluctant to purchase on their own).

For the purposes of this report, we'll call this strategy the "SS/RMD retirement strategy." For worker and consumer audiences, we'll call it the "*Spend Safely in Retirement* Strategy."

> The SS/RMD retirement strategy can be an effective, straightforward way for middle-income workers to generate lifetime retirement income from virtually any IRA or 401(k) plan without purchasing an annuity.

The best way for an older worker to implement the SS/RMD strategy is to work enough to pay for their living expenses until age 70; if possible, they shouldn't start Social Security benefits or begin withdrawing from savings to pay for living expenses.

The next best way to implement the SS/RMD strategy is to use a portion of savings to enable the delay of Social Security benefits as long as possible, but no later than age 70. Then, invest remaining savings and use the RMD to calculate retirement income from savings. The primary disadvantage of this approach is that it can use a substantial amount of savings to enable delaying Social Security; this is the reason the best way to implement the strategy is to continue working, if possible.

We analyzed this latter approach, assuming the worker retires at age 65 but uses a portion of savings to enable delaying Social Security until age 70. In addition, the retiree uses the RMD to calculate retirement income with remaining savings. The IRS rules dictate the minimum withdrawal starting at age 70-1/2; at that age, the withdrawal percentage is 3.65%, and it increases each year thereafter. See Appendix E for a partial table of the RMD withdrawal percentages. We assumed a withdrawal percentage of 3.5% from ages 65 to 70.

Figure 4 compares the SS/RMD strategy to 15 different retirement income solutions using the Subproject B metrics and shows that the SS/RMD strategy offers the following results:

- Produces more expected average total retirement income compared to most strategies that we analyzed.
- Projects total income that keeps pace with inflation.
- Produces a moderate, compromise level of accessible wealth, for flexibility and the ability to change direction in the future. It produces more accessible wealth compared to strategies that use annuities. But it provides less accessible wealth than strategies that maximize flexibility, such as SWPs with low withdrawal rates and/or strategies that don't use savings to enable the delay of Social Security benefits.

- Provides a moderate, compromise level of bequests, for the same reasons.
- Produces low measures of downside volatility, depending on asset allocation – under 2% for Retirees #1 and #2 and under 3% for Retiree #3.

The SS/RMD strategy should be straightforward to implement in most employer-sponsored defined contribution retirement plans and IRA platforms. Many administrators can calculate the RMD and automatically pay it to the retiree according to the frequency elected by the retiree. Another advantage is that the RMD is already familiar to many retirees who choose to have the minimum amounts withdrawn from their retirement savings.

The portion of savings that enables delaying Social Security could be invested in a liquid fund with minimal volatility in principal, such as a money market fund, a short-term bond fund, or a stable value fund in a 401(k) plan. In the years leading up to retirement, an older worker might want to start building a "retirement transition fund" that will enable delaying Social Security benefits. This fund can protect a substantial amount of retirement income in the period leading up to retirement, since the retirement transition fund should be invested in stable investments and Social Security is not impacted by investment returns.

Our metrics support investing the RMD portion significantly in stocks – up to 100% if the retiree can tolerate the additional volatility (which is modest because of the dominance of Social Security benefits). However, the asset allocation to stocks for a typical target date fund for retirees (often around 50%) or balanced fund (often ranging from 40% to 60%) also produces reasonable results, and these funds are commonly available in IRA and 401(k) platforms.

To communicate this strategy to retirees, plan administrators and advisers should characterize Social Security as a secure retirement paycheck that a retiree might use to pay for basic living expenses. They should characterize the RMD income as a variable annual retirement bonus that can fluctuate in order to pay for discretionary living expenses. Many middle-income workers are accustomed to managing their finances with secure paychecks and variable bonuses, so it's natural to continue this financial discipline in retirement.

The SS/RMD strategy works best when the retiree delays Social Security until age 70, but delays until earlier ages, such as 67, 68, or 69 still provide significant advantages.

The SS/RMD strategy represents a straightforward way for middle-income workers to generate a stream of lifetime retirement income from their savings. It cannot address the issue of inadequate savings, as discussed in Section 6.1 and Section 7. Also, it might not be sufficient to address significant future discontinuities in either income or living expenses, such as cessation of income from work, paying off a mortgage, or increased expenses for medical and long-term care late in life. These situations may call for refinements of the SS/RMD strategy or supplemental risk-mitigation strategies.

Sections 9.4 and 10.4 contain a more detailed description of how to implement the SS/RMD strategy.

Section 5: Subproject C: Utilizing Home Equity for Retirement Income

Many older workers and retirees have more home equity than retirement savings, and for some, home equity represents a high proportion of their total net worth. If their financial assets aren't sufficient to finance their retirement, they may want to consider using their home equity to increase their retirement income or otherwise improve their financial security.

We examined various ways to deploy home equity, including:

- Doing nothing during retirement and allowing home equity to be used as a bequest, or
- Taking out a reverse mortgage at retirement and using it for one of three possible uses:
    1. Provide a resource that can be tapped for unforeseen emergencies such as long-term care expenses.
    2. Provide a regular fixed monthly income, called a tenure payment, similar to an annuity.
    3. Fill in gaps in income when total income falls below specified thresholds due to unfavorable investment returns. This can help mitigate sequence of returns risk.

There are other uses for home equity that we did not analyze. For example, retirees can sell their home and/or downsize, realize a capital gain, and add the proceeds to their retirement savings to be used to generate retirement income.

Also, there are other uses of reverse mortgages recently analyzed by various researchers, most notably to address sequence of returns risk. We acknowledge the importance of their results, but we did not attempt to duplicate them.

For the three hypothetical retirees we analyzed, we used the metrics developed in Subproject B to show how the metrics might be improved with the above uses of home equity. For this purpose, we used six viable retirement income strategies identified in Subproject B as a foundation for analyzing the additional impact of using home equity.

We note that the results of our analyses are highly dependent upon our specific assumptions for the values of retirement savings and home equity. In the general population, there is a wide range of relative values of these amounts, which should be considered when developing retirement income solutions for specific individuals.

5.1 General Observations and Conclusions from Subproject C

Our analyses demonstrate that reverse mortgages can have legitimate uses in retirement planning, including the uses described above. Specifically, reverse mortgages can be used to:

- Increase monthly income in predictable ways through a monthly tenure payment,
- Increase accessible wealth in predictable ways, to be used for unforeseen emergencies or long-term care expenses, or
- Reduce downside volatility and the chances that total income will fall below specified thresholds.

A reverse mortgage should be one of the tools that retirees and their advisers consider on a case-by-case basis, using analyses to quantify how financial security can be improved by strategically deploying reverse mortgages.

A reverse mortgage is most appropriate when retirees intend to stay in their house for an extended period, perhaps for the rest of their lives. They also need to understand the costs of reverse mortgages, which can be considerable, so they can decide if the costs justify the benefits.

Section 14 contains a more detailed discussion of the results of our analyses. Table 2 contains the values of the metrics that integrate financial resources and home equity for a subset of the retirement income analyses from Subproject B. Figure 5 displays the values in a dashboard.

Section 6: Additional Observations and Conclusions

Here are additional comments and observations that use our analyses and are discussed in subsequent sections of this report.

6.1 Implications of Inadequate Retirement Resources

The hypothetical retirees we used for our analyses have assets and circumstances that are more favorable than most current older workers, yet even our hypothetical retirees would fall short of common retirement income replacement goals recommended by financial advisers. This heightens the importance of efficiently deploying all available resources including IRAs, DC plans, home equity, whole life insurance, bank accounts, and other assets. In addition, the most important decisions many retirees will face are deciding when to retire, when to claim Social Security, whether to deploy home equity, and how best to manage/reduce living expenses.

Section 7 shows how the results of our analyses support these conclusions.

6.2 Integrating IRAs, DC Retirement Plans, and Home Equity

Section 8 contains thoughts on integrating and coordinating resources from IRAs, DC retirement plans, and home equity. Each of these resources has different features and cost structures. Retirees may want to prioritize the utilization of each resource based on expected costs and performance, and on the availability of features that meet the retirees' specific needs and circumstances.

6.3 How Plan Sponsors Can Use Our Analyses

Section 9 discusses how plan sponsors may want to use our analyses and conclusions. Employers that sponsor DC retirement plans may want to help their older workers assess the adequacy of their resources and offer methods within their plans that enable their participants to cost-effectively generate retirement income.

> Employers can help their older workers realistically assess their retirement resources, so they can make more informed life decisions.

Employees who realistically assess their retirement resources can then make more informed life decisions, such as how long to continue working, whether they need to work part-time in retirement, and whether they need to reduce their living expenses.

Employers could assist their older workers by providing skilled and unbiased counseling on these decisions, as many of the financial analyses presented in this report will be beyond the skills of most retirees. Employers can also offer alternative career trajectories that enable their older workers to continue working.

Many employers are reluctant to offer retirement income solutions in their plans, due to the potential complexity and exposure to fiduciary liability. The SS/RMD strategy is a straightforward retirement income solution that might be effective for many middle-income retirees and might minimize the employer's fiduciary liability exposure.

6.4 How Retirees and Their Advisers Can Use Our Analyses

Section 10 discusses how retirees and their advisers can develop diversified portfolios of retirement income that meet retirees' specific goals and objectives, considering all their resources, including accounts in DC retirement plans, IRAs, and home equity. Specifically, the SS/RMD strategy can be a straightforward, effective strategy for middle-income retirees that can also be used to protect retirement income in the period leading up to retirement.

Many of the analyses required to evaluate their retirement situation are beyond the existing skills and interest of most retirees, so advisers can add significant value by preparing these analyses themselves and helping retirees prioritize potentially conflicting goals. This can help retirees make more informed lifestyle decisions regarding reducing their budgets for living expenses, continuing to work, deploying home equity, and leaving realistic legacies.

> Financial advisers and institutions may need new business models in order to better serve middle-income retirees.

Many advisers develop customized retirement income solutions for high net worth individuals. These advisers can use the methods and analyses in this report in this effort.

In addition, the framework and analyses might help advisers efficiently serve the middle-income market with "mass customized" strategies, opening up new business opportunities for advisers. For example, even if a retiree uses the SS/RMD strategy, an adviser can help design the retirement transition fund and help with asset allocation of the RMD retirement income generator. An adviser can also assist with evaluating the feasibility of using a reverse mortgage to enhance retirement income.

Financial advisers and institutions may need new business models in order to better serve middle-income retirees, for the following reasons:

- There's a potential for conflicts of interest if strategies that are optimal for the retiree produce less compensation for the adviser than other strategies, or if optimal solutions do not produce adequate compensation for the adviser.
- Advisers and financial institutions that focus exclusively on one type of product or solution may not be best suited to help retirees who need to optimally deploy all their assets.
- Many critical retirement decisions are made at a single point in time, and may not require ongoing monitoring and adjustment that generate fees for advisers.

6.5. How Financial Institutions Can Use Our Analyses

Section 11 discusses how the analyses in this report can be used by financial institutions and advisers to help form recommendations for constructing retirement income portfolios that are in the best interest of their clients who are close to or already in retirement.

Financial institutions may want to develop "mass customized" solutions that can cost-effectively serve their middle-income clients, particularly those with modest savings and significant home equity. Such solutions would acknowledge the relative importance of decisions for these middle-income retirees, as discussed above.

6.6. Income Tax Considerations

For our analyses, we treated all retirement income sources as pre-tax and did not make an adjustment for differences in income taxation. Such an adjustment is beyond the scope of our analyses.

We note that adjustments to recognize the differences in taxation might be minimal and most likely would not influence our results and conclusions, due to the levels of projected retirement income, the tax treatment of Social Security benefits, and current federal income tax rates. For example, for most retirement income solutions for Retirees #1 and #2, retirees would pay either no federal income tax or would be taxed at a 10% rate on a modest portion of their income. Retiree #3 would pay federal taxes at a 10% or 15% rate, and for a few solutions, they would pay taxes at a 25% rate on a modest portion of their income. Retiree #3 is the only hypothetical retiree we analyzed who might want to consider income taxes as having a modest influence on their retirement income strategies. For all others, the goal to minimize income taxes should take a secondary role compared to other goals analyzed in this report, such as planning for income to last for a lifetime and planning for accessible wealth.

The favorable tax treatment of Social Security benefits is yet another reason to consider delaying Social Security until age 70, to maximize the value of the favorable tax treatment. We note that some states also tax Social Security benefits and retirement income, while other states don't apply income taxes to retirees.

Section 10.6 contains a more detailed discussion of federal income tax considerations and summarizes the federal income tax situation for each hypothetical retiree. Appendix F shows the federal income tax rates and standard deduction amounts that are effective in 2017.

6.7. Commentary on Analyses for All Three Phases

One important goal of this project is to encourage the use of rigorous analysis to help retirees and their advisers optimize their retirement income portfolios, and to demonstrate the types of analyses advisers may want to use. We are not necessarily developing or advocating specific solutions that can be considered optimal for retirees, nor do we represent that the methods and assumptions we used are the only reasonable methods and assumptions.

The results presented in this report reflect the specific circumstances of the hypothetical employees and the assumptions used to produce the stochastic forecasts and other analyses. Specifically, our assumptions reflect the current low-interest environment. Different employees and alternative assumptions will produce different results, including the relative advantages of various retirement income strategies.

For example:

- Higher assumed real rates of return generally produce more favorable projections, and vice versa.
- Higher returns of stocks relative to bonds and annuity purchase rates will show more favorable projections for investing solutions, while lower returns of stocks relative to bonds and annuity purchase rates will show more favorable projections for insured solutions.
- Different assumptions for high-performing and low-performing solutions would produce comparisons between these solutions that are different from this report. For example, it's very likely that many solutions in the market may have features and fees that fall between the assumptions we used for our high-performing and low-performing solutions, with resulting values between the two extremes that we assumed. It's also possible to find fees and costs that are lower than assumed for our high-performing solutions, with resulting outcomes that are more favorable than we projected.
- The metric in Subproject B that measures the probability and magnitude of income shortfalls is highly dependent on the assumed threshold of necessary expenses. The higher this assumed threshold, the higher the probability and magnitude of failure for any retirement income solution. In this case, we are demonstrating a suggested *process,* not a suggested optimal solution.
- Older workers and retirees differ by levels of wealth, composition of the portfolio, mortgages, family obligations, etc.

We used stochastic forecasts and efficient frontiers for our analyses, but we acknowledge that other methods, such as deterministic forecasts, can also produce valuable insights into the efficacy of specific retirement income solutions.

As noted near the bottom of Section 4.3, the strategies we analyzed in this report may not be sufficient to address significant future discontinuities in either income or living expenses. One way to address these discontinuities is to use an actuarial method[8] to design lifetime income streams. Such a method would balance the present value of income from all sources with the present value of living expenses, making assumptions about the future discontinuities in either income or expense amounts.

For these reasons, the results from this report may or may not be generalized to other situations, and they may or may not be used to draw definitive conclusions about optimal solutions. We suggest that optimal conclusions result from rigorous analyses, rather than using intuition, a gut feeling, or "winging it."

Nevertheless, important insights may be gained from this report. Retirees, financial advisers, financial institutions, and plan sponsors can use the retirement solutions we analyzed and our conclusions as a starting point for their own investigations. Specifically, the methods used in this report can be used with alternative assumptions and the circumstances of other retirees, and to assess retirement income solutions that we did not analyze.

Ultimately, retirees must select one specific retirement income solution and make decisions based on one method and assumption set. Most likely, the assumptions they choose will turn out to be different from the experience that emerges over the retirement period. The best action that retirees and advisers can take is to make informed decisions based on rigorous analyses and be prepared to adjust their strategies to reflect how emerging experience deviates from the original assumptions.

6.8. Areas for Future Research

Future research can provide additional insights into retirement income strategies and planning, as follows:

- Understanding the behavioral issues and employee preferences that influence retirement decision-making.
- Understanding the retirement decision factors that are often counterproductive, such as the resistance to delay Social Security or buy annuities.
- Investigating the decision support that will help older workers and retirees make effective decisions.
- Estimating the numbers of workers who might benefit by the SS/RMD strategy by using reliable databases on asset levels.
- Exploring the practical details of implementing the SS/RMD strategy, such as the appropriate size for the retirement transition fund, appropriate investments for this fund, and construction of target date funds to accommodate the SS/RMD strategy.

In addition, future research could examine how financial advisers and institutions can incorporate the actuarial method into their products and services to further refine the strategies presented in this report.

PRACTICAL APPLICATIONS

n this section, we discuss the practical applications of our analyses for older workers and retirees, financial advisers, plan sponsors, and financial institutions.

Section 7: Implications of Inadequate Retirement Resources

Our analyses provide supporting evidence for the conclusion that many older workers currently approaching their retirement years may have inadequate financial resources to meet the retirement income goals commonly expressed by financial planners. These goals typically target retirement incomes that range from 70% to 100% of pre-tax preretirement pay.

The hypothetical retirees we used for our analyses have assets and circumstances that are more favorable than most current older workers, yet even our hypothetical retirees would fall short of common retirement goals.

> Many older workers currently approaching their retirement years may have inadequate financial resources to meet common retirement income goals.

7.1 Our Hypothetical Retirees Are Better Off Than Most Older Workers

Let's examine how our hypothetical retirees are better off than most current older workers.

- We assumed our retirees would retire at age 65. The average retirement age for current older workers is typically in the low 60s.[3] Retiring before age 65 will produce lower replacement rates compared to retiring at age 65, all other things being equal.
- We assumed retirement savings of $250,000, $400,000, and $1 million, respectively, for Retirees #1, #2, and #3. These amounts are higher than representative savings amounts reported for current older American workers. For example, a recent report by the Boston College Center for Retirement Studies (CRR) reported savings and home equity values by quintile for households ages 65 to 69.[2] The median net financial wealth of the fourth quintile (between 61st and 80th percentile) was $175,000, and the comparable figure for the fifth quintile (between 81st and 100th percentile) was $1,150,000. This would place Retirees #1 and #2 somewhere in the high part of the fourth quintile (by percentiles, most likely in the 70s). Retiree #3 is solidly in the fifth quintile. Other surveys of financial assets of older workers report similar results.[3,4]

- We assumed home equity amounts of $200,000, $350,000, and $500,000, respectively, for Retirees #1, #2, and #3. The CRR report mentioned above reports median home equity values of $175,000 for the fourth quintile and $330,000 for the fifth quintile. This would place Retiree #1 in the upper fourth quintile, and Retirees #2 and #3 in the fifth quintile.

7.2. The Replacement Ratios for Our Hypothetical Retirees Fall Short of Common Retirement Income Goals

Now let's look at the initial replacement ratios projected at age 65 for our three hypothetical retirees. First, let's look at the range of replacement ratios reported in Table 1, which contained four sets of high- and low-performing retirement income solutions, 24 solutions in total. This exhibit assumes that the retirees deploy their savings but not their home equity to generate income.

- For Retiree #1, the initial replacement ratios at age 65 ranged from 49% to 64%. The strategy with the highest amount of projected *average* retirement income throughout retirement produced an *initial* replacement ratio of 63%. This strategy used savings to enable starting Social Security at age 70 and devoted all remaining savings to a SPIA. Note that not many retirees start Social Security at age 70 or devote all assets to a SPIA.

- For Retiree #2, the initial replacement ratios at age 65 ranged from 46% to 56%. The strategy with the highest amount of projected average retirement income throughout retirement produced an initial replacement ratio of 50%. This strategy used savings to enable starting Social Security at age 70 and devoted all remaining savings to an RMD SWP with 100% of assets invested in equities. Once again, not many retirees start Social Security at age 70 or would invest all assets in equities.

- For Retiree #3, the initial replacement ratios at age 65 ranged from 45% to 59%. The strategy with the highest amount of projected average retirement income throughout retirement produced an initial replacement ratio of 49%. This strategy used savings to enable starting Social Security at age 70 and devoted all remaining savings to an RMD SWP with 100% of assets invested in equities. Once again, not many retirees start Social Security at age 70 or would invest all assets in equities.

Now let's suppose that these hypothetical retirees used their home equity to generate a monthly income through a tenure reverse mortgage. The analyses in Table 2 include six high-performing retirement income solutions in combination with reverse mortgages, compared to the 24 high- and low-performing retirement income solutions in Table 1. These analyses produce results that are closer to the range of common retirement income guidelines advocated by financial planners.

- For retiree #1, the initial replacement rates at age 65 ranged from 68% to 73%.
- For retiree #2, the initial replacement rates at age 65 ranged from 62% to 65%.
- For retiree #3, the initial replacement rates at age 65 ranged from 59% to 66%.

7.3. Implications for Older Middle-Income Workers and Retirees

Based on the previous results, we drew the following conclusions:

- Most older American workers will fall short of retirement income goals commonly expressed by financial planners if current trends continue regarding ages at retirement and prevailing levels of retirement savings. This result points to the importance of optimizing the amount of retirement income generated by Social Security and retirees' savings, reflecting the desired tradeoff between income and liquidity, as well as how much stock market risk the retiree is willing to take. In addition, retirees may need to consider some combination of working longer and/or reducing their living expenses.
- Older workers with modest retirement savings and significant home equity will want to carefully explore how they can use their home equity to generate retirement income or enhance their financial security. They will want to balance the possible need to generate additional regular income with the need to protect against late-life expenses for medical and long-term care.

> Older workers with modest retirement savings will need to make informed decisions to deploy all their assets to generate retirement income and enhance their financial security. In many situations, the strategies analyzed in this report will not be enough to compensate for inadequate savings and/or inadequate home equity.

7.4. The Most Important Retirement Income Decisions for Middle-Income Workers

The above results demonstrate that the most important decisions for older, middle-income workers are:

- Deciding when to leave the paid workforce and whether to work part time for a period until full retirement.
- Deciding whether to use savings to enable optimizing Social Security benefits, typically by delaying commencement of benefits.
- Managing and reducing living expenses, specifically housing, transportation, and medical costs.
- Deciding whether to deploy home equity to help finance retirement (analyzed in Subproject C).

For these workers, determining the specific method they'll use for deploying remaining savings after optimizing Social Security benefits may not be as critical as the above decisions.

As a result, it's critical that older workers and retirees understand the amount of retirement income they will likely generate from various sources. This will help them make more informed choices regarding the decisions listed above.

Section 8. Integrating In-Plan and Out-of-Plan Resources

Many retirees might have a variety of financial resources available for funding their retirement, such as employer-sponsored retirement plans (both defined benefit and defined contribution), IRAs, bank accounts, investment accounts, whole life insurance policies, tax deferred annuities, and home equity.

This section discusses ideas for coordinating the drawdown strategies for various assets.

8.1. Start with Setting Goals

Older workers and retirees should start their planning by setting a few important goals that can significantly influence subsequent decisions. To start, they should answer the following questions:

- How much guaranteed lifetime income do they need? One starting point is the amount needed to cover nondiscretionary living expenses. This decision will help them decide if it's desirable to optimize Social Security benefits and/or deploy some savings into an annuity.
- How much true liquidity do they need? This is the amount of savings they should set aside for planned, one-time expenses, such as home or car repairs, and for unplanned emergencies. This money should be set aside in a liquid account and not be used to generate retirement income.
- How much allocation liquidity will make them feel comfortable? This is the amount of savings that's used to generate retirement income, and with which the retiree has the flexibility to change the method of generating income at any point with remaining funds.

Making these decisions can help older workers and retirees assess the tradeoff between the amount of guaranteed income they want vs. the amount of accessible wealth they might have during their retirement.

In addition to the goals listed above, some retirees may desire to leave a legacy after they die. In some cases, retirees can plan for legacies with assets that aren't being used to generate retirement income, such as life insurance, home equity that is intentionally preserved, businesses, and personal assets. Retirees interested in leaving a legacy should incorporate legacy planning into their retirement income planning, because it could significantly influence their choice of retirement income generators and asset allocation. A stated priority to have enough money available for a legacy after the retiree dies will often mean they'll need to accept reduced income throughout their retirement in order to preserve enough assets for their projected legacy.

8.2. Explore Available Options with Employer-Sponsored Retirement Plans

Older workers who participate in defined benefit (DB) retirement plans will want to understand the amount of lifetime monthly income that their plan will pay upon their retirement. If their plan allows a lump sum payment, they will want to carefully analyze the amount of monthly retirement income they'll receive from their DB plan compared to the amount of income they could receive if they elect the lump sum and deploy it among the types of retirement income solutions analyzed in this report. Under current market conditions, it

will be very hard to generate more lifetime retirement income by electing the lump sum payment.[9]

If they elect the monthly income from their DB plan, their pension income, together with optimized Social Security benefits, may be sufficient to meet all their needs for guaranteed lifetime retirement income. This can free up other savings to be invested significantly in stocks for growth, using a SWP to generate retirement income.

Participants in employer-sponsored defined contribution (DC) retirement plans will also want to learn about the payment options in their plans and the investment performance of the funds in their plans. It's possible their plan may have institutionally priced index funds with very low investment costs, under 10 basis points. This is often true with larger employers. In this case, it may be best if the retiree leaves the savings in their DC retirement plan so it can deploy SWP solutions, and not roll their savings into an IRA. Also, it will help if their plan offers monthly payment options, or if their plan will calculate the RMD each year and pay it in the frequency elected by the retiree.

On the other hand, some DC plans, particularly those at small employers, offer investment funds with higher costs than can be achieved with low-cost index funds in an IRA at a mutual fund company. In this case, the retiree might consider rolling their accounts over to such an IRA to generate income through a SWP. Many financial institutions will facilitate automatic monthly payments and will calculate the RMD for their clients.

Participants in employer-sponsored DC plans who decide to retire before they start Social Security benefits may want to investigate how to use their plan to implement a strategy to optimize Social Security benefits. In this case, the retiree would set aside a portion of their savings to replace the monthly Social Security benefit they are deferring until the age when they plan to start their Social Security benefit. They could elect a fixed period payment option if it's available in their plan. They would then invest these funds in a liquid fund such as a stable value or money market fund, since these funds would have a short investment horizon. Many employer-sponsored DC plans offer stable value funds with higher interest rates compared to retail bank accounts or money market funds.

Optimizing Social Security benefits and using accounts in employer-sponsored DC plans or IRAs to set up automatic payment features also help protect savings against fraud or cognitive decline.

8.3. Explore Available Options Outside Employer-Based Plans

Retirees who desire an annuity may need to look outside their employer-sponsored DC plan, since many DC plans don't offer any annuity products. In addition, some annuity solutions are typically available only outside of DC plans, such as FIAs or VA/GLWBs. In this case, the retiree could roll out just the portion of their savings that they want to deploy to an annuity. They could leave remaining savings in their DC plan if they determine it's the best place to implement a SWP and/or a strategy to delay starting Social Security benefits.

Retirees with whole life insurance policies or tax-deferred annuities may want to analyze the amount of annuity income that could be available from their policy. Most such policies offer lifetime annuity payment options or payment options over a fixed period. These sources can be used to generate guaranteed lifetime

retirement income or to implement a strategy to delay Social Security benefits. These policies can also be incorporated into legacy planning, if that's an important goal.

Older workers and retirees will want to analyze the amount of retirement income they can realistically expect from all of their retirement savings sources. For some, this can be a retirement reality check if their income falls far short of their needs for living expenses. They could then analyze how they could deploy their home equity to boost their retirement income. This could include a tenure payment or strategies to reduce sequence-of-returns risk.

Retirees with sufficient retirement savings to generate retirement income that will cover their living expenses may want to consider methods they can use to deploy their home equity to protect against the risk of high long-term care expenses. This could entail setting up a reverse mortgage line of credit as soon as possible and letting the line of credit grow with interest until it is needed.

Given the numbers of older workers and retirees with modest financial resources, it will be critical for them to be creative and diligent in exploring all the potential options that are available to them for generating retirement income. There is a need for developing tools and services that can help them make effective retirement planning decisions.

Section 9: How Plan Sponsors Can Use These Analyses

Many plan sponsors have the desire to help their older workers transition into retirement, but they are wary of programs that are administratively complex or might incur fiduciary liability. It is possible, however, for plan sponsors to help older workers make effective decisions while mitigating these concerns.

Employers that sponsor DC retirement plans may want to help their older workers assess the adequacy of their resources and offer methods within their plans that enable their participants to generate retirement income. If an older worker is unsure about the adequacy of their savings or isn't confident about how to go about generating retirement income from savings, their default decision could be to continue working indefinitely. Eventually this decision might be undesirable for both the worker and employer.

Employees who realistically assess the income they can receive from their retirement resources can then make more informed life decisions, such as how long to continue working, whether they need to work part time in retirement, and whether they need to reduce their living expenses.

9.1. The Most Important Decisions Facing Older Middle-Income Workers

Section 8 addresses the challenges that many older workers experience when faced with inadequate resources to retire at traditional retirement ages and meet common retirement income goals. For such workers, the most important decisions may be:

- When and how to transition from the paid workforce, including the option of part-time work.
- When to start Social Security benefits.
- How to deploy their retirement savings.
- How to manage and reduce their living expenses, most notably their expenses for housing, transportation, and medical costs.
- Whether to deploy their home equity to enhance retirement security.

Employers could assist their older workers by providing skilled and unbiased counseling on these decisions, as many of the analyses suggested in this report will be beyond the skills of most retirees. In addition, they could provide software modeling tools that will help make the decision process more understandable.

Employers can also offer alternative career trajectories that enable their older workers to continue working.

9.2. The Next Evolution in DC Retirement Plans

Our prior report, *Optimizing Retirement Income in DC Retirement Plans*, asserts that the transition from defined benefit to defined contribution retirement plans won't be complete until many DC plan sponsors offer their retiring employees a carefully designed and communicated program of retirement income that complements the plan's investment menu.[5] That report describes retirement income programs that are

reasonable to implement in today's environment. Such a program could package retirement income solutions that address different retirement planning goals, including:

- A retirement income that's guaranteed for life, no matter how long the retiree lives.
- A retirement income that has the potential for growth to address inflation risk.
- A retirement income that won't decrease if investments perform poorly.
- Flexibility to access savings if life circumstances change.

Such a program could include:

- An installment payment feature that implements a SWP with a few different withdrawal strategies, together with a few different funds with varying asset allocations.
- Withdrawal strategies that could be the IRS RMD or could use fixed percentages such as 3%, 4%, 5%, or 6%. As a practical matter for tax-qualified plans, after age 70-1/2, the RMD would override the fixed percentage if the RMD results in a higher withdrawal amount.
- A period-certain payout to enable delaying Social Security benefits.
- The ability to purchase SPIAs or DIAs that are fixed, inflation adjusted, or adjusted by a growth factor such as 3%.

Most DC administrators should be able to enable the first three solutions by offering installment payment and period certain payouts, and by calculating the IRS RMD and automatically paying this amount in the frequency requested by retirees. These features would go a long way to helping most retirees. As discussed earlier in this report, many middle-income retirees might achieve sufficient guaranteed, lifetime retirement income just by optimizing their Social Security income. They can then supplement their guaranteed income with SWPs that are implemented in the DC plan.

Plan sponsors that don't want the administrative complexity of SPIAs or DIAs could allow workers over age 59-1/2 to initiate in-service distributions and roll over the assets to IRAs at financial institutions that offer annuities, including SPIAs, DIAs, FIAs and VA/GLWBs.

Our prior report, *Optimizing Retirement Income in DC Retirement Plans*, goes into more detail about the types of retirement income generators (RIGs) plan sponsors may want to offer, and the analyses they would complete to design a retirement income program.[5]

9.3. Address Fiduciary Issues

An important concern for plan sponsors is their exposure to fiduciary liability when selecting and communicating retirement income solutions to offer plan participants. As discussed in the report, *The Next Evolution in Defined Contribution Retirement Plans*, ERISA requires plan sponsors to act in the best interests of plan participants, which the courts have characterized as requiring fiduciaries to engage in a prudent decision-making process.[10]

One goal for both this report and our prior report is to demonstrate processes and analyses that a plan sponsor and/or adviser could conduct as part of the prudent decision-making process when designing payout options. For more details on the relevant fiduciary issues, see the above report and the related SCL/SOA report, *Foundations in Research for Regulatory Guidelines on the Design & Operation of Retirement Income Solutions in DC Plans*.[11] This latter report uses guidance under ERISA Section 404(c) on the investment menu as a template for structuring a program of retirement income. For example, a plan sponsor could offer three distinct RIGs:

- A SWP with various withdrawal percentages including the RMD
- A lifetime annuity
- A period-certain payout to enable delaying Social Security benefits

Participants would have the ability to allocate their savings among more than one RIG.

The above report also contains a discussion of the issues to consider for a default retirement income solution. One default payout option that might minimize plan sponsor's fiduciary concerns is the IRS RMD combined with the plan's qualified default investment alternative (QDIA) that is appropriate for retirees. Presumably the plan sponsors would design the QDIA to comply with safe harbors that provide the plan sponsor with protection from fiduciary exposure. Utilizing the IRS required minimum distribution as a default payout strategy can be one way for a plan sponsor to protect themselves from fiduciary liability, since the plan sponsor would be complying with federal regulations and the retiree will incur substantial penalties if the minimum amounts aren't withdrawn from the plan.

Such a default might encourage older workers to make a positive election regarding their retirement income solution, should they want to retire before age 70-1/2. In this case, they could start by using a portion of their savings to build a retirement transition fund using their retirement savings in the plan (described below) and allowing the default retirement income solution to apply to the remainder of their savings.

9.4. Details on the SS/RMD Retirement Strategy

One possible strategy that could work for large numbers of middle-income retirees and which isn't overly complex is the SS/RMD retirement strategy described earlier in this report. Plan sponsors could construct a choice environment to facilitate implementing this strategy.

For example, a retiree could make a positive election that deploys a portion of their accounts into a retirement transition fund that enables delaying Social Security benefits and then deploy the remainder of their accounts in the default RMD/QDIA payout option described above. The retiree might also have the option to elect other SWPs and payout options.

Plan sponsors could also structure their target date funds to systematically start building a retirement transition fund in the five to 10 years leading up to retirement to help protect against stock market crashes during this period.

The goal of such a retirement transition fund is to enable retirees to delay the start of Social Security benefits for as long as possible but no later than age 70. It could be determined as "X" years multiplied by the annual amount of Social Security benefits that are being delayed, where X equals the delay period. Of course, there would be some judgment involved with determining the target amount of this fund and how to build this fund as the older worker approaches retirement. Such a fund could be invested in stable value or money market funds, and would offer monthly payouts over a specified period.

A retirement transition fund could also serve as a resource that older workers and retirees can tap as they phase from full-time to part-time employment to eventual full retirement. This facilitates a flexible transition from the full-time workforce, particularly when older workers may be uncertain about their eventual retirement date.

Plan sponsors can also help by providing counseling services to help older workers develop strategies for transitioning into retirement, including building a retirement transition fund and implementing the SS/RMD retirement strategy.

These ideas would be improvements over the current DC plan sponsor environment, where many plan sponsors do little or nothing to help their older workers and retirees transition into retirement and generate income from their DC plan.

Section 10: How Retirees and Advisers Can Use These Analyses

Retirees and their advisers can develop diversified portfolios of retirement income that meets the retiree's specific goals and objectives by considering all resources, including accounts in DC retirement plans, IRAs, and home equity. Solutions on or close to an efficient frontier can be starting points for consideration. Then, to compare selected solutions in more detail, they can use the type of metrics illustrated in Tables 1 and 2 and in the retirement income dashboards in Figures 4 and 5.

10.1. Balance the Tradeoffs

When deciding on retirement income strategies and how best to deploy all financial resources, retirees will want to balance a few tradeoffs, including:

- The amount of income expected vs. the amount of accessible wealth throughout retirement (allocation liquidity).
- The amount of income expected vs. the possible amount of any bequests.
- The amount of investment risk assumed vs. the potential volatility of income.
- The possibility and magnitude of potential shortfalls vs. target threshold income amounts.

Advisers can help older workers and retirees make more informed, critical life decisions, such as when and how to leave the paid work-force, when to claim Social Security, how to manage and reduce living expenses, and whether to deploy home equity.

Retirees will want to determine if their expected retirement income is sufficient to cover their basic and discretionary living expenses. If it isn't, armed with estimates of potential shortfalls, they can make informed, important lifestyle choices regarding the decisions listed in Section 7.4: adjusting their budgets for living expenses, continuing to work, deciding when to claim Social Security, and whether to deploy home equity.

10.2. Plan for Future Discontinuities

Many retirees may experience predictable future discontinuities in retirement income or living expenses. For example:

- Some older workers might continue working for a period of time, but it's unrealistic to assume that they'll be able to work for the rest of their lives. As a result, their income from working will stop at some age.
- Many retirees will pay off a monthly mortgage at some point during their retirement (if they don't do it before they retire). Or they may use savings to immediately pay off a remaining mortgage balance, as a purposeful strategy to reduce both living expenses and investment risk.

- Expenses due to child care or care for dependent parents may reduce or be eliminated in retirement.
- Living expenses and income may change upon the death of a spouse.
- Some retirees will experience high costs for long-term care late in their retirement.

An adviser can help retirees by developing plans with them that address these future discontinuities. It's reasonable for retirees to address the first two discontinuities with adjustments to their retirement income strategy, perhaps using modeling software.

Another way to address significant discontinuities is to use an actuarial method that develops retirement income streams by balancing the present value of income from all sources with the present value of living expenses, making assumptions to model these future discontinuities.[8]

Advisers can also recommend risk-mitigation strategies for shocks such as the death of a spouse or long-term care. The death of a spouse can be addressed through strategies to continue income after the first death.

It's important to note, however, that the potential costs of long-term care can overwhelm any retirement income strategy by draining a retiree's savings. Retirees and their advisers may want to consider special risk-mitigation strategies, such as purchasing long-term care insurance or purposefully holding home equity in reserve. Fully addressing the risk of long-term care, however, is beyond the scope of this project.

In addition to the sources of discontinuities listed above, political or macroeconomic events can produce future discontinuities in income or living expenses. Examples include possible modifications to Social Security benefits or tax rules, recessions, or high inflation. Retirees and their advisers will want to consider the extent to which they are able to address these events and whether these events would have an influence on their retirement income strategies.

10.3. One Example of a Retirement Income Portfolio

One possible approach for a combination solution is to cover essential living expenses with guaranteed, lifetime income sources such as Social Security benefits and income from defined benefit plans (if available), together with using a portion of retirement savings to buy a high-performing annuity or a monthly tenure payment from a reverse mortgage line of credit. A SWP would be applied to the remainder of retirement savings to generate retirement income to cover discretionary living expenses.

The financial analyses in this report support a high allocation to stocks for the portion of savings devoted to the SWP, due to the high percentage of retirement income that's provided by Social Security. However, behavioral considerations may call for moderate equity allocations.

For SWP strategies, retirees may want to fine-tune the withdrawal rate, to reflect a possible desire to consume savings at a low rate to hold savings in reserve for late-life expenses or bequests, or to consume savings at a high initial rate to enjoy their initial retirement years while they're still active. The progression of income analyses shown in Figure 3 can give insights into this decision.

As noted previously in this report, many middle-income retirees may receive sufficient lifetime guaranteed income from optimized Social Security benefits. Income from SWPs may be a small portion of their total income, so deploying simple, easy-to-implement solutions like the IRS RMD may be appropriate.

10.4 Considerations for the SS/RMD Retirement Strategy

The SS/RMD retirement strategy is a specific application of the above insights. In this case, the retiree would devote a portion of their retirement savings to enable them to delay Social Security income as long as possible, up to age 70. If the worker retires before age 70, the worker could set aside savings in a protected, liquid account that approximately equals the amount the worker would have received from Social Security during the delay period. This could be called a "retirement transition fund." This fund could be invested in a money market or short-term bond fund, or the stable value fund of a DC plan.

Furthermore, if the older worker wanted to protect their income in the period leading up to retirement, the worker could systematically start transferring retirement savings from their invested accounts to their retirement transition fund before their anticipated retirement date. This approach has the advantage of providing flexibility to the retiree regarding their retirement date, including a phased retirement plan, compared to DIAs that can lock in specific annuity start dates. A retirement transition fund can also be used to prevent tapping longer-term investments during a stock market downturn in the period immediately preceding or immediately following retirement.

There are two important caveats on the SS/RMD strategy:

- It relies significantly on Social Security benefits and, as such, is subject to political risk if Congress reduces benefits for retirees and near-retirees due to the system's funding challenges. For example, a reduction in future cost-of-living adjustments has been proposed for current retirees as a cost-saving measure. Retirees and their advisers will need to consider whether they think the chance of this possibility is great enough to warrant adjusting their retirement income strategies.
- It doesn't address significant, future discontinuities in income or living expenses. For example, a retiree might work part time for a few years, but it's unrealistic to expect anyone to continue working indefinitely. Also, a retiree might pay off their mortgage during retirement, thus lowering the total amount of their living expenses.

Regarding this last caveat, the SS/RMD can be a starting point for developing a retirement income strategy, with adjustments to reflect future discontinuities in income or expenses using retirement planning software that includes this capability. Another possibility is to use an actuarial method, which calculates streams of retirement income by balancing the present value of future income from all sources with the present value of future living expenses.[8]

More affluent retirees, such as Retiree #3 with $1 million in savings, may desire more sophisticated strategies:

- They might prefer additional guaranteed income from high-performing annuities.
- They might want to adopt more refined withdrawal methods for SWPs, such as an actuarial method, or deploy techniques to smooth yearly fluctuations, such as applying minimum or maximum withdrawal amounts each year (a.k.a. floors and guardrails).
- They may want to adopt more refined investment and asset allocation strategies than a target date fund.

Nevertheless, the SS/RMD strategy might still be a good starting point for affluent retirees.

10.5. Considerations for Integrating All Financial Resources

Our prior report, *Optimizing Retirement Income Portfolios in DC Retirement Plans*, goes into detail on the various issues and analyses that will help retirees decide on the specific RIGs to deploy and the specific asset allocation strategies that would work best for them.[5] It also contains a discussion on protecting against the threat of potential long-term care expenses. This prior report primarily focused on financial assets in DC plans.

This current report expands on the prior report by analyzing methods to deploy home equity to enhance retirement income or to use it to address the threat of long-term care expenses. Many of the analyses suggested in this report are beyond the skill set of most retirees, however, so skilled advisers can help by preparing the necessary analyses that will help their clients make informed decisions.

Specifically, advisers can help their clients understand the advantages and disadvantages of various retirement income solutions and estimate the amounts of retirement income that are reasonable to expect. If the retiree desires to deploy home equity, an adviser can help them understand their options, including the advantages and disadvantages of reverse mortgages and their costs.

The analyses in this report focus on retirement income that can be generated through employer-sponsored DC plans, IRAs, and home equity. When developing a retirement income portfolio, retirees and their advisers may also want to consider all potential sources of retirement income, including these:

- Defined benefit plans offer lifetime retirement income that's protected from capital markets and, if available, should be considered when assessing a retiree's amount of guaranteed lifetime retirement income.
- Similarly, annuity and life insurance policies held outside employer-sponsored retirement plans are potential sources of guaranteed, lifetime retirement income.
- Assets, benefits, and insurance policies held by spouses should also be considered.

Advisers can also help their clients understand how to reduce their living expenses, if necessary, to match their retirement income. In addition, retirees with legacy objectives can consider charitable gift annuities as part of their retirement income portfolio.

10.6. Income Tax Considerations

We treated all retirement income sources as pre-tax and did not make an adjustment for differences in income taxation. Such an adjustment is beyond the scope of our analyses.

We note that adjustments to recognize the differences in taxation might be minimal and most likely would not influence our results and conclusions, due to the levels of projected retirement income, the tax treatment of Social Security benefits, and current federal income tax rates. As a result, the goal to minimize income taxes should take a secondary role compared to other goals analyzed in this report, such as planning for income to last for a lifetime and planning for accessible wealth.

However, the favorable tax treatment of Social Security benefits is yet another reason to consider delaying Social Security until age 70.

Here's a summary of the tax treatment of various sources of income that we analyzed:

- A portion of Social Security income, ranging from 15% for affluent retirees to 100% for low-income retirees, is exempt from federal income taxes.
- All income from SWPs and annuities will be fully subject to income taxes, assuming they are made from deductible IRAs and 401(k) plans and not Roth 401(k) or IRAs.
- Retirees age 65 and over realize an additional standard deduction to income taxes.
- Monthly tenure payments from reverse mortgages are not subject to income taxes.

To more clearly explain the tax considerations we considered in this report, let's assume 2017 tax rates, standard deductions, and personal exemptions apply to the initial income amounts shown in Table 1 for our hypothetical retirees. Further, let's assume these income amounts are the only taxable income they receive.

Here's a summary of the federal income tax status for Retiree #1:

- For retirement income solutions that start Social Security at age 65, this retiree would pay no income tax for most solutions, and for a few solutions, she would pay a 10% rate on a very modest amount of taxable income.
- For solutions that use savings to delay Social Security until age 70, she would pay no taxes after age 70 for all solutions. When she uses retirement savings to enable delaying Social Security until age 70, all her gross income is fully taxable between ages 65 and 70, since her "Social Security benefit" during this time is withdrawals from savings, which we assume would be fully taxable. During this time, most of her income could be taxed at the 10% rate, and a modest portion of her income would be taxed at a 15 % rate.
- All her actual Social Security income would be exempt from federal income taxes, whether she starts Social Security at age 65 or 70.

Here's a summary of the federal income tax status for Retiree #2:

- For retirement income solutions that start Social Security at age 65, this retiree would pay no income tax for most retirement income solutions, and for a few solutions, they would pay a 10% rate on a very modest amount of taxable income.
- For solutions that use savings to delay Social Security until age 70, they would pay no taxes after age 70 for all solutions. When they use retirement savings to enable delaying Social Security until age 70, all their gross income is fully taxable between ages 65 and 70. During this time, most of their income could be taxed at the 10% rate, and a modest portion of their income would be taxed at a 15 % rate.
- With most retirement income solutions, all their actual Social Security income would be exempt from federal income taxes, whether they start Social Security at age 65 or 70. With a few retirement income solutions, less than 10% of their Social Security income would be subject to federal income taxes.

Here's a summary of the federal income tax status for Retiree #3:

- For retirement income solutions that start Social Security at age 65, this retiree would pay federal income tax at a 15% rate on a portion of their income, and they'd pay at a 10% rate for some of their income.
- For most solutions that use savings to delay Social Security until age 70, after age 70, they would pay federal income tax at a 15% rate on a portion of their income, and they'd pay taxes at a 10% rate for some of their income. For a few solutions, they would pay taxes at a 10% rate on all their taxable income. When they use retirement savings to enable delaying Social Security until age 70, all their gross income is fully taxable between ages 65 and 70. During this time, a portion of their income could be taxed at the 10% rate, and a portion of their income would be taxed at a 15 % rate, and for one retirement income solution a 25% tax rate would also apply to a small portion of income.
- The portion of their actual Social Security income that would be exempt from federal income taxes would range from one-fourth to three-fourths, depending on the specific retirement income solution and whether they start Social Security at age 65 or 70.

We note that some states also tax Social Security benefits and retirement income, while other states don't apply income taxes to retirees.

For retirees taxed at higher income tax rates, monthly tenure payments from reverse mortgages may also be attractive, since they aren't subject to federal or state income taxes.

Appendix F shows the federal income tax rates and standard deduction amounts that are effective in 2017.

10.7. New business models for financial advisers may be needed

New business models may be needed by financial advisers to implement some of the ideas and strategies in this report. Currently many advisers receive their income from transaction charges by selling annuity products or by assessing asset-under-management (AUM) charges against invested assets. Such charges could potentially create financial conflicts of interest in the following situations:

- Our analyses show that risk-averse, middle-income retirees might realize more guaranteed income by using savings to delay Social Security benefits, instead of buying an annuity that generates transaction charges.
- Similarly, if assets are deployed soon in retirement to enable delaying Social Security benefits, AUM charges would drop quickly once these assets have served their purpose.
- Retirees who have some assets in low-cost employer-sponsored DC plans and some assets in IRAs may want to keep their savings in the employer's plan and have separate strategies for deploying DC money and IRA money. An adviser might not realize transaction or AUM charges on money left in DC plans.
- AUM and commission-based advisers may not receive any compensation by suggesting reverse mortgages and coordinating strategies to deploy financial assets.
- Advisers may not receive any compensation coordinating strategies with the other resources mentioned above, such as DB plans, existing whole life insurance or annuity products, and charitable gift annuities.

Many critical decisions are made at a single point in time of retirement and may not require ongoing monitoring and adjustment. For example, consider a retiree who optimizes Social Security benefits, obtains a tenure reverse mortgage payment, and deploys remaining financial assets in a RMD SWP that invests assets substantially in index funds. Such a retiree may need a substantial amount of help to understand and set up such a strategy but may not need much help once it's been implemented. Ideally financial advisers will devise compensation schemes that fairly compensate them for the initial work at retirement and which then subsequently pay only as needed.

Section 11: How Financial Institutions and Advisers Can Use These Analyses

The Department of Labor (DOL) recently promulgated regulations that would require financial professionals who are providing advice to consumers with respect to their retirement accounts to act as fiduciaries. An important requirement of these regulations is that their recommendations must be made in the best interest of their clients. Note, however, that these rules only apply to tax-qualified retirement plans and IRAs, and do not apply to other assets such as home equity and investments outside of tax-advantaged retirement accounts.

At the time of the writing of this report, the implementation of these regulations has been delayed until mid-2019, while the DOL reviews certain features of these rules. Nevertheless, the rules have sparked intense interest in how financial institutions and advisers can act in the best interests of their clients.

Here we discuss how financial institutions can use the methods in this report to develop recommendations for their clients who are approaching and entering retirement. We do not comment on the public policy merits of the fiduciary rules. Instead, we are presenting methods that financial institutions and advisers might use to help them comply with public policy by demonstrating they are acting in the best interests of their clients.

11.1 Rigorous Analyses Can Be Used to Comply with Public Policy

The analyses in this report represent one way that financial institutions and advisers can prepare recommendations for constructing retirement income portfolios that are in the best interest of their clients who are close to or already in retirement. Ideally, these portfolios would be constructed by integrating deployment of all their assets, including employer-sponsored retirement plans, savings in IRAs, and home equity. Such institutions and advisers would base their recommendations on rigorous analyses and data that demonstrate their recommendations best meet the specific goals and circumstances of each client, as well as the market conditions at the time of the recommendation.

> The analyses in this report represent one way that financial institutions can demonstrate they are acting in the best interests of their clients.

Advisers and financial institutions might best serve their clients if they're able to recommend diversified retirement income portfolios with the potential to be allocated among different common retirement income classes, including Social Security benefits, invested assets, annuities, and a reverse mortgage. Other resources, such as continued work, and financial resources, such as whole life insurance and charitable gift annuities, might also be considered.

11.2 Start with Understanding Clients' Goals, Circumstances, and Priorities

Ideally, financial institutions and advisers will want to understand each client's goals and circumstances that can influence the retirement income allocation decision, including:

- The desired amount of retirement income expected throughout retirement.
- The expected pattern of change in retirement income over time, for example, to keep pace with inflation.
- The amount of protection that's needed against decreases in retirement income due to investment losses and interest rate changes.
- The portion of income that the retiree wants to be guaranteed for life, no matter how long the retiree and their spouse/partner (if applicable) lives.
- The current health status and life expectancy of the retiree and their spouse/partner, if applicable.
- The desired protection against the threat of long-term care and the potential influence on the retirement income allocation decision.
- The specific needs and desires for liquidity and access to savings throughout retirement.
- The retiree's desires to leave a legacy upon death.

Each of these goals has the potential to conflict with other goals, so an important task for the adviser is to help the retiree prioritize and make tradeoffs among competing goals. The analyses in this report can help quantify the tradeoffs among competing goals and help quantify the "price" incurred by meeting a specific goal.

11.3 Demonstrate "Best Interest" Recommendations

We suggest that financial institutions and advisers demonstrate they're acting in the best interests of their clients by:

- Using a disciplined and documented process to understand each client's goals and circumstances, and
- Demonstrating how their recommendations for constructing a specific retirement income portfolio best meets these unique goals and circumstances by using an analytical framework and data.

Such a process will be an improvement over using intuition and gut feeling for making retirement income recommendations. Financial institutions and advisers who automatically exclude or overlook common retirement income classes might be at a disadvantage compared to professionals who can consider a broad range of retirement income classes when making retirement income allocation recommendations.

Financial institutions may want to develop "mass customized" solutions or platforms that can cost-effectively serve middle-income clients, particularly those with modest savings and significant home equity. Such solutions would acknowledge the relative importance of decisions for these middle-income retirees, as discussed in Section 7.4. Such a platform could include help with optimizing Social Security benefits,

calculating annual withdrawal amounts from SWPs under an RMD or actuarial method, and providing annuity bidding services.

Financial institutions and advisers can also use the methods and analyses presented in this report as a foundation for developing customized solutions for their high net worth clients.

TECHNICAL DISCUSSION

Section 12: Subproject A – Assessing the impact of performance for financial solutions

Subproject A assesses the impact of investment performance earned on retirement savings on the total amount of retirement income retirees may receive over their lifetime. We include both investments in stocks and bonds plus the use of annuities. We present analyses that help retirees and their advisers make decisions on deploying retirement savings, recognizing and integrating the amount of expected Social Security benefits.

The amount of retirement income generated from savings can be impacted by performance of retirement income solutions through:

- Asset use decisions, such as whether to use savings to enable a strategy that optimizes Social Security benefits, as well as allocation between invested assets and annuities
- Asset allocation decisions – the mix of stocks and bonds in invested assets
- Investment timing decisions, including selling stocks when the market is down
- The level of fees charged to retirement savings
- Annuity product features, including transaction charges and the competitiveness of insurance company pricing

This subproject analyzes various retirement income solutions to quantify the impact of high-performing vs. low-performing retirement income solutions, as we define those terms (see below). We express the results in terms of the income received during retirement. We completed these analyses for three hypothetical retirees.

12.1. Hypothetical Retirees Analyzed

This subproject analyzes the retirement income outcomes for three hypothetical retirees, utilizing efficient frontier analyses for income versus accessible wealth, and graphs showing the progression of retirement income. These three hypothetical retirees are the same as used for the recent paper, *Optimizing Retirement Income in Defined Contribution Retirement Plans*.[5]

The hypothetical retiree situations all assume full retirement at age 65 with details as follows:

- Constrained retiree #1: Single woman with $250,000 in retirement savings. Last wage earnings equal $50,000 per year (this assumption is necessary for estimating Social Security benefits).
- Constrained retiree #2: Married couple with $400,000 in retirement savings. Husband is the primary wage-earner, and the wife receives a Social Security benefit based on her own work record that equals 50% of the husband's earned benefit. The last wage earnings of the husband equal $75,000 per year.
- Affluent retiree #3: Same as #2 above, except that retirement savings equal $1,000,000 and the husband's wage earnings have always been at or above the Social Security Wage Base.

Notes:

- We assumed that these hypothetical retirees all earned salaries for at least 35 years when estimating Social Security benefits. We estimated salaries prior to the final year using average wage increases.
- The assumed amounts of retirement savings are the amounts devoted to generating retirement income and do not include savings that would be devoted to other purposes, such as a fund for planned, significant one-time expenses, an emergency fund for unexpected expenses, or a fund for long-term care expenses.

See Appendix A for a full description of the assumptions we used for each hypothetical retiree.

12.2 Retirement Income Solutions Analyzed

Our analyses consider the following retirement income generators (RIGs):

- Single premium immediate annuities (SPIAs)
- Deferred income annuities (DIAs)
- Systematic withdrawal plans from invested savings (SWPs)
- Variable annuities with guaranteed lifetime withdrawal benefits (VA/GLWBs)
- Fixed index annuities (FIAs)

Here are the SWPs we analyzed:

- 3% SWP: The annual income equals 3% of invested assets at the beginning of each year. Income is adjusted up or down each year, depending on investment performance. This SWP approximates a conservative strategy with the goal of preserving principal; withdrawals equal or slightly exceed income from interest and dividends.
- We also valued 5% and 7% SWPs with more substantial withdrawals of principal.
- An RMD SWP is one that reflects the IRS required minimum distribution, which is also based on the value of assets each year and adjusts the withdrawals up or down each year. The RMD withdrawal percentage is 3.65% of assets at age 70-1/2 and increases each year thereafter. We assumed a withdrawal percentage of 3.5% for ages 65 to 69.

We did not analyze SWPs that fix the withdrawal amount at retirement and do not adjust for subsequent investment performance, such as a strict application of the four percent rule (where the initial annual withdrawal is set at 4% of savings and subsequent withdrawal amounts increase at the inflation rate). Our prior analyses show that these SWPs run the risk of exhausting assets in unfavorable economic scenarios.[5]

We also analyzed solutions that combine two different RIGs, where 30% of assets were devoted to either SPIAs or FIAs, and remaining assets were devoted to various SWPs. Projected retirement incomes from all the solutions we analyzed include Social Security benefits.

For a description of the various RIGs described above and a glossary of terms, please see our prior report, *The Next Evolution in Defined Contribution Retirement Plans: A Guide for DC Plan Sponsors to Implementing Retirement Income Programs*.[10]

12.3 Description of Analyses

We analyzed the various solutions using an efficient frontier analysis, showing the tradeoff between the amount of retirement income and accessible wealth throughout retirement. We also prepared graphs for selected retirement income solutions that show the progression of the range of possible retirement income and wealth amounts throughout retirement (called retirement income and wealth progression analyses). These can help people gain an understanding of the pattern of income and accessible wealth throughout retirement, and the potential volatility in the total amount of retirement income.

We completed Subproject A in two phases; each phase examines specific strategies that meet various goals to generate reliable retirement income.

- Phase 1: Retirement resources are deployed at the time of retirement (age 65) at the same time as Social Security benefits are started – a parallel claiming strategy. This phase examines the effectiveness of combining systematic withdrawals with immediate annuities, compared to stand-alone retirement income solutions. It also serves as the baseline case for comparing to future phases.

- Phase 2: Retirement savings are deployed at retirement and Social Security benefits are delayed to enable optimization of Social Security income – a serial claiming strategy. We assumed that the retiree would make annual withdrawals from savings between ages 65 and 70 that equal the expected Social Security benefit at age 70. Remaining assets are deployed in the appropriate retirement income solution starting at age 65.

12.4 Description of Efficient Frontier Analysis

Efficient frontier analyses typically compare the tradeoff between two different goals· We used the following efficient frontier analysis:

- Illustrate the tradeoff between income and available wealth: The vertical Y-axis shows the average annual real retirement income from the retirement income solution under the median stochastic forecast throughout retirement. This average is calculated using the projected amount of income at each future age, multiplied by the probability of survival to each future age and adjusted for projected inflation.
- The horizontal X-axis shows the average real remaining wealth over the retirement period, calculated in the same manner as described for the Y-axis, except that average annual real remaining wealth throughout retirement is calculated.

Survival weighting effectively produces averages for varying longevity. Stochastic forecasts allow for varying investment performance, and medians are used to avoid overemphasis on highly favorable investment scenarios.

This is the same as Efficient Frontier #2 as used for the previous project outlined in *Optimizing Retirement Income in Defined Contribution Retirement Plans*.[5]

See Appendix B for the investment return and inflation assumptions we used to project account values and retirement income, as well as the mortality assumptions used to calculate the probabilities of survival to various ages. Appendix C describes the assumptions we made for pricing the following annuity solutions: SPIAs, DIAs, VA/GLWBs, and FIAs.

12.5 Assumptions for High-Performing and Low-Performing Solutions

We characterized high-performing vs. low-performing solutions as follows:

- Invested assets for high-performing solutions experience returns that are 50 basis points less than returns on relevant indices. This reduction in return could be due to poor timing or selection decisions or the level of fees. Low-performing solutions experience returns that are 150 basis points less than returns on relevant indices.
- Assumed rates for high-performing SPIAs and DIAs come from Income Solutions® (as of January 2017), a competitive annuity bidding platform. Low-performing rates are assumed to be 10% lower than high-performing solutions, due to higher transaction fees and/or noncompetitive annuity selection.
- Assumed annual investment and insurance charges for VA/GLWB annuities are 150 basis points for high-performing solutions, with no surrender charges. Low-performing solutions have annual investment and insurance charges of 350 basis points, with surrender charges starting at 8.5% in the first year, phasing out gradually after eight years. Both cases assume a 60/40 stock/bond asset allocation.

- For high-performing FIAs, the maximum annual credited rate (cap rate) is 4.50% based on performance of the S&P 500 minus dividends, and the minimum credited rate is 0%. For low-performing FIAs, the maximum cap rate is 2.5% and the minimum is 0%. Both high- and low-performing FIAs have surrender charges of 8.5% the first year, 8% the second year, and decreasing by 1% each year thereafter, down to 3% for year seven and 0% for years eight and after—applied to account value.

12.6 Treatment of Home Equity

Subprojects A and B assume no deployment of home equity to increase retirement income or enhance retirement security. In effect, we're assuming there is no significant home equity, or that financial resources are sufficient to generate retirement income. If a retiree has substantial home equity, this assumption implies it will be used in one of these ways:

- The retiree continues to enjoy living in the home, potentially mortgage-free at some point.
- The value of the home will eventually be used as a legacy to children or charities.
- At some point in the future, the home equity will be realized as a capital gain through a sale. At that time, the resulting gain – after expenses and taxes, if any – would be added to financial assets.

Subproject C examines and analyzes alternative uses of home equity to increase retirement income and enhance financial security.

12.7 Summary of Efficient Frontier Analyses

Figures 1-1-H, 1-1-L, 1-2-H, 1-2-L, 1-3-H, and 1-3-L show the efficient frontier graphs and tables for Retirees #1, #2, and #3, respectively, for commencing Social Security benefits at age 65, for both high- (H) and low- (L) performance cases.

Figures 2-1-H, 2-1-L, 2-2-H, 2-2-L, 2-3-H, and 2-3-L show the efficient frontier graphs and tables for Retirees #1, #2, and #3, respectively, for using savings to enable commencing Social Security benefits at age 70 for the primary earner and age 66 for the spouse, if applicable. (Henceforth we'll shorten the description of this strategy to "delaying Social Security to 70.") We show results for both high- and low-performing cases.

12.8 Caveats and Cautions for Interpreting the Results

The results significantly depend on the assumptions regarding capital market returns, product features, and high vs. low performance. For example, for Retirees #2 and #3, fixed SPIAs are on the efficient frontier for low-performing solutions but not for high-performing solutions. Most likely this result can be attributed to our assumptions regarding high-performing and low-performing solutions. For example, when comparing low-performing and high-performing solutions, the projected incomes for RMD solutions increased more than the SPIA solutions did. In effect, the high-performing RMD solution "knocked" the high-performing SPIA solution off the efficient frontier.

Because of this observation, we caution readers from drawing specific conclusions about the superiority of one retirement income solution over another, based on small differences in projected values. Our analyses should be used for general observations and conclusions.

For example, in some cases FIAs are on the efficient frontier (see Figures 1-1-H and 1-1-L), and in other cases, FIAs are just below the efficient frontier (See Figures 2-2-L or 2-3-L). These results should not be interpreted to endorse FIAs in one situation but not the other.

VA/GLWB annuities did not appear on the efficient frontiers but were just below. (See Figures 1-1-L, 1-2-L, and 1-3-L). These results should not rule out consideration of VA/GLWB annuities.

The results presented here also depend significantly on the assumptions we made for the hypothetical retirees. Individual circumstances can vary substantially regarding family composition and needs, relative amounts of financial wealth and home equity, and the health of the retiree and spouse (if married).

12.9 The Tradeoff Between Income and Accessible Wealth

In most cases, our analyses demonstrate a tradeoff between expected average income and average accessible wealth. Higher accessible wealth produces lower average income, and vice versa. However, when developing retirement income strategies, it's important to understand the value of accessible wealth and distinguish between true liquidity and allocation liquidity.[7]

- True liquidity can be spent without impacting the amount of retirement income. Examples of true liquidity can be amounts set aside to spend on planned large one-time expenses, such as home repairs or car purchases, or for a reserve for unexpected emergencies. As we noted previously, we assumed that the asset values for our analyses will be used to generate retirement income and would not be used for true liquidity purposes.

- Allocation liquidity can be used to change the method of generating retirement income to respond to changes in life circumstances or goals. Examples might include a need for more regular income or reducing investment or longevity risk. As such, our analyses help retirees assess the value of being able to change their mind regarding the method they use to generate retirement income.

Some retirees may desire accessible wealth as a reserve for long-term care expenses. This may not be an effective strategy, since a significant long-term care event can quickly drain retirement savings and significantly reduce retirement income. Retirees may want to develop a separate strategy for addressing long-term care expenses, such as buying long-term care insurance or using home equity as a reserve (which we address in Subproject C).

If accessible wealth is spent, it is no longer available to generate retirement income. If accessible wealth amounts are not spent during retirement, then the retiree will experience the income generated by that wealth throughout retirement and would not have realized the value of the accessible wealth. In other words, in this situation, the value of the accessible wealth is the peace of mind the retiree might gain with the knowledge that they can access their savings.

The amounts of projected accessible wealth could be considered as a proxy for bequests, but Subproject B directly calculates and displays the values of average expected bequests.

With the above considerations in mind, our analyses can be used to assess if accepting lower average income is worth the tradeoff for higher average accessible wealth. For example:

- Figure 1-1-H shows that a pure SPIA strategy has no accessible wealth and average income of $28,682.
- A pure FIA strategy has average accessible wealth of $89,946 and an only slightly lower average income ($28,455) than the pure SPIA strategy.
- In this situation, an RMD strategy provides even higher average accessible wealth ($210,339) but lower average income ($27,533).

12.10 Coordinating Asset Allocation and Social Security Claiming Decisions

In all cases, the only SWPs on the efficient frontier were invested 100% in equities. SWPs with lower allocations to stocks fell predictably below the efficient frontier. It's understandable that many retirees may feel uncomfortable with such a high allocation to stocks. However, such a high allocation might be justified from the perspective of a total retirement income portfolio.

In almost all the situations we analyzed, significantly more than half of the total retirement income is provided by guaranteed sources of income, such as Social Security, SPIAs, and FIAs. In these cases, fluctuations in income amounts generated by SWPs invested in stocks do not result in significant fluctuations in the total amount of retirement income. For example, when retirement savings are used to optimize Social Security benefits (commencing at age 70) for middle-income retirees (Retirees #1 and #2), a very high percentage of retirement income (75% to 86%) is attributed to Social Security benefits.

When comparing the impact of high-performing vs. low-performing solutions, there is generally a greater impact on average accessible wealth than average income. For example, here are comparisons of two high- and low-performing solutions on the efficient frontiers from Figures 1-1-H and 1-1-L:

- Solution: 30% FIA/70% RMD with 100% stocks. Average income for the high-performing solution is $27,835, 6.5%% higher than the $26,145 amount for the low-performing solution. Average accessible wealth for the high-performing solution is $173,599, 15.3% higher than the $150,499 amount for the low-performing solution.
- Solution: 100% RMD with 100% stocks. Average income for the high-performing solution is $27,533, 6.8%% higher than the $25,789 amount for the low-performing solution. Average accessible wealth for the high-performing solution is $210,339, 17.4% higher than the $179,208 amount for the low-performing solution.

The reason is that Social Security income amounts are a large portion of the total retirement income, but the benefits are not impacted by decisions regarding high-performing or low-performing solutions, and they aren't included in the measures of accessible wealth.

Subproject B will show the same result with average bequests.

Using savings to enable delaying Social Security increases average income but decreases average accessible wealth. For example, for high-performing retirement income solutions, here are comparisons between delaying Social Security and starting it at age 65 for three solutions on the efficient frontier for Retiree #2 (comparing Figures 1-2-H and 2-2-H):

- RMD w/100% stocks: Average income increases 4%, but average accessible wealth decreases 40%.
- 30% FIA/70% 3% SWP w/100% stocks: Average income increases 8%, but average accessible wealth decreases 40%.
- 3% SWP w/100% stocks: Average income increases 10%, but average accessible wealth decreases 41%.

12.11 Special Considerations for Risk-Averse Middle-Income Retirees

A risk-averse middle-income retiree who needs to maximize current income should consider using savings to enable delaying Social Security before purchasing a SPIA or FIA starting at age 65. For example, let's consider Retiree #1 who is considering starting Social Security at age 65 and uses low performing annuities.

- If she instead uses savings to enable delaying Social Security and buys a SPIA with remaining savings, her average income increases from $27,477 to $29,045. (Accessible wealth amounts are zero for savings used to purchase SPIAs).
- If she instead uses savings to enable delaying Social Security and buys a FIA with remaining savings, her average income increases from $27,022 to $28,845, but her average accessible wealth would decrease from $83,955 to $52,382. She would need to decide if she still has sufficient average accessible wealth for her peace of mind with the delay strategy.

12.12. Protecting Retirement Income in the Period Leading up to Retirement

We also prepared preliminary efficient frontier analyses that compared strategies to protect retirement income in the period leading up to retirement, such as target date funds, deferred income annuities (DIAs), fixed income annuities (FIAs), or guaranteed lifetime withdrawal benefits (GLWBs). We did not include these analyses in this report, since they didn't add any additional insights into assessing the impact of performance on total retirement income, considering Phases 1 and 2 of this report and our prior report, *Optimizing Retirement Income in Defined Contribution Retirement Plans*.[5]

We tentatively concluded that the SS/RMD retirement strategy might do a better job of protecting retirement income in the period leading up to retirement than the other strategies mentioned above for middle-income retirees. The reasons are:

- Social Security benefits are not impacted by investment returns, and they represent a very large portion of the total retirement income.

- An older worker can build a "retirement transition fund" in the period leading up to retirement that will enable optimizing Social Security benefits with a delay strategy. This fund would be invested in funds that are protected from stock market fluctuations, such as money market funds, short-term bond funds, or stable value funds.

Affluent retirees may desire more protection than the SS/RMD strategy can deliver, in which case they may want to consider investing a portion of savings in bond funds, DIAs, FIAs, and GLWBs.

Further analysis may be needed to understand the circumstances where the SS/RMD strategy might work best; such analysis is beyond the scope of this project.

12.13 Discussion of Results – Retirement Income and Wealth Progression Analyses

For six retirement income solutions, we prepared line graphs that display the progression of real retirement income and remaining real accessible wealth from years one through 30 of the retirement period for Retiree #2. Figure 3 includes graphs that display the 10th, 25th, 50th, 75th, and 90th percentiles of our stochastic forecasts for high-performing solutions that use savings to enable delaying Social Security benefits. Savings used to provide income until Social Security begins are assumed to earn a 0% real return, and, for these examples, any other savings not used for such bridge funding or for annuity purchase are assumed to be invested in a 50% stock/bond mix.

These graphs are useful to gain insights into whether income can be expected to increase relative to inflation and how quickly savings are depleted over retirement. For example, Figure 3 shows the following results from our projections:

- A 3% SWP produces income that declines slightly in real terms at the 50th percentile result but keeps up with inflation at the 75th and 90th percentiles.
- A 7% SWP produces retirement income that declines significantly in real terms for all percentiles.
- A RMD SWP produces retirement income that keeps pace with inflation at all percentiles, compared to the 3% or 7% SWPs. The range of results for projected retirement incomes is broader between the percentiles for the RMD SWP compared to the 3% or 7% SWP.
- A fixed SPIA produces income that predictably declines relative to inflation, and there is no accessible wealth after age 70. If this is a concern, a retiree can purchase a SPIA that increases at a fixed rate or is indexed for inflation.
- An FIA produces income amounts that keep pace with inflation. There's not much variation in accessible wealth amounts between the different stochastic percentiles.
- The VA/GLWB annuity produces amounts that decline relative to inflation throughout the retirement period.

Section 13: Subproject B – Metrics for Assessing Retirement Income Solutions

The efficient frontier and retirement income progression analyses described in Subproject A are two powerful techniques to assess retirement income solutions. The expected amounts of retirement income and liquidity as measured by the efficient frontier analysis are important considerations, but they don't give a complete assessment of a specific retirement income solution.

This subproject supplements the analyses mentioned previously for Subproject A by developing additional metrics for assessing how various retirement income solutions meet common retirement income objectives. Financial advisers and institutions can use these metrics to construct solutions that meet their clients' specific goals and circumstances. This can help financial advisers and institutions demonstrate they're acting in the best interests of their clients when recommending retirement income solutions.

We also developed a retirement metrics dashboard to graphically display and compare six retirement income solutions on one page for all the metrics.

13.1 The Need for New Metrics

Much of the early retirement planning research analyzed withdrawal strategies established at the inception of retirement. Testing of such strategies is usually completed with Monte Carlo simulations of annual investment returns over an assumed fixed retirement period, such as 30 years. The classic four percent rule is an example of such a strategy where the first-year withdrawal is set at 4% of savings at retirement, and subsequent annual withdrawals increase for inflation. Results are typically measured as a failure rate equal to the percentage of Monte Carlo runs where savings are depleted before the end of the retirement period, and the average or median bequest produced is also measured.

Various researchers have demonstrated the challenges and shortcomings of these analytical techniques and the strict application of the four percent rule as described above.[5] For example, the four percent rule can result in depleted savings during a retiree's lifetime, particularly in unfavorable economic scenarios. As a result, we didn't include a strict application of the four percent rule in our analyses.

Recently, retirement researchers have focused on strategies where withdrawal amounts are not set at inception but instead are a function or percentage of the current portfolio. Withdrawals are adjusted up or down in future years to reflect emerging investment experience. Examples include taking a fixed percentage of remaining assets at the beginning of each year, and any method where each year's withdrawal is set as current savings divided by an estimate of remaining life. A specific example would be utilizing Required Minimum Distribution (RMD) tables. We focus on these variable withdrawal strategies in this research.

Subproject A shows the trade-off of expected average retirement income vs. average liquidity throughout retirement. These measures included all sources of retirement income—Social Security, withdrawals from savings, and annuities. The advantage of using these measures is that two measures can be used to evaluate the performance of retirement strategies. A disadvantage is that combining everything into two measures doesn't provide much description of what's happening over the course of retirement. Is income increasing or decreasing in real terms? What is the size of average or median bequests? Is annual income dropping to a level that would cause hardship?

For this Subproject B, we analyzed a subset of retirement strategies examined in Subproject A, and we show a more robust set of performance measures. Similar to Subproject A, our analyses incorporate randomness for both longevity and investment returns.

We established the following goals for these retirement income metrics:

- Each metric should assess an important yet distinct retirement planning goal.
- We want to present the minimum number of metrics that assess the most important goals, with minimum overlap between metrics.
- The metrics should be reasonably understood and explained to older workers and retirees. We want to avoid complex measures that are not intuitively understood by older workers and their advisers.

13.2 Metrics Analyzed

With the above goals in mind, we utilized the following metrics:

1. **Average annual real retirement income from the specific solution expected throughout retirement, including Social Security.** This is the same number as calculated in our efficient frontiers for Subproject A (see Section 12 for a detailed explanation).

2. **Expected direction of retirement income.** Is income expected to keep pace with inflation or fall behind? This is the ratio of average real income expected throughout retirement (item 1 above) to the amount of income expected in the first year of retirement. A ratio above 100% indicates that, on average, the retiree can expect real income to increase over the retirement period, while a ratio below 100% indicates that annual income throughout retirement is expected to decrease in real terms.

3. **Average real accessible wealth expected throughout retirement.** This is the same number as currently calculated in our efficient frontiers for Subproject A (see Section 12 for more details).

4. **Expected direction of accessible wealth.** Is accessible wealth expected to decrease or grow throughout retirement? This is the ratio of average real accessible wealth expected throughout retirement (item 3 above) to the amount of retirement savings at the beginning of retirement. A ratio above 100% indicates that on average, the retiree can expect real accessible wealth to increase over the retirement period, while a ratio below 100% indicates that accessible wealth throughout retirement is expected to decrease in real terms.

5. Average real bequest at death. This is the average amount of real remaining savings projected at each age throughout retirement under the median stochastic forecast, adjusted for the probability of dying at each future age and adjusted for future inflation.

6. Undesirable volatility. We calculate this ratio with the numerator determined as the sum of any decreases in total retirement income for each year in the forecast period. We averaged the amount of these decreases over the entire forecast period, weighted by the probability of surviving to each year. If the projected retirement income in a year increases, it's counted as zero when calculating the average decrease in total retirement income.

When calculating the amount of decrease or increase in total projected retirement income, Social Security income is included. The denominator is the average real retirement income (first metric described above). We measured just decreases in income, on the assumption that an increase in income would not be viewed unfavorably by retirees. Other volatility measures, such as standard deviation, include upside volatility, which would be desirable to retirees.

This metric measures the potential need to reduce spending in a future year. This helps retirees understand the "comfort margin" they might have with their budget for living expenses. Note that such decreases can be offset by past or future increases in income.

7. Probability of plan failure and magnitude of failure. For each of our three retiree examples, we established the following guideline annual expense amounts:

- Retiree #1: $27,129
- Retiree #2: $47,823
- Retiree #3: $82,215

We assumed that these minimum amounts would increase for inflation each year. We acknowledge that there's evidence that retirees may reduce spending in real terms as they age.[12] Retirees and their advisers may want to consider if it's necessary to protect all retirement income from inflation, or just a portion.

The above amounts were derived as the amount of Social Security income beginning at age 65 plus the amount of income that could be generated by an inflation-adjusted single premium immediate annuity. This represents a straightforward approach for generating a level real amount of retirement income, and we use this benchmark in comparing results for various strategies. See Appendix A for a further explanation of our methodology for selecting these amounts, including a comparison to average expenditures for retirement-age Americans.

Plan failure means not generating enough income in one or more years to pay for the above guideline expenses. The probability metric is the percentage of Monte Carlo projections that experience failure at each age weighted by the probability of surviving to each future age. The magnitude of failure measures the average lifetime dollar shortfall for those cases that fail.

Note that the amount of these assumed threshold expenses will significantly impact the probability and magnitude of shortfall. All other things being equal, the larger the difference between the initial amount of retirement income and the guideline expense, the lower the probability and magnitude of shortfall will be.

The above goals represent a series of tradeoffs that retirees and their advisers need to assess when developing retirement income solutions.

Tables 1-1, 1-2, and 1-3 show the dashboard metrics for Retirees #1, #2, and #3 respectively. Figures 4-1, 4-2, and 4-3 display the dashboard results graphically.

13.3 Summary of Solutions Analyzed

For each of the three hypothetical retirees, we completed four sets of the dashboard metrics. One goal of these analyses is simply to display the use of the metrics for comparing and assessing different strategies. We also used the analyses to gain insights into a few key questions, including:

- Does increasing investment in equities result in unacceptable increases in downside volatility and the probability and magnitude of shortfalls, and can the extra risk be justified? What is the relationship between downside volatility and shortfalls?
- What is the interplay between a strategy to delay Social Security benefits and the asset allocation decision?

Here are the four sets we prepared:

- **Set 1:** Compare the impact of varying the equity allocation (100%, 75%, and 50%) among two different retirement income solutions:

  - 30% SPIA/70% RMD
  - 100% RMD

  Assume Social Security has been optimized by delaying benefits until age 70, and that high-performing solutions are deployed.

- **Set 2:** Compare the impact of starting Social Security at age 65 vs. using savings to enable delaying Social Security until age 70 for three possible retirement income solutions:

  - 100% SPIA
  - RMD, 0% stocks
  - RMD, 100% stocks

  Assume high-performing solutions are deployed.

- **Set 3:** Analyze the impact of low-performing solutions to compare to results from other sets, and assess the impact of delaying Social Security (SS) benefits to age 70. We analyzed low-performing versions of the following retirement income solutions:

  - RMD, 0% stocks, SS at age 65
  - RMD, 0% stocks, SS at age 70
  - VA/GLWB, SS at age 65
  - VA/GLWB, SS at age 70
  - FIA, SS at age 65
  - FIA, SS at age 70

- **Set 4:** Compare six solutions that optimize Social Security by delaying benefits until age 70 for the primary wage earner, deploy high-performing solutions, and are close to the efficient frontier:

  - 100% FIA
  - 100% VA/GLWB
  - 3% SWP, 100% stocks
  - RMD, 100% stocks
  - 30% SPIA/70% RMD, 100% stocks
  - 30% FIA/70% RMD, 100% stocks

13.4 The Advantages of Delaying Social Security

Delaying the start of Social Security benefits is particularly effective for risk-averse retirees who would otherwise prefer to invest savings in fixed-income investments or buy annuities. Here are some examples from our analyses:

- Suppose Retiree #2 decides to allocate all savings to high-performing fixed income investments and uses the IRS Required Minimum Distribution (RMD) to calculate annual income from savings. The average annual lifetime income (Metric #1) increases as follows:
  - Claiming Social Security at age 65: $43,827
  - Use savings to enable delaying Social Security until age 70: $49,235
  - Increase: 12.3%.
- Another advantage is the reduced probability of a shortfall (Metric #6). This metric is 100% when Social Security starts at age 65, but it drops to 16% when Social Security starts at age 70.
- There are two costs of this delay strategy:
  - Average accessible wealth (Metric #3) drops from $207,259 (age 65 start) to $128,588 (age 70 start)
  - Average bequest (Metric #5) drops from $78,000 to $43,842.

However, these costs can be partially offset by investing remaining assets in equities instead of fixed income (see next point).

For details, see Table 1-2, Set 2 for Retiree #2.

13.5 Coordinating Asset Allocation and Social Security Claiming Decisions

Once Social Security benefits have been optimized with a delay strategy, the analyses can justify significant allocation of remaining savings to equities. Let's continue the example of Retiree #2 who uses retirement savings to enable delaying Social Security to age 70 and will invest any remaining savings and use the RMD to calculate the annual income from savings.

- If assets are invested 100% in equities, the average income is $53,334, representing an 8.3% increase, compared to investing 100% of savings in fixed income and starting Social Security at age 70.
- Importantly, the "cost" of the delay strategy mentioned above is almost entirely negated by investing 100% in equities:
  - The average accessible wealth for the 100% equities/SS at age 70 strategy is $194,031.
  - This almost equals the $207,259 average accessible wealth for the 100% fixed income/SS at age 65 strategy.
  - The average bequest for 100% equity/SS at age 70 is $104,323, which is greater than the $78,000 average bequest for the 100% fixed income/SS at age 65 strategy.
- Finally, the $53,334 average annual income of the 100% equities/SS at age 70 strategy is 21.7% higher than the average annual income ($43,827) for the 100% fixed income/SS at age 65 strategy.

See Table 1-2, Sets 1 and 2 for Retiree #2.

13.6. Optimized Social Security Might Provide Sufficient Annuity Income for Middle-Income Retirees

In some cases, the increased Social Security benefits achieved by delaying the start of benefits may be all the guaranteed income that a retiree needs, and the retiree may not need additional guaranteed income through the purchase of an annuity.

Let's continue the example of Retiree #2 who uses savings to delay Social Security until age 70.

- This retiree is considering investing 100% of remaining savings in stocks and using RMD to calculate annual income from remaining savings. (Call it SS/RMD/100% stocks strategy.)
- Alternatively, this retiree is considering devoting 30% of remaining savings (after optimizing SS) to the purchase of a high-performing SPIA to increase guaranteed income. Any remaining savings would be invested 100% in equities and use the RMD to calculate annual retirement income from invested assets (call this the 30% SPIA/SS/RMD/100% strategy).

Comparing the metrics for these two strategies:

- The average annual incomes of these two strategies are very close:
  - $53,334 for SS/RMD/100% stocks
  - $53,212 for 30% SPIA/SS/RMD/100% stocks

- Downside volatility metrics are low for both strategies (-1.5% vs. -1.1%, respectively).
- Probabilities of shortfalls are low for both strategies (4% vs. 1%, respectively).
- Average accessible wealth is 39% higher for the SS/RMD/100% stocks strategy ($194,031 vs. $139,408, respectively).
- Average bequest is 43% higher ($104,323 vs. $73,058, respectively).

See Table 1-2, Set 1 for Retiree #2.

Delaying Social Security to age 70 moderately increases the guaranteed portion of the total retirement income. Let's continue the example of Retiree #2.

- If this retiree starts Social Security at age 65, the combined earned Social Security income for both the worker and their spouse is $33,303 at retirement. Suppose the worker invests 100% of assets in equities and uses RMD percentages to calculate annual retirement income. In this case, Social Security represents about 72% of total income at retirement.
- If this retiree and their spouse use savings to enable the Social Security delay to age 70 strategy, then the combined Social Security income at age 70 is $43,309. Note that this amount (in real dollars) will be paid starting at age 65 as a withdrawal from savings to enable delaying Social Security until age 70. This amount represents 86% of total income at retirement.

See Table 1-2, Sets 1 and 2 for Retiree #2.

13.7 The Significant Role of Social Security Income

For many middle-income retirees, such as Retirees #1 and #2, Social Security benefits represent a large percentage of their overall retirement income – 75% to 86%. In this case, the presence of significant Social Security benefits tends to dominate the metrics that assess retirement income, leading to less downside volatility and probability of shortfalls regardless of the method used to deploy retirement savings. For affluent retirees, such as Retiree #3, Social Security benefits have less of a dampening effect, providing 46% to 71% of total retirement income, depending on the age at which Social Security starts and the method of deploying retirement savings.

For example, suppose the retirement income solution used to deploy retirement savings is the IRS RMD with 100% of savings invested in equities. In this case, the downside volatility metric is -2.8% for Retiree #3 but only -1.5% for Retiree #2. Similarly, the probability of a shortfall is 18% for Retiree #3 but only 4% for Retiree #2.

See Tables 1-2 and 1-3, Set 4 for Retirees #2 and #3.

Using savings to enable delaying Social Security until age 70 is particularly attractive for risk-averse retirees who would otherwise invest significantly in low-performing fixed income assets or buy low-performing annuities. For example, suppose Retiree #2 invests 100% of savings in low-performing fixed income investments and uses RMD to calculate annual income from savings.

- By using savings to enable delaying Social Security to age 70, average annual income increases 14.1% compared to starting Social Security at age 65 ($48,499 vs. $42,488, respectively).
- The probability of shortfall is 100% for starting Social Security at age 65 but only 33% for starting Social Security at age 70. The magnitude of lifetime shortfall is -$152,653 when starting Social Security at age 65 but -$35,973 when starting Social Security at age 70.
- A delay strategy combined with low-performing VA/GLWB or FIA annuities shows similar effects but with lower magnitude.

See Table 1-2, Set 3 for Retiree #2.

13.8 The Tradeoff Between Income and Accessible Wealth

Results for different strategies (SWP percent and annuity choice) show a quantifiable tradeoff between the amount of income expected to be received throughout retirement and the expected amount of accessible wealth and bequest. The choice of strategy produces much more variance in the expected accessible wealth and bequest values, however, compared to the expected income values.

For example, for Retiree #2, comparing Set 4 (six high-performing solutions all with SS delayed to age 70):

- The annual expected income ranged from $50,319 (3% SWP/100% stocks) to $53,334, (RMD/100% stocks), a 6.0% spread.
- The expected accessible wealth ranged from $92,632 (100% FIA) to $245, 447 (3% SWP/100% stocks), a 165% spread.
- The expected bequest ranged from $9,662 (100% FIA) to $229,872 (3% SWP/100% stocks), a spread of more than 2,200%.

See Table 1-2, Set 4 for Retiree #2.

For retirees who are comfortable with investing 100% of remaining savings in stocks, using a portion of savings to enable delaying Social Security benefits reduces the risk of downside volatility and the probability and magnitude of shortfalls at the expense of amounts of accessible wealth and bequests.

For example, for Retiree #2 who uses RMD with 100% stocks, see the results when comparing starting Social Security at age 65 vs. age 70:

- Expected annual income increases from $51,038 to $53,334, an increase of 4.5%.
- Average accessible wealth decreases from $323,626 to $194,031, a decrease of 40%.
- Average bequest decreases from $185,843 to $104,323, a decrease of 44%.
- Downside volatility decreases from -2.6% to -1.5%.
- Probability of shortfall decreases from 39% to 4%.

See Table 1-2, Set 2 for Retiree #2.

13.9 Integrating the Results

Table 1 shows amounts of the various metrics for Retirees #1, #2, and #3. Figure 4 displays the metrics graphically in a dashboard. Figure 6 shows the percentages of initial retirement income provided by Social Security for various retirement income solutions.

Table 1 and Figure 4 show that the SS/RMD retirement strategy is a relatively straightforward solution to implement, as follows: A retiree would use a portion of savings to enable delaying Social Security benefits until age 70 and use the IRS RMD to calculate income generated from remaining assets. The retiree can select the equity asset allocation that they are most comfortable with (100%, 75%, or 50%). Higher stock allocations produce higher average income, accessible wealth, and bequest amounts, but also higher downside volatility metrics.

For many middle-income retirees, this solution represents a reasonable tradeoff between the goals of maximizing income, expected real increases in retirement income, reasonable levels of accessible wealth, modest bequest amounts, and low values for downside volatility and probability of shortfall.

It should be straightforward to implement this solution within most employer-sponsored defined contribution retirement plans and IRA platforms. Note that the equity allocation of many target date funds (TDF) is around 50% at retirement. As a result, one straightforward asset allocation decision is to use the applicable TDF in an employer-sponsored DC plan or a low-cost TDF offered by IRA administrator.

A more refined strategy that reduces downside volatility and probability of shortfall devotes a portion of assets (30% in our analyses) to either a SPIA, GLWB, or FIA, with remaining assets invested 100% in stocks and using the IRS RMD to determine retirement income from invested assets. Compared to the solution described above, it provides roughly the same amount of total average income but lower accessible wealth and bequest amounts. This strategy would be more complicated to implement in most DC plans, but it could be implemented in a retail IRA environment.

Section 14: Subproject C – Utilizing Home Equity for Retirement Income

We examined various ways to deploy reverse mortgages, including using them to generate regular retirement income, using them strategically to mitigate sequence of return risk with systematic withdrawal plans, and having available funds to pay for high medical and long-term care expenses.

Reverse mortgages are offered under the Home Equity Conversion Mortgage (HECM) program administered by the U.S. Housing and Urban Development Department and the Federal Housing Agency. Borrowing can take the form of a line of credit, which grows over time, or regular monthly tenure payments that last while the borrower remains in their home. For more details on reverse mortgages and a robust discussion of strategic uses for reverse mortgages to secure retirement, see "Reverse Mortgages: How to Use Reverse Mortgages to Secure Your Retirement."[7]

We examined how both line of credit and tenure options can be used to:

- Increase the amount of retirement income generated
- Improve the sustainability of retirement income
- Provide additional liquidity for emergencies and long-term care

14.1 Summary of Analyses

For Retirees #1, #2, and #3, we used the metrics developed in Subproject B to show how the metrics might be improved with various uses of home equity. We used six retirement income strategies identified as Set 4 in Subproject B. These six strategies are close to the efficient frontiers developed in Subproject A and represent distinct, reasonable strategies.

For each retiree, we produced four sets of metrics for the six retirement income solutions mentioned above, with the following four uses of home equity:

- **Use #1:** The retiree does not deploy home equity, which serves to increase bequests at death.
- **Use #2:** The retiree obtains a reverse mortgage line of credit (LOC) at retirement, but the loan isn't tapped throughout retirement. This analysis shows the increase in accessible wealth throughout retirement to use for high medical or long-term care expenses, or other contingencies.
- **Use #3:** The retiree takes out a reverse mortgage LOC at retirement and takes a tenure monthly payment to increase their retirement income. Our analyses display the resulting increases in total retirement income as well as the increases in accessible wealth throughout retirement as the LOC is drawn down. We calculate the tenure payment as the maximum payment that's allowed based on the age of the retiree and the value of the home equity.
- **Use #4:** The retiree obtains a reverse mortgage at retirement but only draws on it in years when the total retirement income falls below our assumed shortfall threshold for retirement income amounts. This situation would typically occur if investment results were unfavorable or inflation is high.

We acknowledge that there are other viable methods for deploying home equity. For example, several papers have analyzed viable strategies that take out a reverse mortgage LOC at retirement and use it to mitigate sequence of returns risk and enhance retirement security.[13,14,15,16] Similar to our analyses, these studies support setting up the LOC at retirement (or even earlier, when the youngest borrower is 62) instead of waiting to take out the LOC as a last resort, when it's needed to fill in gaps in income, or to use for unforeseen emergencies such as long-term care expenses. Setting up the LOC early instead of waiting can result in higher available amounts, due to the feature that the LOC grows with the interest rate on the loan.

We do not attempt to duplicate the significant findings of the papers noted above. Instead, we build on these papers by using the metrics and dashboard developed in Subproject B to show how retirees and their advisers can analyze and decide how to deploy home equity in retirement.

Tables 2-1, 2-2, and 2-3 show the dashboard metrics for Retirees #1, #2, and #3, respectively. Figures 5-1, 5-2, and 5-3 display the dashboard results graphically.

Appendix D describes our assumptions used to price reverse mortgages.

14.2 Discussion of Results

Let's examine the results for Retiree #2, the 65 year-old couple with $400,000 in retirement savings. We assumed this couple owns a mortgage-free house valued at $350,000. Table 2-2 shows the following results:

- **Use #1**, no deployment, shows no changes in the metrics except that the bequest values are increased by roughly the value of the home equity. The remaining sets use home equity throughout retirement, so the values from Use #1 can be used to assess the reduction in bequests under subsequent uses.
- **Use #2**, LOC set up to be used for contingencies, shows increases in average accessible wealth ranging from $260,756 to $265,956. These amounts are less than the home equity, due to limits on the amounts that can be borrowed and the expenses of the reverse mortgage. The increase in accessible wealth could be tapped for long-term care expenses and other emergencies without impacting the amount of retirement income generated by savings. In other words, the increase in accessible wealth could be viewed as true liquidity. The bequest amounts are lower than Use #1 by amounts ranging from $21,959 to $23,567, due to the initial expenses of the reverse mortgage growing at the loan interest rate over the retirement period. These amounts can be viewed as the "cost" of setting up a fund to pay for long-term care expenses from the LOC but without the risk pooling provided by long-term care insurance.
- **Use #3**, LOC used for a fixed tenure payment, is similar to an annuity. Note the tenure payment will be paid for life if the borrower stays in the home and meets homeowner obligations. The analyses show increases in average annual income ranging from $9,126 to $9,386. Note that these amounts are lower than the annual tenure payments that are level at $11,964 in nominal dollars because average income is converted to real dollars after inflation. The average accessible wealth and bequest amounts are considerably lower than Use #2 because the LOC is tapped continuously throughout retirement. Retiree #2 can use this information to decide if the increase in retirement

income is worth the reduction in the potential protection against long-term care expenses and bequests. Of course, Retiree #2 could take out less than the maximum tenure payment to increase the amount of the LOC that could be tapped for emergencies.

- **Use #4**, LOC used to fill in shortfalls, shows little change in the amounts of average income, average accessible wealth, and average bequests amounts. The analyses show that the probability of shortfalls falls to zero for four of the six retirement income solutions (the other two solutions had a zero probability of shortfall without using home equity).

The analyses for Retirees #1 and #3 produce similar results.

14.3 Income Tax Considerations

Note that with Use #3, the monthly tenure payment is not subject to income taxes. Our analyses add the monthly tenure payment to income from Social Security, which will be partially subject to income taxes, and withdrawals from savings, which will be fully subject to income taxes (assuming they're made from deductible IRAs and 401(k) plans and not Roth 401(k) or IRAs).

We believe that adjusting for income taxes would have a minimal impact on our results and conclusions. See Section 10.6 for the reasons supporting this conclusion and for a more complete discussion of income taxes.

14.4 Caveats and Cautions

These analyses demonstrate how retirees and their advisers can weigh and compare various uses of home equity when developing retirement income strategies and methods to protect against unforeseen emergencies. We caution readers against drawing general conclusions that reverse mortgages should be used broadly. It's best to use reverse mortgages when the retiree plans to stay in the house for the foreseeable future and can afford the costs for maintenance, insurance, and property taxes. This way, the costs for initiating the reverse mortgage are amortized over many years.

It's also recommended that retirees and their advisers decide on the best use, if any, for deploying home equity by analyzing the pros and cons of each potential solutions using analyses similar to those described in this report.

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Appendices: Assumptions and Methods

Appendix A: Assumptions for Hypothetical Retirees

Retiree #1: Single female retiring at 65
Retirement savings at age 65: $250,000
Home equity at age 65: $200,000
Pre-retirement income: $50,000
Social Security starting at 65: $16,604
Social Security starting at age 70: $23,491
Assumed threshold of annual minimum needed income: $27,129 (54% of pre-retirement pay)

Retirees #2: Married 65-year-old couple
Retirement savings at age 65: $400,000
Home equity at age 65: $350,000
Pre-retirement income (husband): $75,000
Pre-retirement income (wife): $25,500
Social Security starting at 65:

- Husband's worker benefit: $22,202
- Wife's worker benefit: $11,101

Husband's Social Security worker's benefit at starting at 70: $31,411
Wife's Social Security worker's benefit starting at 66: $11,898
Estimated threshold of annual minimum needed income: $47,823 (48% of combined pre-retirement pay for the couple)

Retirees #3: Married 65-year-old couple
Retirement savings at age 65: $1,000,000
Home equity at age 65: $500,000
Pre-retirement income (husband): $127,200
Pre-retirement income (wife): $45,100
Social Security starting at 65:

- Husband's worker benefit: $30,610
- Wife's worker benefit: $15,305

Husband's Social Security worker's benefit starting at 70: $43,307
Wife's Social Security worker's benefit at starting at 66: $16,404
Estimated threshold of annual minimum needed income: $82,215 (48% of combined pre-retirement pay for the couple)

Development of guideline expenses

For each of Retiree #s 1, 2, and 3, we set a guideline for retirement spending as the amount of Social Security (assuming commencement at 65) plus the amount of income that could be generated from savings by purchase of an inflation-adjusted single-premium immediate annuity (SPIA). This guideline would cover both essential and discretionary spending.

The reason for assuming Social Security begins at the assumed retirement age of 65 is that this is a more typical behavior than deferring Social Security, even though deferral may be financially advantageous.

The rationale for using the income that could be generated from an inflation-adjusted SPIA is that it provides a good benchmark for the cost of retirement.[17]

We set the guidelines as level real amounts although there is some evidence that spending decreases over the course of retirement.[12] However, it is not clear whether such decreases are voluntary or forced by budget constraints. Also, many retirees will experience late-in-life expense increases for medical costs and/or long-term care. To keep things simple, we set level, real income guidelines.

Payout rates for inflation-adjusted SPIAs were 4.21% for a 65-year-old female (Retiree #1) as of January 2017 and 3.63% for a 65-year-old couple (Retirees #2 and #3). The following chart shows the development of the expense guidelines.

Expense guidelines	Retiree #1	Retiree #2	Retiree #3
Final earnings pre-retirement	$50,000	$100,500	$172,300
Social Security at 65	$16,604	$33,303	$45,915
Savings at 65	$250,000	$400,00	$1,000,000
Inflation-adjusted SPIA payout rate	4.21%	3.63%	3.63%
Level real income from savings	$10,525	$14,520	$36,30
Expense guideline	$27,129	$47,823	$82,215

For the purposes of comparison, the *2015 Consumer Expenditure Survey*[18] by the U.S. Bureau of Labor Statistics shows the average mean expenditures per household for all items as follows:

- Ages 65-74: $49,477 (average 1.8 persons per household)
- Ages 75 and older: $38,123 (average 1.6 persons per household)

As a result, the expense threshold for Retiree #2 might be representative of a new average retiree, while Retiree #3 might be considered an affluent retiree.

Appendix B: Investment Return and Mortality Assumptions

	Real Returns			Correlation Coefficients		
	Arithmetic Mean	Geometric Mean	Standard Deviation	Stocks	Bonds	Inflation
Stocks	5.1%	3.1%	20.0%	1.0	0.1	-0.2
Bonds	0.3%	0.2%	7.0%	0.1	0.1	-0.6
Inflation	2.1%	2.0%	4.2%	-0.2	-0.6	1.0

Note: These are the same return assumptions used in our prior study, *Optimizing Retirement Income Solutions in Defined Contribution Retirement Plans*,[5] and they are lower than historical averages. Bond returns reflect the current low interest rate environment, and stock returns reflect a lower-than-historical premium over bond returns.

In terms of recent trends, bond yields and inflation expectations (as measured by the difference between yields on Treasury Bonds and Treasury Inflation-Protected Securities) have risen substantially since late summer 2016. Currently, both yields and inflation expectations are very slightly below the above return assumptions, but given the upward trends, it did not seem appropriate to reduce the bond and inflation assumptions. It seemed reasonable to hold the stock assumption given no change in our forward outlook for the dividend and dividend growth components. The standard deviations and correlations reflect long-term historical averages, and we don't believe there's a better way to do future estimates for these parameters than using the historical averages.

Charges for investments used in systematic withdrawal plans (SWPs)

- High-Performing: 50 basis points applied each year to account value
- Low-Performing: 150 basis points applied each year to account value

Mortality Assumptions

The mortality table for survival probabilities is the Society of Actuaries' *RP-2014 Mortality Tables for Healthy Annuitants*, projected to 2017, and then projected forward from age 65 assuming a 1% annual mortality improvement for ages up to age 85 and the percentage grading down thereafter. Note that this table excludes annuitants who are classified as disabled; it may also include annuitants who are somewhat unhealthy but not disabled.

Appendix C: General Investment and Annuity Product Assumptions

Assumptions for product pricing and investment returns net of expenses are split into categories, labeled "High-Performing" and "Low-Performing."

High-Performing assumptions are intended to be representative of pricing that could obtained by sophisticated plan sponsors (or plan sponsors with consultants) carefully choosing among alternatives to find those that offer the best value.

Low-Performing assumptions are intended to be more representative of the pricing that plan participants with an average level of financial sophistication would obtain in the retail market for financial products. This Low-Performing category also reflects the possibility that retirees will not necessarily be able to make optimal use of investment products in terms of asset allocation timing of investment moves.

In general, we have assumed about a 10% difference in income generation between High-Performing and Low-Performing annuity products, although there are variations for specific products.

We show projected incomes are gross amounts, before income taxes, although all projected retirement incomes will be fully taxable during retirement since they are coming out of a tax-deferred account. However, we have not dealt with the complexity of incorporating taxes because tax effects can vary substantially by household.

Variable annuities with guaranteed lifetime withdrawal benefits (VA/GLWBs)

High-Performing: 150 basis points in total annual charges (50 basis points of investment and insurance charges applied to the account value, 100 basis points for the VA/GLWB rider applied to the benefit base).

Low-Performing: 350 basis points in total annual charges (225 basis points of investment and insurance charges applied to the account value, 125 basis points for the VA/GLWB rider applied to the benefit base). Surrender charges: 8.5% first year, 8% second year, decreasing by 1% each year thereafter, down to 3% for year seven and 0% for years eight and after—applied to account value.

Asset allocation: 60% stocks and 40% bonds for both High-Performing and Low-Performing

Fixed index annuities
Modeling is based on representative FIA products.

High-Performing: Maximum annual credited rate (Cap Rate) of 4.5% based on performance of the S&P 500 minus dividends. Minimum credited rate of 0%.

Low-Performing: Maximum annual credited rate (Cap Rate) of 2.5% based on performance of the S&P 500 minus dividends. Minimum credited rate of 0%.

For both High-Performing and Low-Performing:

- VA/GLWB rider charge: 1.05% of the accumulation value
- Age 65 payout percentages: 4.5% single life, 4% couple (under Option 2, which provides the opportunity for increasing payments)
- For purchases at ages 55 and 60 with payments beginning at 65:

  - Age 55: initial percentages of 3.5%/3%, single/joint, increasing 0.30% each year of deferral
  - Age 60: initial percentages of 4%/3.5%, single/joint, increasing 0.35% each year of deferral

- Surrender charges: 8.5% first year, 8% second year, decreasing by 1% each year thereafter, down to 3% for year seven and 0% for years eight and after—applied to account value.

Single-premium immediate annuities (SPIAs) and Deferred income annuities (DIAs)

For the purposes of this report, annuity payout rates were sampled in January 2017 using the Income Solutions® annuity bidding platform. These payout rates are 9% to 13% below the rates from the original study, which were derived in April 2014. Interest rates are slightly lower than they were then, but that doesn't explain the whole difference. There may be some impact of insurers switching to newer mortality tables for pricing.

Products for Retiree #1
Single-life female product pricing at age 65 (annual income as a percent of annuity purchase price)

- Inflation-adjusted SPIA: 4.21%
- Level payment SPIA: 6.16%
- SPIA with 3% annual growth rate of payments: 4.44%

Deferred income annuities (DIAs)—including special Retiree #1 characteristics

- Single female retiring at age 65
- $180,000 of assets at age 55
- No contributions assumed after age 55
- Rates for level-payment DIA commencing at age 65:
  - Purchase age 55: 9.02%
  - Purchase age 60: 7.50%

Products for Retirees #2 and #3

Joint-life product pricing at age 65 (annual income as a percent of annuity purchase price)

- Inflation-adjusted 100% Joint & Survivor SPIA: 3.63%
- Level payment SPIA: 5.47%
- SPIA with 3% annual growth rate of payments: 3.83%

Deferred income annuities (DIAs)—including special Retiree #2 characteristics

- Married 55-year-old retired couple
- $300,000 of assets at age 55
- No contributions assumed after age 55
- Rates for level-payment Joint & 100% Survivor DIA commencing at age 65:
  - Purchase age 55: 8.12%
  - Purchase age 60: 6.74%

The above rates apply for High-Performing products. Rates for Low-Performing SPIA products are determined by reducing payouts by 10%. For DIAs purchased at age 60 with payments beginning at 65, the reduction for Low-Performing is 15%. For age 55 DIA purchases with a 10-year deferral, the reduction for Low-Performing is 20%.

Caveat regarding annuities

The analyses in this report assume no risk of insurance company default. Retirees and advisers who want to address this risk should consider insurance company ratings and the limits of state guaranty associations. Consistent with the goal of developing a diversified portfolio of retirement income, retirees may want to consider diversifying annuity purchases among more than one insurance company.

Appendix D: Assumptions Regarding Reverse Mortgages

Home is mortgage-free at retirement.

Upfront fees are financed through the mortgage, going into the loan balance, and include:

- Allowed loan origination fee
- 0.5% mortgage insurance premium
- $2,500 for closing costs

Loan terms:

- Lender's margin: 3%
- 10-year LIBOR: 2.4%
- Home price growth: 2%
- Age: 65
- One-month LIBOR: 0.7%
- Expected rate: 5.375%
- PLF: 49.4%

Since our Monte Carlo simulations just simulate bond returns rather than interest rates, interest rates or home appreciation aren't forecasted stochastically. These rates are fixed throughout the forecast period. The 10-year LIBOR is justified based on bond real bond return of 0.3% + our inflation expectation of 2.1%.

Retiree 1 home equity: $200,000

- Upfront fees for RM: $7,500
- Net principal limit: $91,300
- Annual tenure payment: $6,695

Retiree 2 home equity: $350,000

- Upfront fees for RM: $9,750
- Net principal limit: $163,150
- Annual tenure payment: $11,964

Retiree 3 home equity: $550,000

- Upfront fees for RM: $11,250
- Net principal limit: $260,450
- Annual tenure payment: $19,099

Appendix E: Withdrawal Percentages Under the IRS Required Minimum Distribution

Age	Distribution period in years	Minimum payout rate
70	27.4	3.65%
71	26.5	3.77%
72	25.6	3.91%
73	24.7	4.05%
74	23.8	4.20%
75	22.9	4.37%
76	22.0	4.55%
77	21.2	4.72%
78	20.3	4.93%
79	19.5	5.13%
80	18.7	5.35%
81	17.9	5.59%
82	17.1	5.85%
83	16.3	6.13%
84	15.5	6.45%
85	14.8	6.76%
86	14.1	7.09%
87	13.4	7.46%
88	12.7	7.87%
89	12.0	8.33%
90	11.4	8.77%

Notes:

- The RMD table continues beyond age 90.
- Use the account holder's age on their birthday during the calendar year.
- If the account holder is married and the spouse is more than 10 years younger, a different table with payout rates that are lower than the above rates applies.

Appendix F: Federal Income Tax Rates and Standard Deductions in 2017

Tax Rate	Taxable Income Single	Taxable Income Married
70	$0 - $9,325	$0 to $18,650
71	$9,326 - $37,950	$18,651 - $75,900
72	$37,951 - $91,900	$75,901 - $153,100
73	$91,901 - $191, 650	$153,101 - $233,350
74	$191,651 - $416,700	$233,351 - $416,700
75	$416,701 - $418,400	$416,701 - $470,700
76	Over $418,400	Over $470,700

Note that taxable income is net of deductions from gross income.

Standard deductions in 2017:

- Single: $6,350
  - Add $1,550 for age 65+
- Married filing jointly: $12,700
  - Add $1,250 for each person age 65+

Stanford Center on Longevity (SCL)

The mission of the Stanford Center on Longevity is to redesign long life. The Center studies the nature and development of the human life span, looking for innovative ways to use science and technology to solve the problems of people over 50 to improve the well-being of people of all ages.

Additional information and research reports may be found at http://longevity.stanford.edu.

Society of Actuaries (SOA) Committee on Post-Retirement Needs and Risks

The Society of Actuaries is an educational and research organization for actuaries. The Society of Actuaries would like to acknowledge the work of its Committee on Post-Retirement Needs and Risks for its role in this research. The Committee's mission is to initiate and coordinate the development of educational materials, continuing education programs and research related to risks and needs during the post-retirement period. Individuals interested in learning more about the committee's activities are encouraged to contact the Society of Actuaries at (847) 706-3500 for more information. Additional information and research reports may be found at:

https://www.soa.org/research/research-projects/pension/research-post-retirement-needs-and-risks.aspx.

SOA Pension Section

The Pension Section of the Society of Actuaries facilitates the professional development of its members and their adaptation to changes in the retirement industry by:

- Conducting meetings, webcasts, seminars, and research studies
- Generating and disseminating literature in the retirement field
- Providing a forum for its members to connect
- Providing leadership opportunities

It is led by the SOA Pension Section Council.

Figure 1-1-H

High Performance Case
Phase 1
Retiree #1: Female retiring at 65 with $250,000
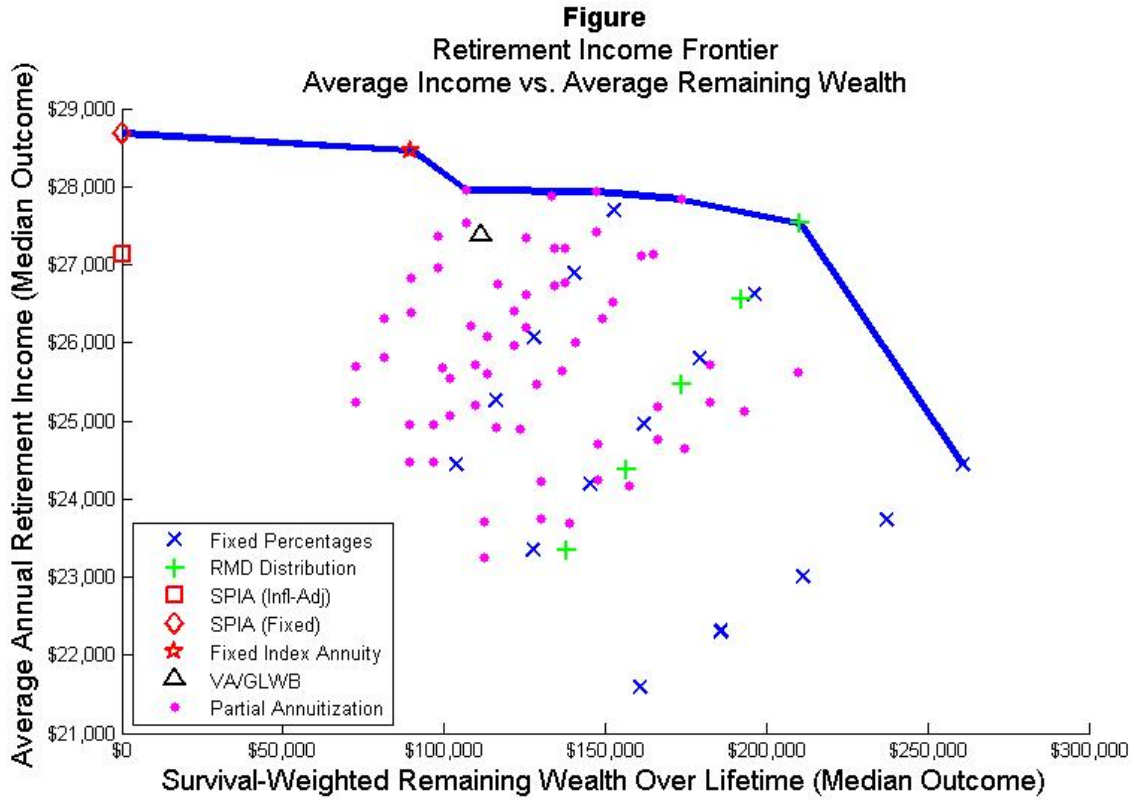
Figure
Retirement Income Frontier
Average Income vs. Average Remaining Wealth

Values on efficient frontier

Retirement Income Solution	Average Accessible Wealth	Average Income
100% Fixed SPIA	$0	$28,682
100% FIA	$89,946	$28,455
30% Fixed SPIA, 70% 7% w/100% stocks	$106,930	$27,950
30% Fixed SPIA, 70% RMD w/100% stocks	$147,237	$27,930
30% FIA, 70% RMD w/100% stocks	$173,599	$27,835
RMD w/100% stocks	$210,339	$27,533
3% SWP w/100% stocks	$260,928	$24,437

Figure 1-1-L

Low Performance Case
Phase 1
Retiree #1: Female retiring at 65 with $250,000
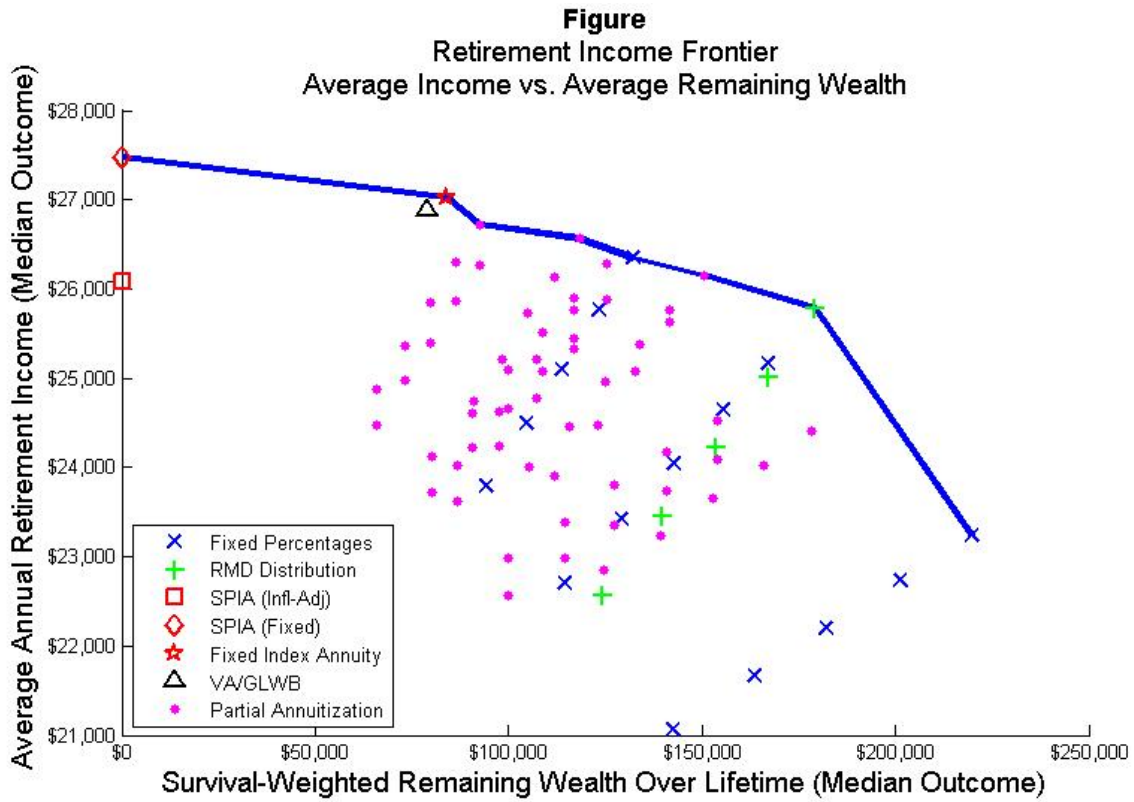
Figure
Retirement Income Frontier
Average Income vs. Average Remaining Wealth

Values on efficient frontier

Retirement Income Solution	Average Accessible Wealth	Average Income
100% Fixed SPIA	$0	$27,477
100% FIA	$83,955	$27,022
30% Fixed SPIA, 70% 7% SWP w/100% stocks	$92,510	$26,722
30% FIA, 70% 7% SWP w/100% stocks	$118,249	$26,565
7% SWP w/100% stocks	$132,157	$26,348
30% FIA, 70% RMD w/100% stocks	$150,499	$26,145
RMD w/100% stocks	$179,208	$25,789
3% SWP w/100% stocks	$219,779	$23,237

Figure 1-2-H

High Performance Case
Phase 1
Retiree #2: Couple retiring at 65 with $400,000
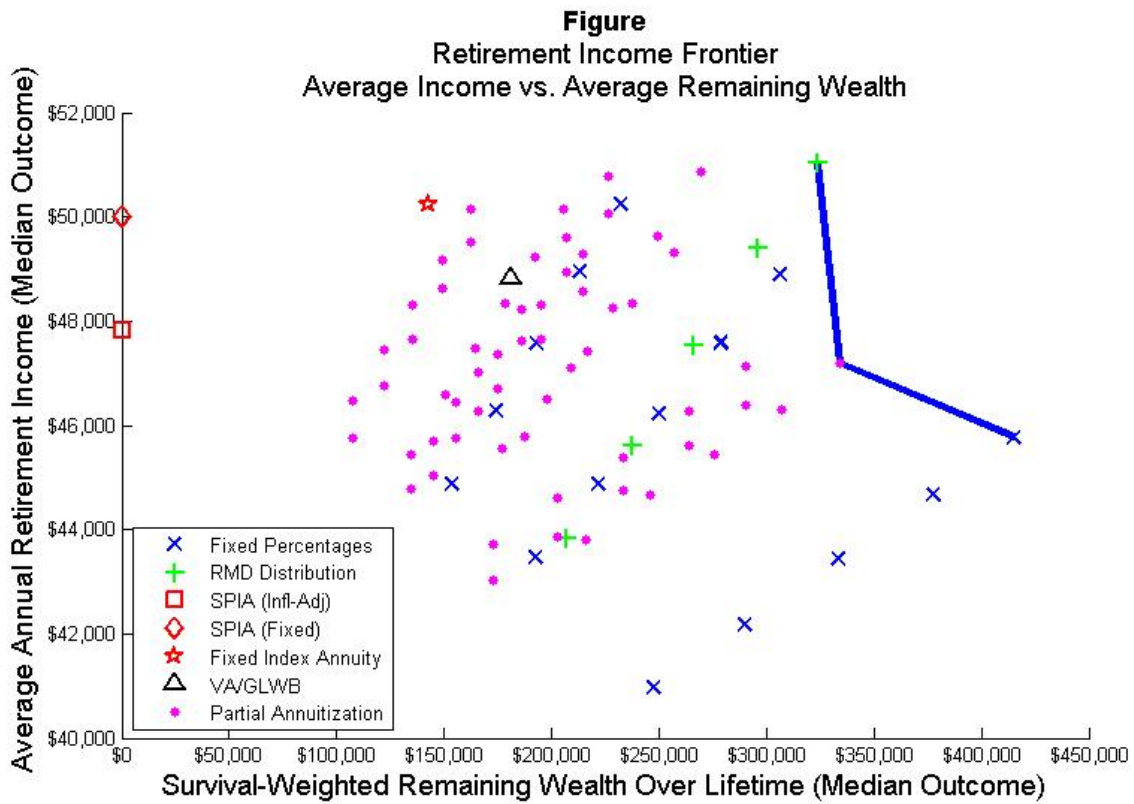
Figure
Retirement Income Frontier
Average Income vs. Average Remaining Wealth

Values on efficient frontier

Retirement Income Solution	Average Accessible Wealth	Average Income
RMD w/100% stocks	$323,626	$51,038
30% FIA, 70% 3% SWP w/100% stocks	$334,162	$47,205
3% SWP w/100% stocks	$415,130	$45,777

Figure 1-2-L

Low Performance Case
Phase 1
Retiree #2: Couple retiring at 65 with $400,000
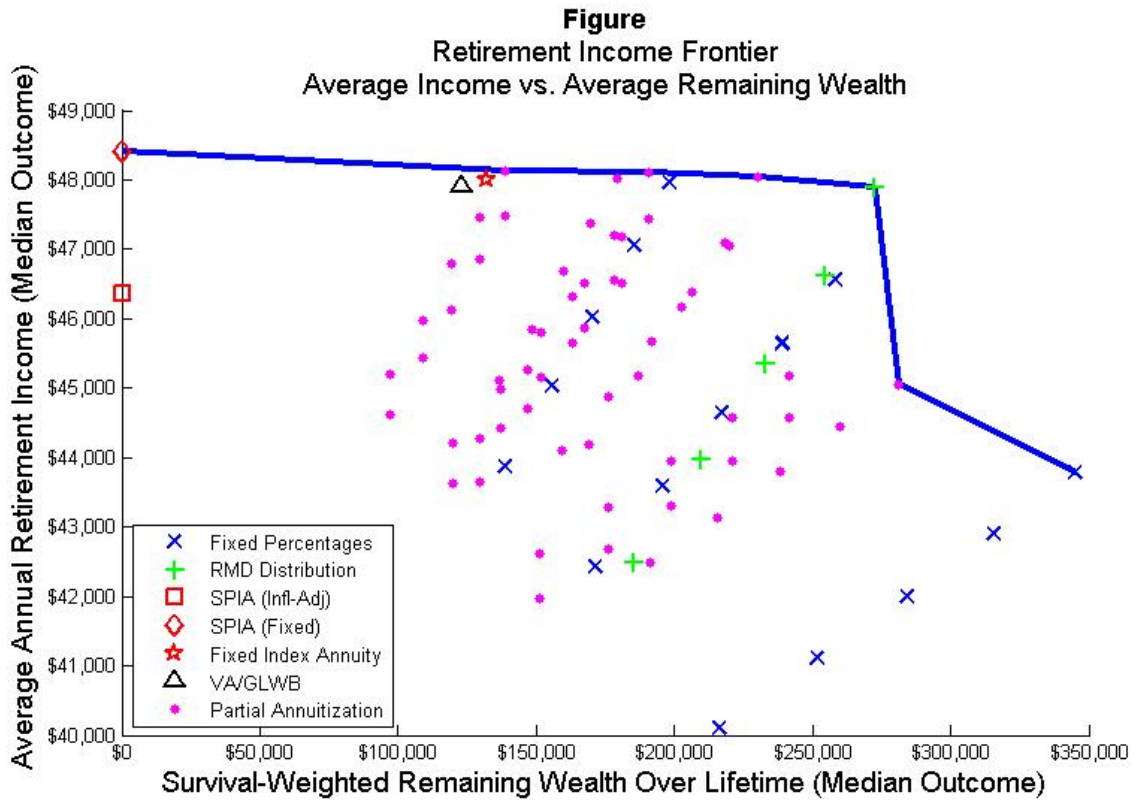
Figure
Retirement Income Frontier
Average Income vs. Average Remaining Wealth

Values on efficient frontier

Retirement Income Solution	Average Accessible Wealth	Average Income
100% Fixed SPIA	$0	$48,409
30% Fixed SPIA, 70% 7% SWP w/100% stocks	$138,771	$48,136
30% Fixed SPIA, 70% RMD w/100% stocks	$190,848	$48,114
30% FIA, 70% RMD w/100% stocks	$230,203	$48,047
RMD w/100% stocks	$272,640	$47,891
30% FIA, 70% 3% SWP w/100% stocks	$281,166	$45,057
3% SWP w/100% stocks	$345,113	$43,794

Figure 1-3-H

High Performance Case
Phase 1
Retiree #3: Couple retiring at 65 with $1 million

Figure
Retirement Income Frontier
Average Income vs. Average Remaining Wealth

Values on efficient frontier

Retirement Income Solution	Average Accessible Wealth	Average Income
RMD w/100% stocks	$809,064	$90,253
30% FIA, 70% 3% SWP w/100% stocks	$835,404	$80,671
3% SWP w/100% stocks	$1,037,824	$77,100

Figure 1-3-L

Low Performance Case
Phase 1
Retiree #3: Couple retiring at 65 with $1 million
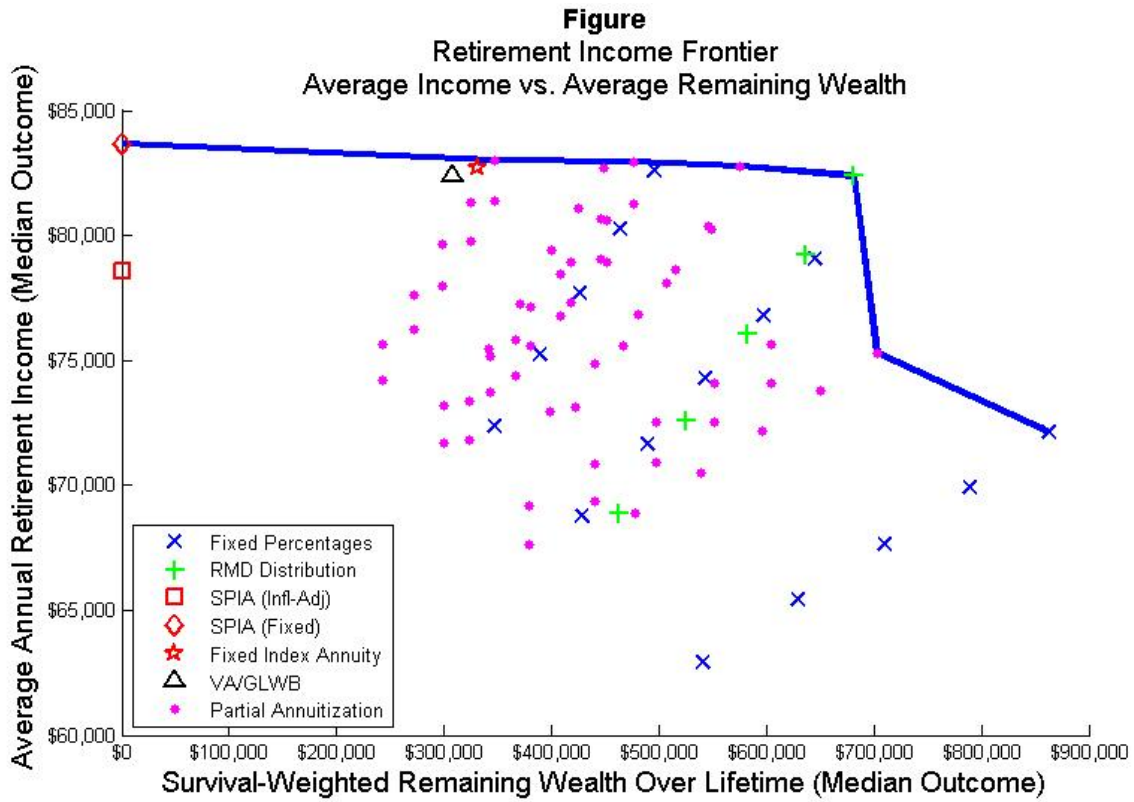
Figure
Retirement Income Frontier
Average Income vs. Average Remaining Wealth

Values on efficient frontier

Retirement Income Solution	Average Accessible Wealth	Average Income
100% Fixed SPIA	$0	$83,679
30% Fixed SPIA, 70% 7% SWP w/100% stocks	$346,926	$82,997
30% Fixed SPIA, 70% RMD w/100% stocks	$477,120	$82,942
30% FIA, 70% RMD w/100% stocks	$575,507	$82,775
RMD w/100% stocks	$681,600	$82,385
30% FIA, 70% 3% SWP w/100% stocks	$702,916	$75,300
3% SWP w/100% stocks	$862,778	$72,142

Figure 2-1-H

High Performance Case
Phase 2
Retiree #1: Female retiring at 65 with $250K and Delayed Social Security Strategy

Figure
Retirement Income Frontier
Average Income vs. Average Remaining Wealth
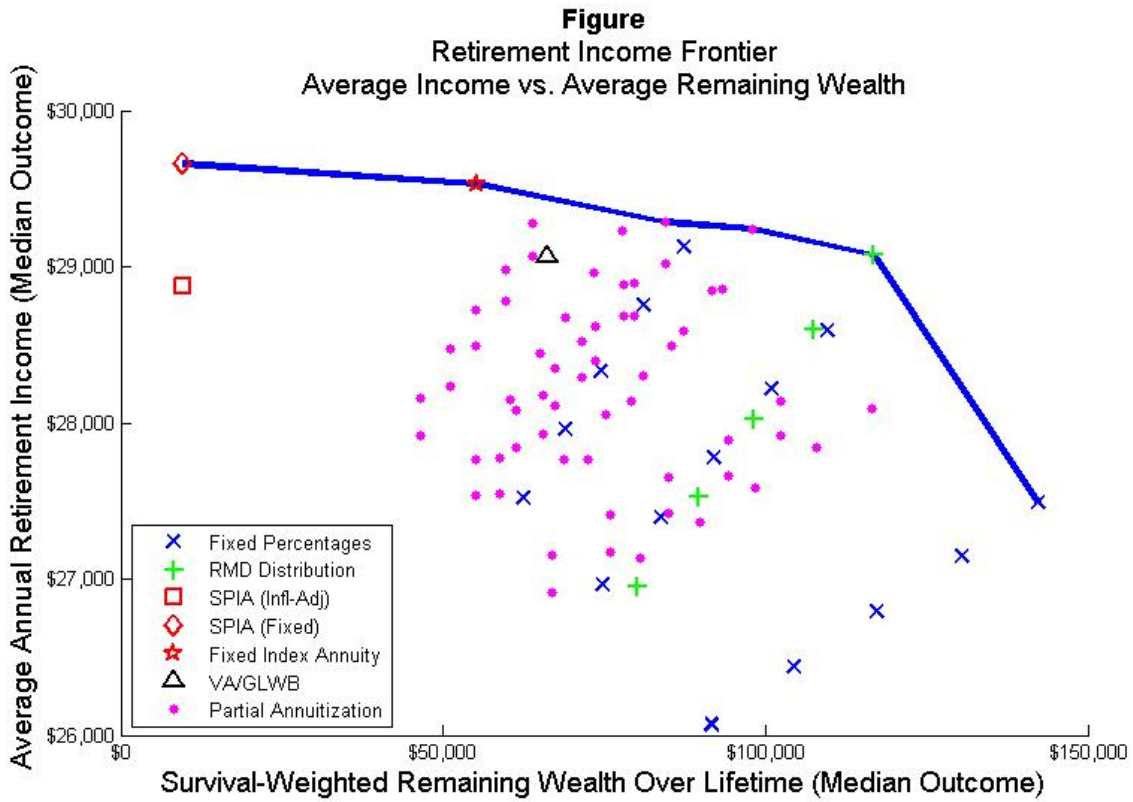
Values on efficient frontier

Retirement Income Solution	Average Accessible Wealth	Average Income
100% Fixed SPIA	$9,520	$29,658
100% FIA	$55,351	$29,529
30% Fixed SPIA, 70% RMD w/100% stocks	$84,393	$29,285
30% FIA, 70% RMD w/100% stocks	$97,915	$29,243
RMD w/100% stocks	$116,721	$29,075
3% SWP w/100% stocks	$142,246	$27,491

Figure 2-1-L

Low Performance Case
Phase 2
Retiree #1: Female retiring at 65 with $250K and Delayed Social Security Strategy

Figure
Retirement Income Frontier
Average Income vs. Average Remaining Wealth
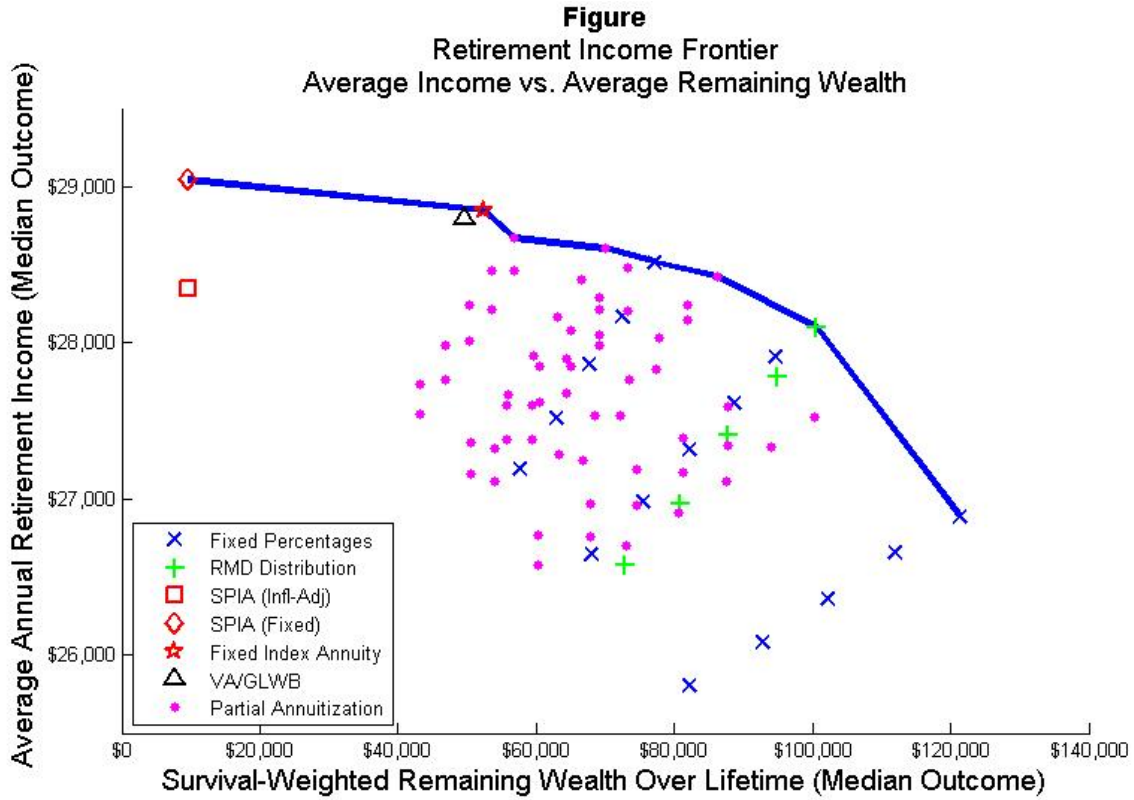
Values on efficient frontier

Retirement Income Solution	Average Accessible Wealth	Average Income
100% Fixed SPIA	$9,544	$29,045
100% FIA	$52,382	$28,845
30% Fixed SPIA, 70% 7% SWP w/100% stocks	$56,805	$28,669
30% FIA, 70% 7% SWP w/100% stocks	$69,961	$28,601
7% SWP w/100% stocks	$77,096	$28,517
30% FIA, 70% RMD w/100% stocks	$86,180	$28,424
RMD w/100% stocks	$100,447	$28,102
3% SWP w/100% stocks	$121,284	$26,889

Figure 2-2-H

High Performance Case
Phase 2
Retiree #2: Couple retiring at 65 with $400K and Delayed Social Security Strategy

Figure
Retirement Income Frontier
Average Income vs. Average Remaining Wealth
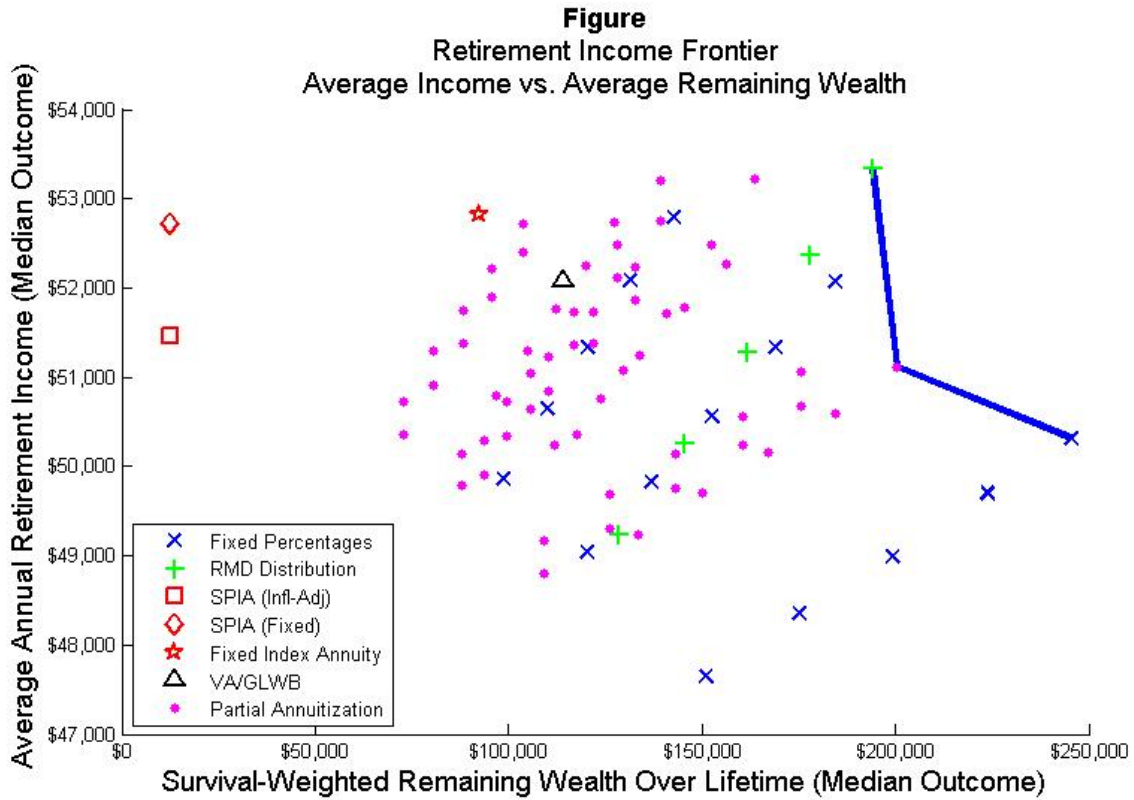
Values on efficient frontier

Retirement Income Solution	Average Accessible Wealth	Average Income
RMD w/100% stocks	$194,031	$53,334
30% FIA, 70% 3% SWP w/100% stocks	$200,450	$51,112
3% SWP w/100% stocks	$245,448	$50,319

Figure 2-2-L

Low Performance Case
Phase 2
Retiree #2: Couple retiring at 65 with $400K and Delayed Social Security Strategy

Figure
Retirement Income Frontier
Average Income vs. Average Remaining Wealth
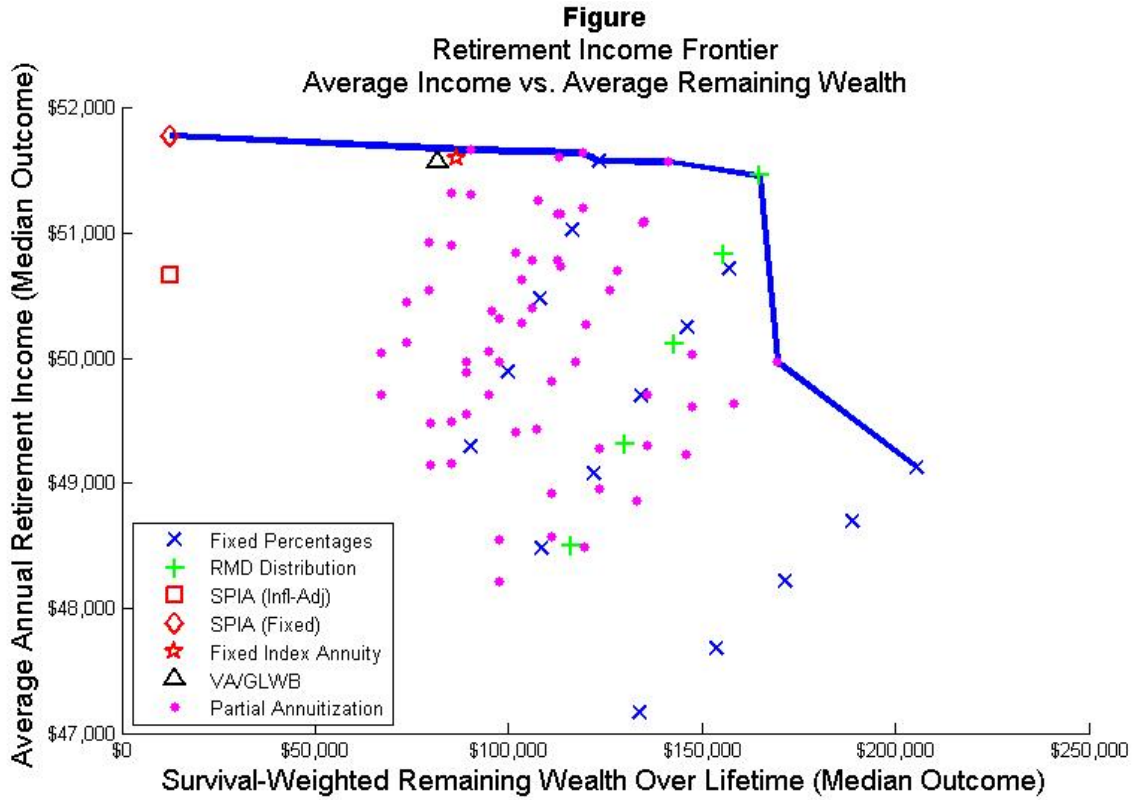
Values on efficient frontier

Retirement Income Solution	Average Accessible Wealth	Average Income
100% Fixed SPIA	$12,407	$51,784
30% Fixed SPIA, 70% 7% SWP w/100% stocks	$90,080	$51,669
30% Fixed SPIA, 70% RMD w/100% stocks	$119,051	$51,645
7% SWP w/100% stocks	$123,326	$51,576
30% FIA, 70% RMD w/100% stocks	$141,370	$51,575
RMD w/100% stocks	$164,848	$51,467
30% FIA, 70% 3% SWP w/100% stocks	$169,570	$49,970
3% SWP w/100% stocks	$205,434	$49,132

Figure 2-3-H

High Performance Case
Phase 2
Retiree #2: Couple retiring at 65 with $1 million and Delayed Social Security Strategy

Figure
Retirement Income Frontier
Average Income vs. Average Remaining Wealth
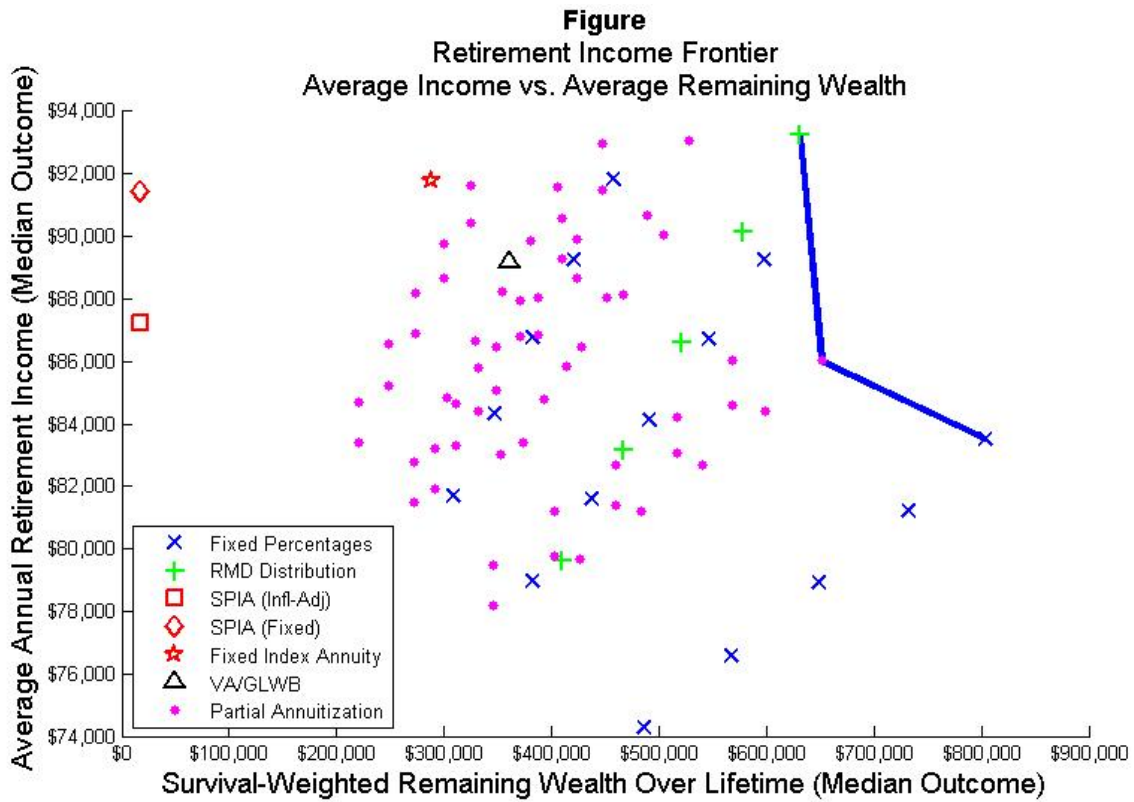
Values on efficient frontier

Retirement Income Solution	Average Accessible Wealth	Average Income
RMD w/100% stocks	$630,876	$93,269
30% FIA, 70% 3% SWP w/100% stocks	$651,278	$86,010
3% SWP w/100% stocks	$803,880	$83,530

Figure 2-3-L

Low Performance Case
Phase 2
Retiree #2: Couple retiring at 65 with $1 million and Delayed Social Security Strategy

Figure
Retirement Income Frontier
Average Income vs. Average Remaining Wealth
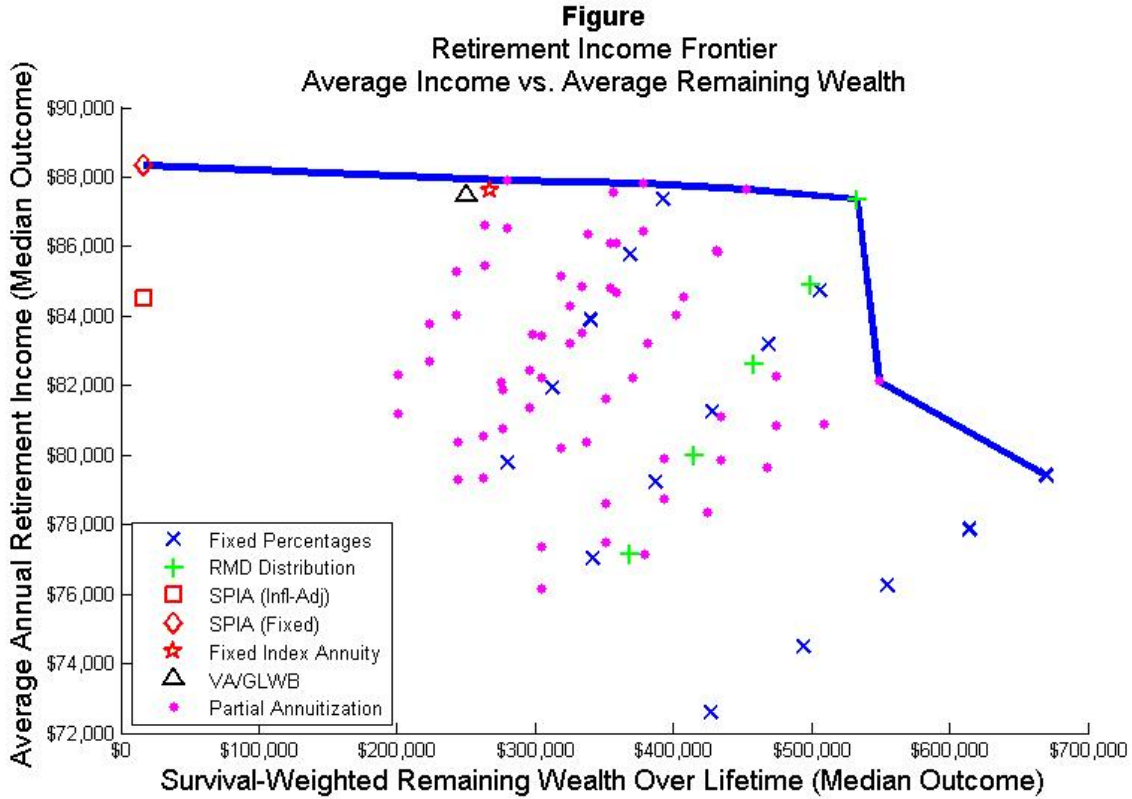
Values on efficient frontier

Retirement Income Solution	Average Accessible Wealth	Average Income
100% Fixed SPIA	$17,105	$88,338
30% Fixed SPIA, 70% 7% SWP w/100% stocks	$279,717	$87,902
30% Fixed SPIA, 70% RMD w/100% stocks	$378,187	$87,809
30% FIA, 70% RMD w/100% stocks	$452,866	$87,635
RMD w/100% stocks	$533,005	$87,357
30% FIA, 70% 3% SWP w/100% stocks	$548,912	$82,123
3% SWP w/100% stocks	$699,975	$79,419

Figure 3 – Retirement Income and Wealth Progression Analyses
Use savings to enable delaying Social Security to 70
High-performing solutions

Figure
Distribution of Annual Withdrawal Amounts (10th, 25th, 50th, 75th, & 90th Percentiles)
3% Withdrawal Rate with 50% Stocks
65-Year Old Retiring Couple with $400k

Figure
Distribution of Remaining Real Wealth (10th, 25th, 50th, 75th, & 90th Percentiles)
3% Withdrawal Rate with 50% Stocks
65-Year Old Retiring Couple with $400k

Figure 3 – Retirement Income and Wealth Progression Analyses
Use savings to enable delaying Social Security to 70
High-performing solutions

Figure
Distribution of Annual Withdrawal Amounts (10th, 25th, 50th, 75th, & 90th Percentiles)
7% Withdrawal Rate with 50% Stocks
65-Year Old Retiring Couple with $400k

Figure
Distribution of Remaining Real Wealth (10th, 25th, 50th, 75th, & 90th Percentiles)
7% Withdrawal Rate with 50% Stocks
65-Year Old Retiring Couple with $400k

Figure 3 – Retirement Income and Wealth Progression Analyses
Use savings to enable delaying Social Security to 70
High-performing solutions

Figure
Distribution of Annual Withdrawal Amounts (10th, 25th, 50th, 75th, & 90th Percentiles)
RMD Withdrawal Rate with 50% Stocks
65-Year Old Retiring Couple with $400k

Figure
Distribution of Remaining Real Wealth (10th, 25th, 50th, 75th, & 90th Percentiles)
RMD Withdrawal Rate with 50% Stocks
65-Year Old Retiring Couple with $400k

Figure 3 – Retirement Income and Wealth Progression Analyses
Use savings to enable delaying Social Security to 70
High-performing solutions

Figure
Distribution of Annual Withdrawal Amounts (10th, 25th, 50th, 75th, & 90th Percentiles)
100% to Fixed SPIA
65-Year Old Retiring Couple with $400k

Figure
Distribution of Remaining Real Wealth (10th, 25th, 50th, 75th, & 90th Percentiles)
100% to Fixed SPIA
65-Year Old Retiring Couple with $400k

Figure 3 – Retirement Income and Wealth Progression Analyses
Use savings to enable delaying Social Security to 70
High-performing solutions

Figure

Distribution of Annual Withdrawal Amounts (10th, 25th, 50th, 75th, & 90th Percentiles)
100% to Fixed Index Annuity
65-Year Old Retiring Couple with $400k

Figure

Distribution of Remaining Real Wealth (10th, 25th, 50th, 75th, & 90th Percentiles)
100% to Fixed Index Annuity
65-Year Old Retiring Couple with $400k

98

Figure 3 – Retirement Income and Wealth Progression Analyses
Use savings to enable delaying Social Security to 70
High-performing solutions

Figure
Distribution of Annual Withdrawal Amounts (10th, 25th, 50th, 75th, & 90th Percentiles)
100% to VA/GLWB
65-Year Old Retiring Couple with $400k

Figure
Distribution of Remaining Real Wealth (10th, 25th, 50th, 75th, & 90th Percentiles)
100% to VA/GLWB
65-Year Old Retiring Couple with $400k

RETIREMENT INCOME DASHBOARD

Figure 4-1

No deployment of home equity

Retiree #1: 65-year old female with $250,000 in savings

Set 1: Compare the impact of asset allocation for high-performance solutions

	30% SPIA/RMD, 100% stocks, SS@70	30% SPIA/RMD, 75% stocks, SS@70	30% SPIA/RMD, 50% stocks, SS@70	RMD, 100% stocks, SS@70	RMD, 75% stocks, SS@70	RMD, 50% stocks, SS@70

AVERAGE INCOME
Average anual real income throughout retirement

DIRECTION OF INCOME
Percentage change in income over retirement

AVERAGE ACCESSIBLE WEALTH
Average real liquid assets throughout retirement

DIRECTION OF WEALTH
Percentage change in wealth over retirement

AVERAGE BEQUEST
Average real assets left at end of life

DOWNSIDE VOLATILITY
Average decrease in total retirement income

PROBABILITY OF SHORTFALL
Chance that income falls below essential exprense threshold

MAGNITUDE OF SHORTFALL
Total average lifetime shortfall when income falls below threshold

100

Figure 4-1

RETIREMENT INCOME DASHBOARD
No deployment of home equity

Retiree #1: 65-year old female with $250,000 in savings

Set 2: Compare the delaying Social Security for high-performance solutions

	100% SPIA, SS@65	100% SPIA, SS@70	RMD, 0% stocks, SS@65	RMD, 0% stocks, SS@70	RMD, 100% stocks, SS@65	RMD, 100% stocks, SS@70

AVERAGE INCOME
Average anual real income throughout retirement

DIRECTION OF INCOME
Percentage change in income over retirement

AVERAGE ACCESSIBLE WEALTH
Average real liquid assets throughout retirement

DIRECTION OF WEALTH
Percentage change in wealth over retirement

AVERAGE BEQUEST
Average real assets left at end of life

DOWNSIDE VOLATILITY
Average decrease in total retirement income

PROBABILITY OF SHORTFALL
Chance that income falls below essential exprense threshold

MAGNITUDE OF SHORTFALL
Total average lifetime shortfall when income falls below threshold

Figure 4-1

RETIREMENT INCOME DASHBOARD
No deployment of home equity

Retiree #1: 65-year old female with $250,000 in savings

Set 3: Assess the impact of low-performing solutions

Figure 4-1

RETIREMENT INCOME DASHBOARD
No deployment of home equity

Retiree #1: 65-year old female with $250,000 in savings

Set 4: Compare high-performing solutions near the efficient frontier

RETIREMENT INCOME DASHBOARD

Figure 4-2

No deployment of home equity

Retiree #2: 65-year old married couple with $400,000 in savings

Set 1: Compare the impact of asset allocation for high-performance solutions

	30% SPIA/RMD, 100% stocks, SS@70	30% SPIA/RMD, 75% stocks, SS@70	30% SPIA/RMD, 50% stocks, SS@70	RMD, 100% stocks, SS@70	RMD, 75% stocks, SS@70	RMD, 50% stocks, SS@70

AVERAGE INCOME
Average anual real income throughout retirement

DIRECTION OF INCOME
Percentage change in income over retirement

AVERAGE ACCESSIBLE WEALTH
Average real liquid assets throughout retirement

DIRECTION OF WEALTH
Percentage change in wealth over retirement

AVERAGE BEQUEST
Average real assets left at end of life

DOWNSIDE VOLATILITY
Average decrease in total retirement income

PROBABILITY OF SHORTFALL
Chance that income falls below essential exprense threshold

MAGNITUDE OF SHORTFALL
Total average lifetime shortfall when income falls below threshold

104

Figure 4-2

RETIREMENT INCOME DASHBOARD
No deployment of home equity

Retiree #2: 65-year old married couple with $400,000 in savings
Set 2: Compare the delaying Social Security for high-performance solutions

	100% SPIA, SS@65	100% SPIA, SS@70	RMD, 0% stocks, SS@65	RMD, 0% stocks, SS@70	RMD, 100% stocks, SS@65	RMD, 100% stocks, SS@70

AVERAGE INCOME
Average anual real income throughout retirement

DIRECTION OF INCOME
Percentage change in income over retirement

AVERAGE ACCESSIBLE WEALTH
Average real liquid assets throughout retirement

DIRECTION OF WEALTH
Percentage change in wealth over retirement

AVERAGE BEQUEST
Average real assets left at end of life

DOWNSIDE VOLATILITY
Average decrease in total retirement income

PROBABILITY OF SHORTFALL
Chance that income falls below essential exprense threshold

MAGNITUDE OF SHORTFALL
Total average lifetime shortfall when income falls below threshold

105

Figure 4-2

RETIREMENT INCOME DASHBOARD
No deployment of home equity

Retiree #2: 65-year old married couple with $400,000 in savings

Set 3: Assess the impact of low-performing solutions

Figure 4-2

RETIREMENT INCOME DASHBOARD
No deployment of home equity

Retiree #2: 65-year old married couple with $400,000 in savings
Set 4: Compare high-performing solutions near the efficient frontier

	100% FIA, SS@70	100% GLWB, SS@70	3% SWP, 100% stocks, SS@70	RMD, 100% stocks, SS@70	30% SPIA/RMD, 100% stocks, SS@70	30% FIA/RMD, 100% stocks, SS@70

AVERAGE INCOME
Average anual real income throughout retirement

DIRECTION OF INCOME
Percentage change in income over retirement

AVERAGE ACCESSIBLE WEALTH
Average real liquid assets throughout retirement

DIRECTION OF WEALTH
Percentage change in wealth over retirement

AVERAGE BEQUEST
Average real assets left at end of life

DOWNSIDE VOLATILITY
Average decrease in total retirement income

PROBABILITY OF SHORTFALL
Chance that income falls below essential exprense threshold

MAGNITUDE OF SHORTFALL
Total average lifetime shortfall when income falls below threshold

107

Figure 4-3

RETIREMENT INCOME DASHBOARD
No deployment of home equity

Retiree #3: 65-year old married couple with $1,000,000 in savings

Set 1: Compare the impact of asset allocation for high-performance solutions

| | 30% SPIA/RMD, 100% stocks, SS@70 | 30% SPIA/RMD, 75% stocks, SS@70 | 30% SPIA/RMD, 50% stocks, SS@70 | RMD, 100% stocks, SS@70 | RMD, 75% stocks, SS@70 | RMD, 50% stocks, SS@70 |

AVERAGE INCOME
Average anual real income throughout retirement

DIRECTION OF INCOME
Percentage change in income over retirement

AVERAGE ACCESSIBLE WEALTH
Average real liquid assets throughout retirement

DIRECTION OF WEALTH
Percentage change in wealth over retirement

AVERAGE BEQUEST
Average real assets left at end of life

DOWNSIDE VOLATILITY
Average decrease in total retirement income

PROBABILITY OF SHORTFALL
Chance that income falls below essential exprense threshold

MAGNITUDE OF SHORTFALL
Total average lifetime shortfall when income falls below threshold

108

Figure 4-3

RETIREMENT INCOME DASHBOARD
No deployment of home equity

Retiree #3: 65-year old married couple with $1,000,000 in savings

Set 2: Compare the impact of delaying Social Security for high-performing solutions

	100% SPIA, SS@65	100% SPIA, SS@70	RMD, 0% stocks, SS@65	RMD, 0% stocks, SS@70	RMD, 100% stocks, SS@65	RMD, 100% stocks, SS@70

AVERAGE INCOME
Average anual real income throughout retirement

DIRECTION OF INCOME
Percentage change in income over retirement

AVERAGE ACCESSIBLE WEALTH
Average real liquid assets throughout retirement

DIRECTION OF WEALTH
Percentage change in wealth over retirement

AVERAGE BEQUEST
Average real assets left at end of life

DOWNSIDE VOLATILITY
Average decrease in total retirement income

PROBABILITY OF SHORTFALL
Chance that income falls below essential exprense threshold

MAGNITUDE OF SHORTFALL
Total average lifetime shortfall when income falls below threshold

Figure 4-3

RETIREMENT INCOME DASHBOARD
No deployment of home equity

Retiree #3: 65-year old married couple with $1,000,000 in savings

Set 3: Assess the impact of low-performing solutions

Figure 4-3

RETIREMENT INCOME DASHBOARD
No deployment of home equity

Retiree #3: 65-year old married couple with $1,000,000 in savings

Set 4: Compare high-performing solutions near the efficient frontier

	100% FIA, SS@70	100% GLWB, SS@70	3% SWP, 100% stocks, SS@70	RMD, 100% stocks, SS@70	30% SPIA/RMD, 100% stocks, SS@70	30% FIA/RMD, 100% stocks, SS@70

AVERAGE INCOME
Average anual real income throughout retirement

DIRECTION OF INCOME
Percentage change in income over retirement

AVERAGE ACCESSIBLE WEALTH
Average real liquid assets throughout retirement

DIRECTION OF WEALTH
Percentage change in wealth over retirement

AVERAGE BEQUEST
Average real assets left at end of life

DOWNSIDE VOLATILITY
Average decrease in total retirement income

PROBABILITY OF SHORTFALL
Chance that income falls below essential exprense threshold

MAGNITUDE OF SHORTFALL
Total average lifetime shortfall when income falls below threshold

111

Figure 5-1

RETIREMENT INCOME DASHBOARD
Includes deployment of home equity

Retiree #1: 65 year-old female with $250,000 in savings and $200,00 in home equity

Set 4-A: High-performing solutions – add value of home without considering reverse mortgage

Figure 5-1

RETIREMENT INCOME DASHBOARD
Includes deployment of home equity

Retiree #1: 65 year-old female with $250,000 in savings and $200,00 in home equity

Set 4-B: High-performing solutions – open reverse mortgage LOC as reserve for contingencies

Figure 5-1

RETIREMENT INCOME DASHBOARD
Includes deployment of home equity

Retiree #1: 65 year-old female with $250,000 in savings and $200,00 in home equity

Set 4-C: High-performing solutions – add reverse mortgage tenure payment
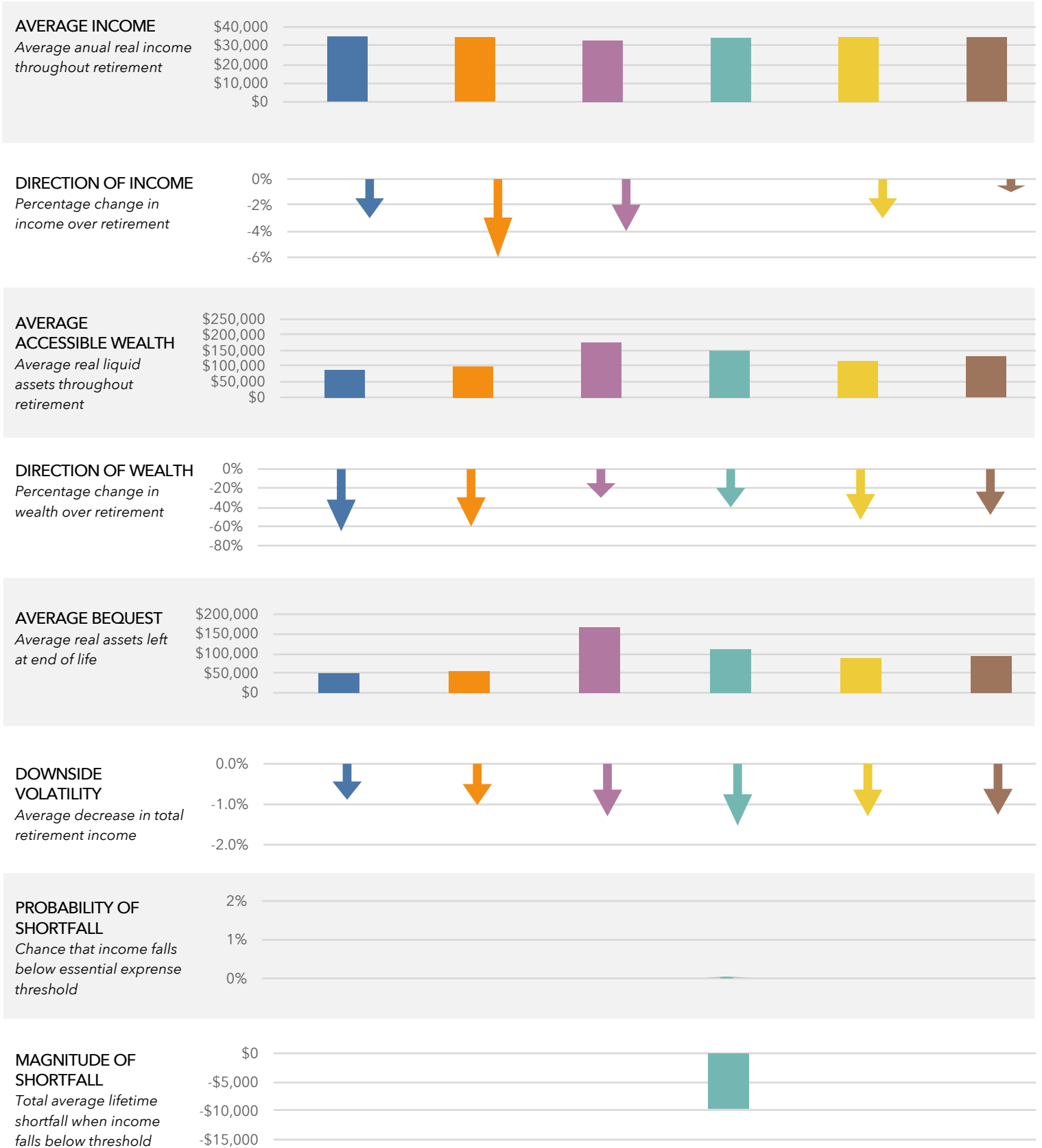
Figure 5-1

RETIREMENT INCOME DASHBOARD
Includes deployment of home equity

Retiree #1: 65 year-old female with $250,000 in savings and $200,00 in home equity

Set 4-D: High-performing solutions – use reverse mortgage LOC to fill in shortfalls

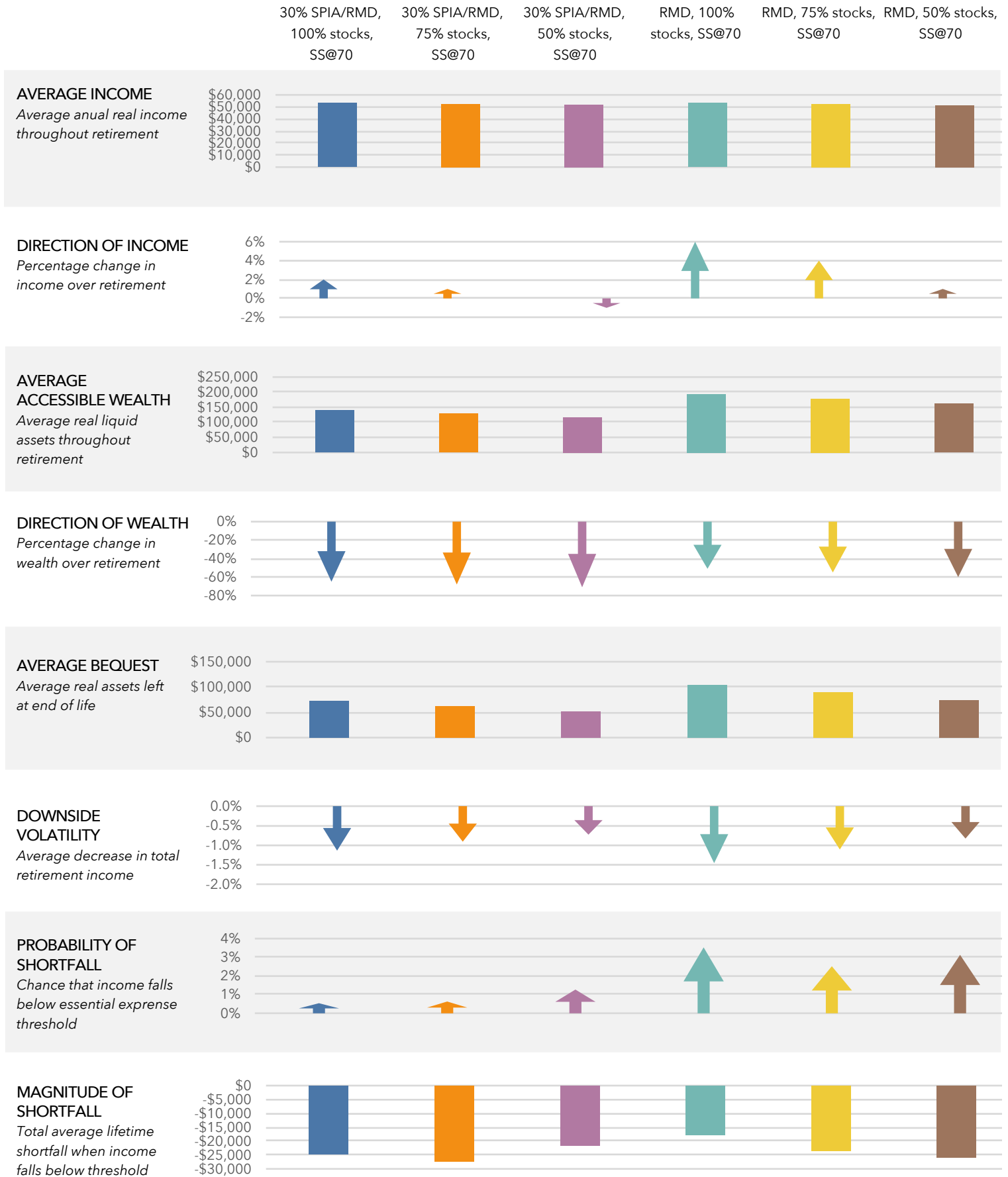**Figure 5-2**

RETIREMENT INCOME DASHBOARD
Includes deployment of home equity

Retiree #2: 65-year old married couple with $400,000 in savings and $350,000 in home equity

Set 4-A: High-performing solutions – add value of home without considering reverse mortgage

Figure 5-2

RETIREMENT INCOME DASHBOARD
Includes deployment of home equity

Retiree #2: 65-year old married couple with $400,000 in savings and $350,000 in home equity
Set 4-B: High-performing solutions – open reverse mortgage LOC as reserve for contingencies

RETIREMENT INCOME DASHBOARD

Figure 5-2

Includes deployment of home equity

Retiree #2: 65-year old married couple with $400,000 in savings and $350,000 in home equity

Set 4-C: High-performing solutions – add reverse mortgage tenure payment

Figure 5-2

RETIREMENT INCOME DASHBOARD

Includes deployment of home equity

Retiree #2: 65-year old married couple with $400,000 in savings and $350,000 in home equity

Set 4-D: High-performing solutions – use reverse mortgage LOC to fill in shortfalls
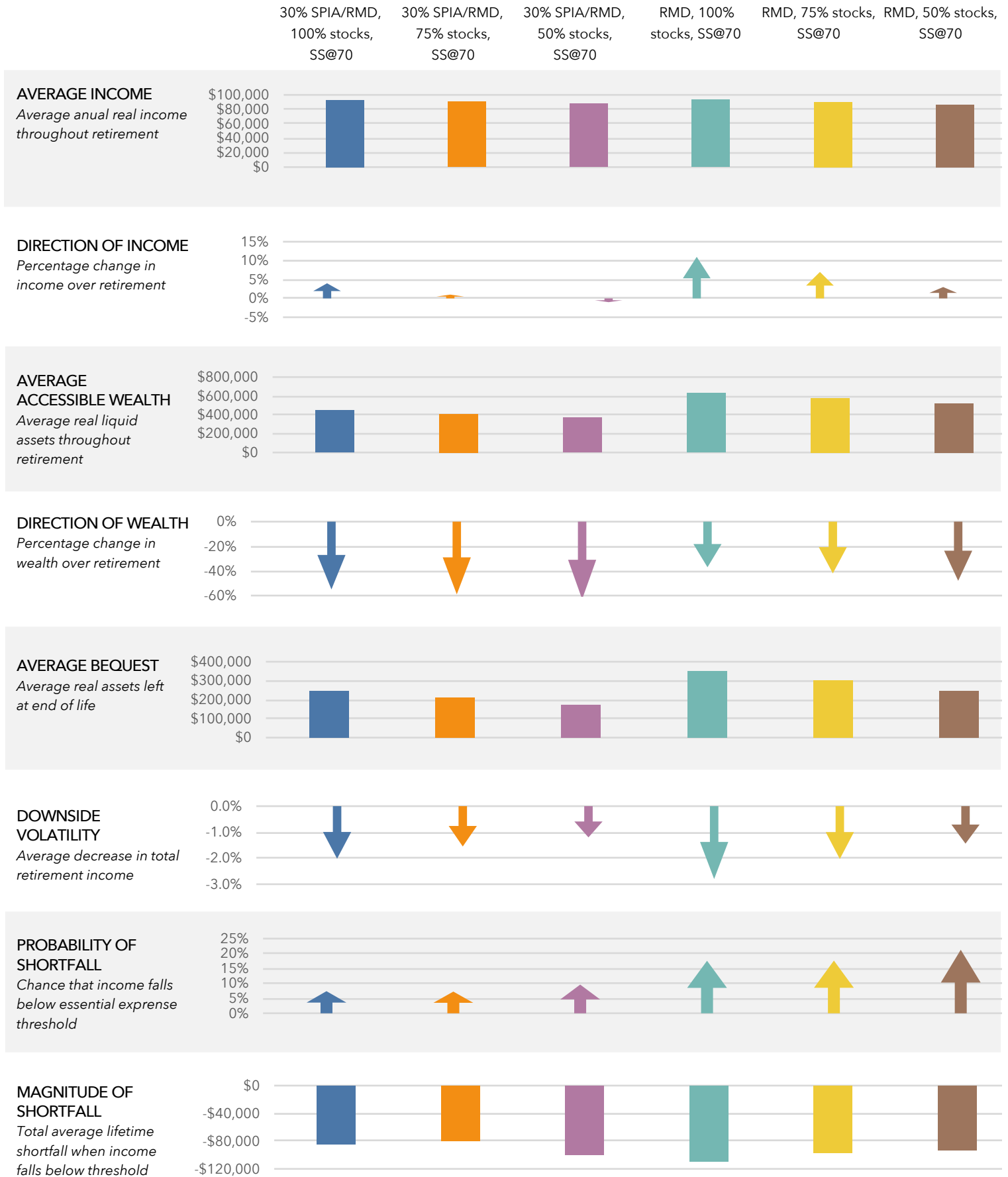
Figure 5-3

RETIREMENT INCOME DASHBOARD
Includes deployment of home equity

Retiree #3: 65-year old married couple with $1,000,000 in savings and $500,000 in home equity

Set 4-A: High-performing solutions – add value of home without considering reverse mortgage

Figure 5-3

RETIREMENT INCOME DASHBOARD
Includes deployment of home equity

Retiree #3: 65-year old married couple with $1,000,000 in savings and $500,000 in home equity

Set 4-B: High-performing solutions – open reverse mortgage LOC as reserve for contingencie

Figure 5-3

RETIREMENT INCOME DASHBOARD
Includes deployment of home equity

Retiree #3: 65-year old married couple with $1,000,000 in savings and $500,000 in home equity
Set 4-C: High-performing solutions – add reverse mortgage tenure payment
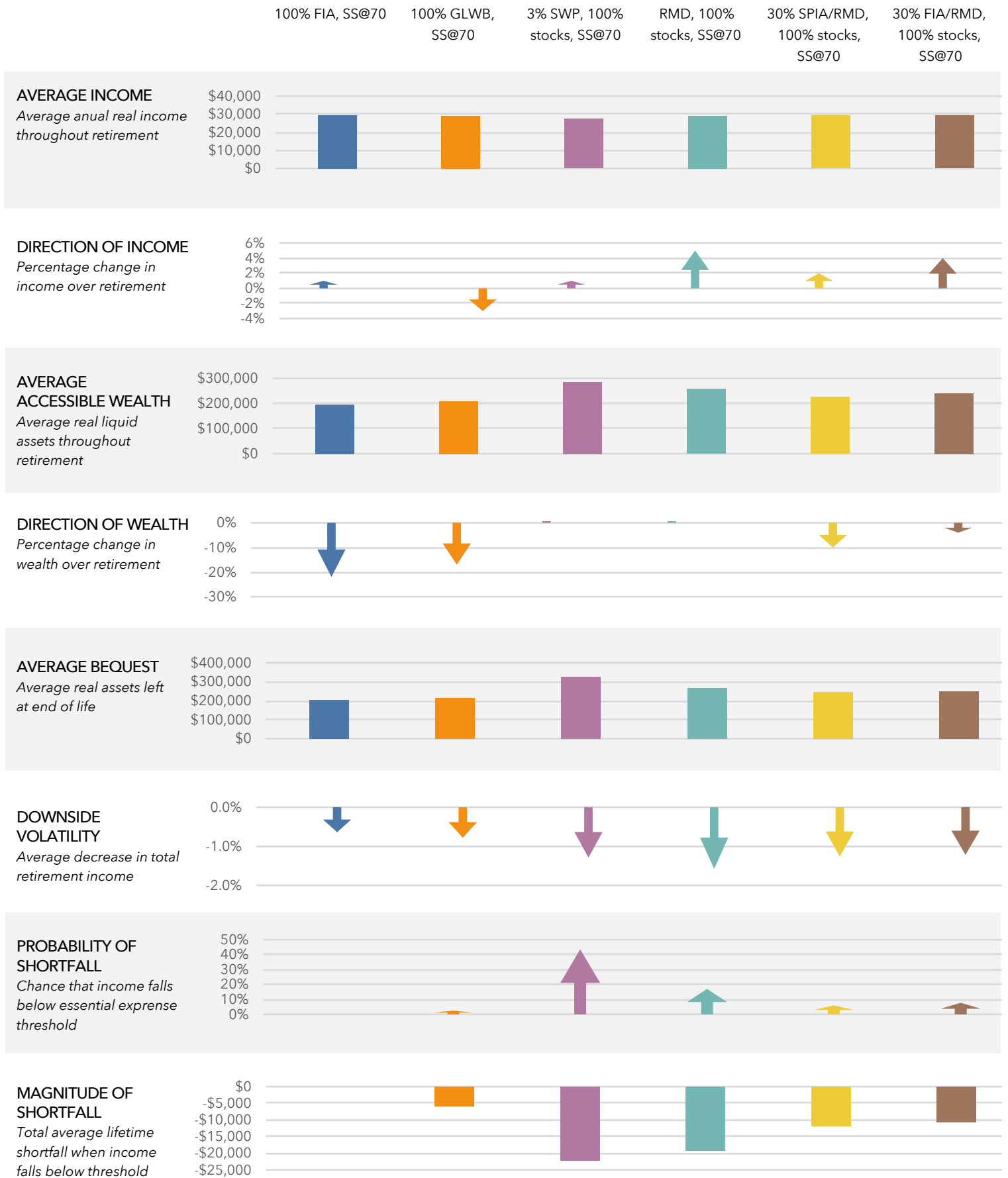
Figure 5-3

RETIREMENT INCOME DASHBOARD
Includes deployment of home equity

Retiree #3: 65-year old married couple with $1,000,000 in savings and $500,000 in home equity

Set 4-D: High-performing solutions – use reverse mortgage LOC to fill in shortfalls

	100% FIA, SS@70	100% GLWB, SS@70	3% SWP, 100% stocks, SS@70	RMD, 100% stocks, SS@70	30% SPIA/RMD, 100% stocks, SS@70	30% FIA/RMD, 100% stocks, SS@70

AVERAGE INCOME
Average anual real income throughout retirement

DIRECTION OF INCOME
Percentage change in income over retirement

AVERAGE ACCESSIBLE WEALTH
Average real liquid assets throughout retirement

DIRECTION OF WEALTH
Percentage change in wealth over retirement

AVERAGE BEQUEST
Average real assets left at end of life

DOWNSIDE VOLATILITY
Average decrease in total retirement income

PROBABILITY OF SHORTFALL
Chance that income falls below essential exprense threshold

MAGNITUDE OF SHORTFALL
Total average lifetime shortfall when income falls below threshold

Figure 6-1 RETIREMENT INCOME DASHBOARD

Percent of Initial Retirement Income Provided by Social Security

Retiree #1: 65-year old female with $250,000 in savings

	30% SPIA/RMD, 100% stocks, SS@70	30% SPIA/RMD, 75% stocks, SS@70	30% SPIA/RMD, 50% stocks, SS@70	RMD, 100% stocks, SS@70	RMD, 75% stocks, SS@70	RMD, 50% stocks, SS@70
Set 1: Compare the impact of asset allocation for high-performance solutions *No home equity deployment*	82%	82%	82%	85%	85%	85%

	100% SPIA, SS@65	100% SPIA, SS@70	RMD, 0% stocks, SS@65	RMD, 0% stocks, SS@70	RMD, 100% stocks, SS@65	RMD, 100% stocks, SS@70
Set 2: Compare the impact of delaying Social Security for high-performing solutions *No home equity deployment*	52%	75%	67%	85%	67%	85%

	RMD, 0% stocks, SS@65	RMD, 0% stocks, SS@70	GLWB, SS@65	GLWB, SS@70	FIA, SS@65	FIA, SS@70
Set 3: Assess impact of low-performing solutions *No home equity deployment*	67%	85%	57%	79%	60%	80%

|	100% FIA, SS@70	100% GLWB, SS@70	3% SWP, 100% stocks, SS@70	RMD, 100% stocks, SS@70	30% SPIA/RMD, 100% stocks, SS@70	30% FIA/RMD, 100% stocks, SS@70
Set 4: Compare high-performing solutions near the efficient frontier *No home equity deployment*	80%	79%	86%	85%	82%	84%

	100% FIA, SS@70	100% GLWB, SS@70	3% SWP, 100% stocks, SS@70	RMD, 100% stocks, SS@70	30% SPIA/RMD, 100% stocks, SS@70	30% FIA/RMD, 100% stocks, SS@70
Set 5: High-performing solutions *Add reverse mortgage tenure payment*	65%	64%	69%	68%	66%	68%
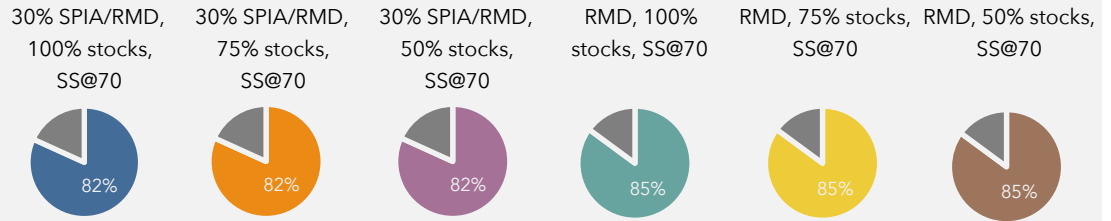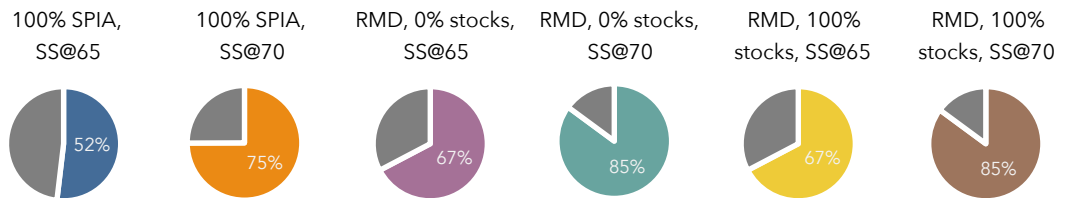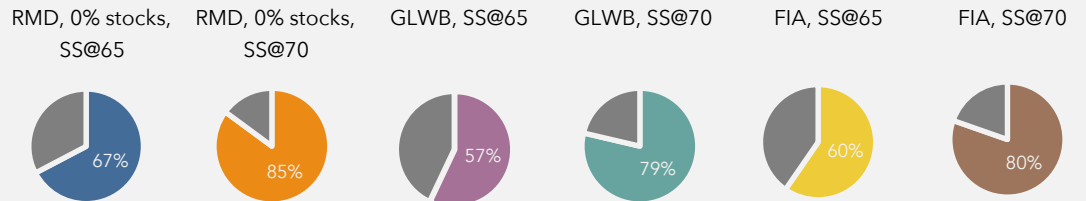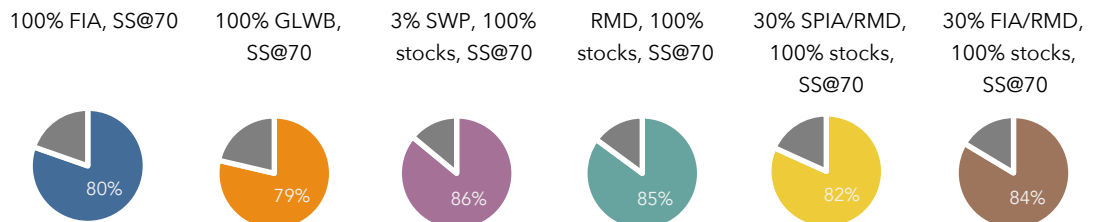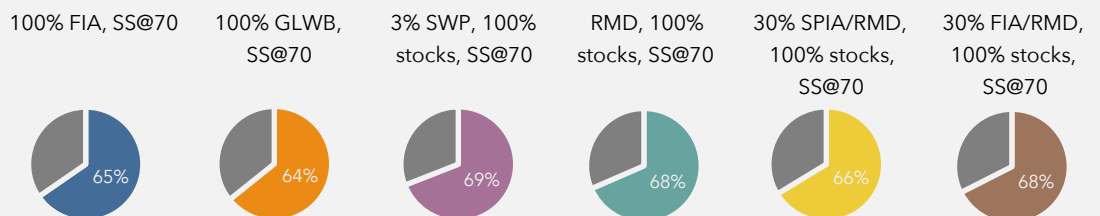
Figure 6-2

RETIREMENT INCOME DASHBOARD

Percent of Initial Retirement Income Provided by Social Security

Retiree #2: 65-year old married couple with $400,000 in savings

Set 1: Compare the impact of asset allocation for high-performance solutions

No home equity deployment

30% SPIA/RMD, 100% stocks, SS@70	30% SPIA/RMD, 75% stocks, SS@70	30% SPIA/RMD, 50% stocks, SS@70	RMD, 100% stocks, SS@70	RMD, 75% stocks, SS@70	RMD, 50% stocks, SS@70
83%	83%	83%	86%	86%	86%

Set 2: Compare the impact of delaying Social Security for high-performing solutions

No home equity deployment

100% SPIA, SS@65	100% SPIA, SS@70	RMD, 0% stocks, SS@65	RMD, 0% stocks, SS@70	RMD, 100% stocks, SS@65	RMD, 100% stocks, SS@70
60%	78%	72%	86%	72%	86%

Set 3: Assess impact of low-performing solutions

No home equity deployment

RMD, 0% stocks, SS@65	RMD, 0% stocks, SS@70	GLWB, SS@65	GLWB, SS@70	FIA, SS@65	FIA, SS@70
72%	86%	65%	81%	68%	83%

Set 4: Compare high-performing solutions near the efficient frontier

No home equity deployment

100% FIA, SS@70	100% GLWB, SS@70	3% SWP, 100% stocks, SS@70	RMD, 100% stocks, SS@70	30% SPIA/RMD, 100% stocks, SS@70	30% FIA/RMD, 100% stocks, SS@70
83%	81%	87%	86%	83%	85%

Set 5: High-performing solutions

Add reverse mortgage tenure payment

100% FIA, SS@70	100% GLWB, SS@70	3% SWP, 100% stocks, SS@70	RMD, 100% stocks, SS@70	30% SPIA/RMD, 100% stocks, SS@70	30% FIA/RMD, 100% stocks, SS@70
67%	66%	70%	69%	68%	69%
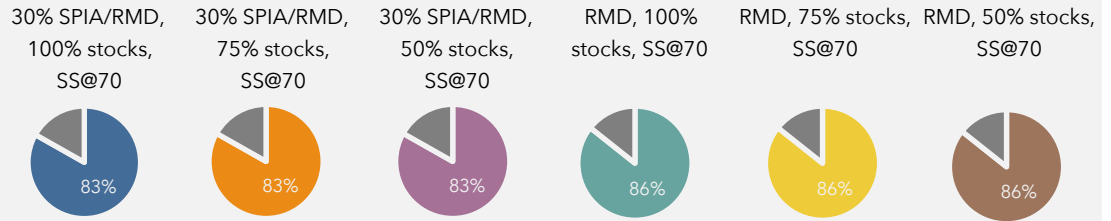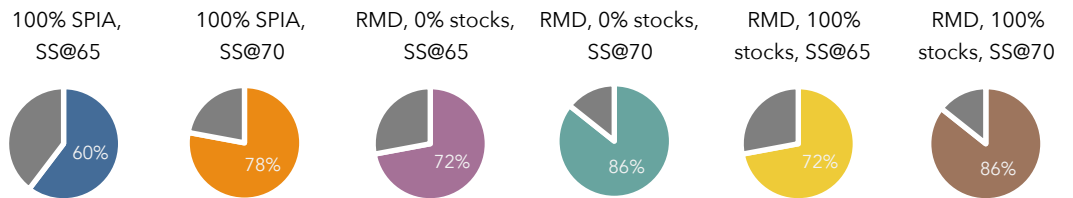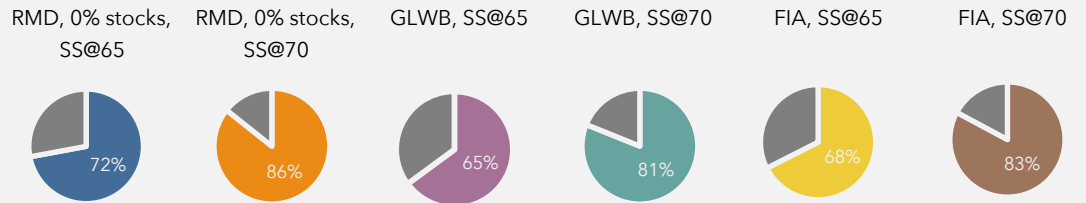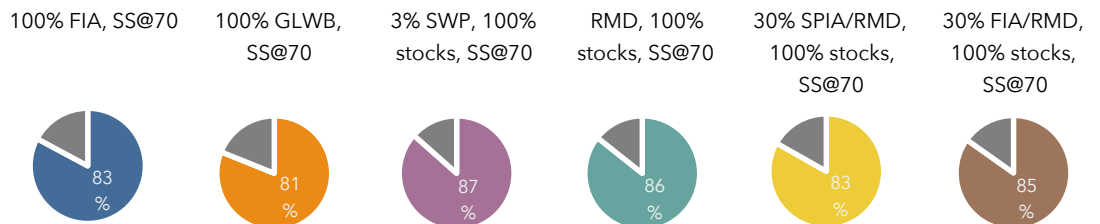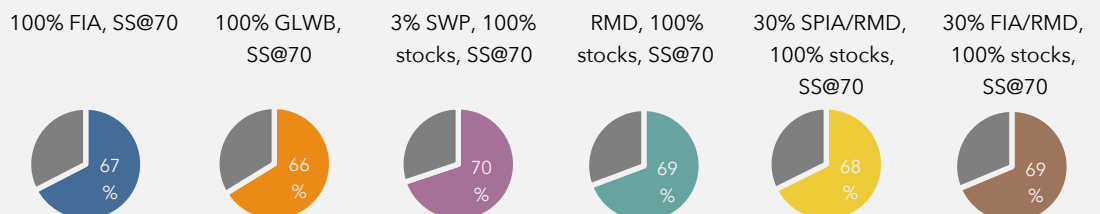
Figure 6-3

RETIREMENT INCOME DASHBOARD

Percent of Initial Retirement Income Provided by Social Security

Retiree #3: 65-year old married couple with $1,000,000 in savings

	30% SPIA/RMD, 100% stocks, SS@70	30% SPIA/RMD, 75% stocks, SS@70	30% SPIA/RMD, 50% stocks, SS@70	RMD, 100% stocks, SS@70	RMD, 75% stocks, SS@70	RMD, 50% stocks, SS@70
Set 1: Compare the impact of asset allocation for high-performance solutions *No home equity deployment*	67%	67%	67%	71%	71%	71%

	100% SPIA, SS@65	100% SPIA, SS@70	RMD, 0% stocks, SS@65	RMD, 0% stocks, SS@70	RMD, 100% stocks, SS@65	RMD, 100% stocks, SS@70
Set 2: Compare the impact of delaying Social Security for high-performing solutions *No home equity deployment*	46%	59%	59%	71%	59%	71%

	RMD, 0% stocks, SS@65	RMD, 0% stocks, SS@70	GLWB, SS@65	GLWB, SS@70	FIA, SS@65	FIA, SS@70
Set 3: Assess impact of low-performing solutions *No home equity deployment*	59%	71%	51%	64%	53%	66%

	100% FIA, SS@70	100% GLWB, SS@70	3% SWP, 100% stocks, SS@70	RMD, 100% stocks, SS@70	30% SPIA/RMD, 100% stocks, SS@70	30% FIA/RMD, 100% stocks, SS@70
Set 4: Compare high-performing solutions near the efficient frontier *No home equity deployment*	66%	64%	72%	71%	67%	69%

|	100% FIA, SS@70	100% GLWB, SS@70	3% SWP, 100% stocks, SS@70	RMD, 100% stocks, SS@70	30% SPIA/RMD, 100% stocks, SS@70	30% FIA/RMD, 100% stocks, SS@70
Set 5: High-performing solutions *Add reverse mortgage tenure payment*	55%	53%	59%	58%	55%	57%

Table 1-1 Retirement Income Metrics: No Deployment of Home Equity
65 year-old female with $250,000 in savings

SET 1: High performance

	30% SPIA/RMD, 100% stocks, SS@70	30% SPIA/RMD, 75% stocks, SS@70	30% SPIA/RMD, 50% stocks, SS@70	RMD, 100% stocks, SS@70	RMD, 75% stocks, SS@70	RMD, 50% stocks, SS@70
Initial Social Security Benefit	$23,491	$23,491	$23,491	$23,491	$23,491	$23,491
Initial Income from Financial Assets	$5,236	$5,236	$5,236	$4,113	$4,113	$4,113
Total Initial Retirement Income	$28,727	$28,727	$28,727	$27,604	$27,604	$27,604
Average Income, All Sources	$29,285	$28,884	$28,520	$29,075	$28,600	$28,022
Direction of Income	102%	101%	99%	105%	104%	102%
Average Accessible Wealth	$84,393	$78,026	$71,599	$116,721	$107,429	$98,175
Direction of Wealth	34%	31%	29%	47%	43%	39%
Average Bequest	$55,296	$49,076	$42,424	$78,166	$69,303	$59,795
Downside Volatility	-1.3%	-1.0%	-0.9%	-1.6%	-1.2%	-1.0%
Probability of Shortfall	6%	6%	8%	17%	17%	18%
Magnitude of Shortfall	-$11,838	-$12,665	-$13,454	-$19,162	-$16,506	-$17,237

SET 2: High performance

	100% SPIA, SS@65	100% SPIA, SS@70	RMD, 0% stocks, SS@65	RMD, 0% stocks, SS@70	RMD, 100% stocks, SS@65	RMD, 100% stocks, SS@70
Initial Social Security Benefit	$16,604	$23,491	$16,604	$23,491	$16,604	$23,491
Initial Income from Financial Assets	$15,400	$7,854	$8,065	$4,113	$8,065	$4,113
Total Initial Retirement Income	$32,004	$31,345	$24,669	$27,604	$24,669	$27,604
Average Income, All Sources	$28,682	$29,658	$23,339	$26,951	$27,533	$29,075
Direction of Income	90%	95%	95%	98%	112%	105%
Average Accessible Wealth	$0	$9,520	$137,935	$80,051	$210,339	$116,721
Direction of Wealth	0%	4%	55%	32%	84%	47%
Average Bequest	$0	$1,943	$76,973	$41,225	$149,519	$78,166
Downside Volatility	-1.1%	-0.8%	-1.0%	-0.8%	-3.0%	-1.6%
Probability of Shortfall	27%	1%	100%	57%	55%	17%
Magnitude of Shortfall	-$33,812	-$4,818	-$91,159	-$19,221	-$61,816	-$19,162

Table 1-1 Retirement Income Metrics: No Deployment of Home Equity
65 year-old female with $250,000 in savings

SET 3: Low performance

	RMD, 0% stocks, SS@65	RMD, 0% stocks, SS@70	GLWB, SS@65	GLWB, SS@70	FIA, SS@65	FIA, SS@70
Initial Social Security Benefit	$16,604	$23,491	$16,604	$23,491	$16,604	$23,491
Initial Income from Financial Assets	$8,065	$4,113	$12,500	$6,375	$11,250	$5,738
Total Initial Retirement Income	$24,669	$27,604	$29,104	$29,866	$27,854	$29,229
Average Income, All Sources	$22,561	$26,573	$26,886	$28,792	$27,022	$28,845
Direction of Income	91%	96%	92%	96%	97%	99%
Average Accessible Wealth	$124,157	$72,875	$78,988	$49,683	$83,955	$52,382
Direction of Wealth	50%	29%	32%	20%	34%	21%
Average Bequest	$64,899	$35,053	$24,496	$14,509	$27,595	$16,020
Downside Volatility	-1.1%	-0.8%	-1.0%	-0.8%	-0.8%	-0.7%
Probability of Shortfall	100%	76%	53%	4%	49%	0%
Magnitude of Shortfall	-$109,890	-$24,465	-$40,546	-$7,141	-$21,540	$0

SET 4: High performance

	100% FIA, SS@70	100% GLWB, SS@70	3% SWP, 100% stocks, SS@70	RMD, 100% stocks, SS@70	30% SPIA/RMD, 100% stocks, SS@70	30% FIA/RMD, 100% stocks, SS@70
Initial Social Security Benefit	$23,491	$23,491	$23,491	$23,491	$23,491	$23,491
Initial Income from Financial Assets	$5,738	$6,375	$3,825	$4,113	$5,236	$4,601
Total Initial Retirement Income	$29,229	$29,866	$27,316	$27,604	$28,727	$28,092
Average Income, All Sources	$29,529	$29,071	$27,491	$29,075	$29,285	$29,243
Direction of Income	101%	97%	101%	105%	102%	104%
Average Accessible Wealth	$55,351	$66,136	$142,246	$116,721	$84,393	$97,915
Direction of Wealth	22%	26%	57%	47%	34%	39%
Average Bequest	$17,342	$22,963	$134,561	$78,166	$55,296	$60,043
Downside Volatility	-0.6%	-0.8%	-1.3%	-1.6%	-1.3%	-1.2%
Probability of Shortfall	0%	3%	44%	17%	6%	8%
Magnitude of Shortfall	$0	-$5,893	-$22,093	-$19,162	-$11,838	-$10,660

Table 1-2 Retirement Income Metrics: No Deployment of Home Equity
65 year-old married couple with $400,000 in savings

SET 1: High performance

	30% SPIA/RMD, 100% stocks, SS@70	30% SPIA/RMD, 75% stocks, SS@70	30% SPIA/RMD, 50% stocks, SS@70	RMD, 100% stocks, SS@70	RMD, 75% stocks, SS@70	RMD, 50% stocks, SS@70
Initial Social Security Benefit	$43,309	$43,309	$43,309	$43,309	$43,309	$43,309
Initial Income from Financial Assets	$8,746	$8,746	$8,746	$7,236	$7,236	$7,236
Total Initial Retirement Income	$52,055	$52,055	$52,055	$50,545	$50,545	$50,545
Average Income, All Sources	$53,212	$52,489	$51,727	$53,334	$52,361	$51,272
Direction of Income	102%	101%	99%	106%	104%	101%
Average Accessible Wealth	$139,408	$128,279	$116,791	$194,031	$178,109	$161,626
Direction of Wealth	35%	32%	29%	49%	45%	40%
Average Bequest	$73,058	$62,376	$51,396	$104,323	$89,063	$73,375
Downside Volatility	-1.1%	-0.9%	-0.7%	-1.5%	-1.1%	-0.8%
Probability of Shortfall	1%	1%	1%	4%	3%	3%
Magnitude of Shortfall	-$24,791	-$27,348	-$21,572	-$17,699	-$23,564	-$25,785

SET 2: High performance

	100% SPIA, SS@65	100% SPIA, SS@70	RMD, 0% stocks, SS@65	RMD, 0% stocks, SS@70	RMD, 100% stocks, SS@65	RMD, 100% stocks, SS@70
Initial Social Security Benefit	$33,303	$43,309	$33,303	$43,309	$33,303	$43,309
Initial Income from Financial Assets	$21,880	$12,270	$12,903	$7,236	$12,903	$7,236
Total Initial Retirement Income	$55,183	$55,579	$46,206	$50,545	$46,206	$50,545
Average Income, All Sources	$50,018	$52,723	$43,827	$49,235	$51,038	$53,334
Direction of Income	91%	95%	95%	97%	110%	106%
Average Accessible Wealth	$0	$12,376	$207,259	$128,588	$323,626	$194,031
Direction of Wealth	0%	3%	52%	32%	81%	49%
Average Bequest	$0	$107	$78,000	$43,842	$185,843	$104,323
Downside Volatility	-0.9%	-0.7%	-0.9%	-0.6%	-2.6%	-1.5%
Probability of Shortfall	29%	0%	100%	16%	39%	4%
Magnitude of Shortfall	-$50,592	$0	-$114,853	-$32,664	-$80,387	-$17,699

Table 1-2 Retirement Income Metrics: No Deployment of Home Equity
65 year-old married couple with $400,000 in savings

SET 3: Low performance

	RMD, 0% stocks, SS@65	RMD, 0% stocks, SS@70	GLWB, SS@65	GLWB, SS@70	FIA, SS@65	FIA, SS@70
Initial Social Security Benefit	$33,303	$43,309	$33,303	$43,309	$33,303	$43,309
Initial Income from Financial Assets	$12,903	$7,236	$18,000	$10,094	$16,000	$8,972
Total Initial Retirement Income	$46,206	$50,545	$51,303	$53,403	$49,303	$52,281
Average Income, All Sources	$42,488	$48,499	$47,903	$51,572	$48,008	$51,598
Direction of Income	92%	96%	93%	97%	97%	99%
Average Accessible Wealth	$185,032	$116,236	$123,104	$81,666	$132,534	$86,627
Direction of Wealth	46%	29%	31%	20%	33%	22%
Average Bequest	$62,219	$34,999	$10,625	$6,063	$14,781	$8,396
Downside Volatility	-0.9%	-0.6%	-0.8%	-0.6%	-0.6%	-0.5%
Probability of Shortfall	100%	33%	48%	0%	42%	0%
Magnitude of Shortfall	-$152,653	-$35,973	-$61,357	-$5,950	-$30,736	$0

SET 4: High performance

	100% FIA, SS@70	100% GLWB, SS@70	3% SWP, 100% stocks, SS@70	RMD, 100% stocks, SS@70	30% SPIA/RMD, 100% stocks, SS@70	30% FIA/RMD, 100% stocks, SS@70
Initial Social Security Benefit	$43,309	$43,309	$43,309	$43,309	$43,309	$43,309
Initial Income from Financial Assets	$8,972	$10,094	$6,729	$7,236	$8,746	$7,757
Total Initial Retirement Income	$52,281	$53,403	$50,038	$50,545	$52,055	$51,066
Average Income, All Sources	$52,819	$52,074	$50,319	$53,334	$53,212	$53,216
Direction of Income	101%	98%	101%	106%	102%	104%
Average Accessible Wealth	$92,632	$114,043	$245,447	$194,031	$139,408	$163,473
Direction of Wealth	23%	29%	61%	49%	35%	41%
Average Bequest	$9,662	$17,296	$229,872	$104,323	$73,058	$75,893
Downside Volatility	-0.5%	-0.6%	-1.2%	-1.5%	-1.1%	-1.1%
Probability of Shortfall	0%	0%	14%	4%	1%	0%
Magnitude of Shortfall	$0	$0	-$22,443	-$17,699	-$24,791	-$11,982

Table 1-3 Retirement Income Metrics: No Deployment of Home Equity
65 year-old married couple with $1,000,000 in savings

SET 1: High performance

	30% SPIA/RMD, 100% stocks, SS@70	30% SPIA/RMD, 75% stocks, SS@70	30% SPIA/RMD, 50% stocks, SS@70	RMD, 100% stocks, SS@70	RMD, 75% stocks, SS@70	RMD, 50% stocks, SS@70
Initial Social Security Benefit	$59,711	$59,711	$59,711	$59,711	$59,711	$59,711
Initial Income from Financial Assets	$29,546	$29,546	$29,546	$24,444	$24,444	$24,444
Total Initial Retirement Income	$89,257	$89,257	$89,257	$84,155	$84,155	$84,155
Average Income, All Sources	$92,970	$90,582	$87,956	$93,269	$90,136	$86,601
Direction of Income	104%	101%	99%	111%	107%	103%
Average Accessible Wealth	$446,879	$409,345	$370,217	$630,876	$577,683	$521,525
Direction of Wealth	45%	41%	37%	63%	58%	52%
Average Bequest	$246,594	$210,505	$173,402	$352,214	$300,658	$247,650
Downside Volatility	-2.0%	-1.6%	-1.2%	-2.8%	-2.0%	-1.4%
Probability of Shortfall	7%	7%	10%	18%	18%	21%
Magnitude of Shortfall	-$84,233	-$79,595	-$99,418	-$109,432	-$96,665	-$92,884

SET 2: High performance

	100% SPIA, SS@65	100% SPIA, SS@70	RMD, 0% stocks, SS@65	RMD, 0% stocks, SS@70	RMD, 100% stocks, SS@65	RMD, 100% stocks, SS@70
Initial Social Security Benefit	$45,915	$59,711	$45,915	$59,711	$45,915	$59,711
Initial Income from Financial Assets	$54,700	$41,450	$32,258	$24,444	$32,258	$24,444
Total Initial Retirement Income	$100,615	$101,161	$78,173	$84,155	$78,173	$84,155
Average Income, All Sources	$87,702	$91,432	$72,224	$79,620	$90,253	$93,269
Direction of Income	87%	90%	92%	95%	115%	111%
Average Accessible Wealth	$0	$17,064	$518,147	$409,566	$809,064	$630,876
Direction of Wealth	0%	2%	52%	41%	81%	63%
Average Bequest	$0	$148	$195,001	$147,904	$464,608	$352,214
Downside Volatility	-1.2%	-1.0%	-1.3%	-1.1%	-3.9%	-2.8%
Probability of Shortfall	29%	6%	100%	67%	39%	18%
Magnitude of Shortfall	-$126,481	-$50,145	-$287,132	-$146,789	-$200,967	-$109,432

Table 1-3 Retirement Income Metrics: No Deployment of Home Equity
65 year-old married couple with $1,000,000 in savings

SET 3: Low performance

	RMD, 0% stocks, SS@65	RMD, 0% stocks, SS@70	GLWB, SS@65	GLWB, SS@70	FIA, SS@65	FIA, SS@70
Initial Social Security Benefit	$45,915	$59,711	$45,915	$59,711	$45,915	$59,711
Initial Income from Financial Assets	$32,258	$24,444	$45,000	$34,100	$40,000	$30,311
Total Initial Retirement Income	$78,173	$84,155	$90,915	$93,811	$85,915	$90,022
Average Income, All Sources	$68,879	$77,145	$82,416	$87,493	$82,677	$87,629
Direction of Income	88%	92%	91%	93%	96%	97%
Average Accessible Wealth	$462,579	$367,881	$307,759	$250,977	$331,336	$268,136
Direction of Wealth	46%	37%	31%	25%	33%	27%
Average Bequest	$155,547	$118,019	$26,562	$20,272	$36,953	$28,150
Downside Volatility	-1.3%	-1.1%	-1.1%	-0.9%	-0.9%	-0.8%
Probability of Shortfall	100%	83%	48%	16%	42%	2%
Magnitude of Shortfall	-$381,633	-$191,872	-$153,394	-$68,126	-$76,840	-$16,769

SET 4: High performance

	100% FIA, SS@70	100% GLWB, SS@70	3% SWP, 100% stocks, SS@70	RMD, 100% stocks, SS@70	30% SPIA/RMD, 100% stocks, SS@70	30% FIA/RMD, 100% stocks, SS@70
Initial Social Security Benefit	$59,711	$59,711	$59,711	$59,711	$59,711	$59,711
Initial Income from Financial Assets	$30,311	$34,100	$22,733	$24,444	$29,546	$26,204
Total Initial Retirement Income	$90,022	$93,811	$82,444	$84,155	$89,257	$85,915
Average Income, All Sources	$91,775	$89,181	$83,530	$93,269	$92,970	$93,073
Direction of Income	102%	95%	101%	111%	104%	108%
Average Accessible Wealth	$288,322	$360,484	$803,880	$630,876	$446,879	$527,840
Direction of Wealth	29%	36%	80%	63%	45%	53%
Average Bequest	$32,431	$58,224	$776,350	$352,214	$246,594	$256,172
Downside Volatility	-0.7%	-1.0%	-2.1%	-2.8%	-2.0%	-2.0%
Probability of Shortfall	0%	10%	48%	18%	7%	8%
Magnitude of Shortfall	$0	-$50,116	-$150,952	-$109,432	-$84,233	-$61,141

Table 2-1 Retirement Income Metrics: Deploy Home Equity
65 year-old female with $250,000 in savings and $200,000 in home equity

Use #1: Add home equity without reverse mortgage

	100% FIA, SS@70	100% GLWB, SS@70	3% SWP, 100% stocks, SS@70	RMD, 100% stocks, SS@70	30% SPIA/RMD, 100% stocks, SS@70	30% FIA/RMD, 100% stocks, SS@70
Initial Social Security Benefit	$23,491	$23,491	$23,491	$23,491	$23,491	$23,491
Initial Income from Financial Assets	$5,738	$6,375	$3,825	$4,113	$5,236	$4,601
Initial Tenure Payment	$0	$0	$0	$0	$0	$0
Total Initial Retirement Income	$29,229	$29,866	$27,316	$27,604	$28,727	$28,092
Average Income, All Sources	$29,529	$29,071	$27,491	$29,075	$29,285	$29,243
Direction of Income	101%	97%	101%	105%	102%	104%
Average Accessible Wealth	$55,351	$66,136	$142,246	$116,721	$84,393	$97,915
Direction of Wealth	22%	26%	57%	47%	34%	39%
Average Bequest	$217,848	$229,977	$339,652	$283,706	$261,616	$266,014
Downside Volatility	-0.6%	-0.8%	-1.3%	-1.6%	-1.3%	-1.2%
Probability of Shortfall	0%	3%	44%	17%	6%	8%
Magnitude of Shortfall	$0	-$5,893	-$22,093	-$19,162	-$11,838	-$10,660

Table 2-1 Retirement Income Metrics: Deploy Home Equity
65 year-old female with $250,000 in savings and $200,000 in home equity

Use #2: Open a reverse mortgage LOC as a contingency for emergencies

	100% FIA, SS@70	100% GLWB, SS@70	3% SWP, 100% stocks, SS@70	RMD, 100% stocks, SS@70	30% SPIA/RMD, 100% stocks, SS@70	30% FIA/RMD, 100% stocks, SS@70
Initial Social Security Benefit	$23,491	$23,491	$23,491	$23,491	$23,491	$23,491
Initial Income from Financial Assets	$5,738	$6,375	$3,825	$4,113	$5,236	$4,601
Initial Tenure Payment	$0	$0	$0	$0	$0	$0
Total Initial Retirement Income	$29,229	$29,866	$27,316	$27,604	$28,727	$28,092
Average Income, All Sources	$29,529	$29,071	$27,491	$29,075	$29,285	$29,243
Direction of Income	101%	97%	101%	105%	102%	104%
Average Accessible Wealth	$195,935	$208,557	$285,053	$257,769	$226,155	$239,895
Direction of Wealth	78%	83%	114%	103%	90%	96%
Average Bequest	$202,805	$214,176	$324,707	$268,140	$246,105	$250,660
Downside Volatility	-0.6%	-0.8%	-1.3%	-1.6%	-1.3%	-1.2%
Probability of Shortfall	0%	3%	44%	17%	6%	8%
Magnitude of Shortfall	$0	-$5,893	-$22,093	-$19,162	-$11,838	-$10,660

Table 2-1 Retirement Income Metrics: Deploy Home Equity
65 year-old female with $250,000 in savings and $200,000 in home equity

Use #3: Open a reverse mortgage LOC for a monthly tenure payment

	100% FIA, SS@70	100% GLWB, SS@70	3% SWP, 100% stocks, SS@70	RMD, 100% stocks, SS@70	30% SPIA/RMD, 100% stocks, SS@70	30% FIA/RMD, 100% stocks, SS@70
Initial Social Security Benefit	$23,491	$23,491	$23,491	$23,491	$23,491	$23,491
Initial Income from Financial Assets	$5,738	$6,375	$3,825	$4,113	$5,236	$4,601
Initial Tenure Payment	$6,695	$6,695	$6,695	$6,695	$6,695	$6,695
Total Initial Retirement Income	$35,924	$36,561	$34,011	$34,299	$35,422	$34,787
Average Income, All Sources	$34,805	$34,388	$32,705	$34,317	$34,521	$34,458
Direction of Income	97%	94%	96%	100%	97%	99%
Average Accessible Wealth	$88,335	$99,081	$176,023	$149,432	$117,184	$130,537
Direction of Wealth	35%	40%	70%	60%	47%	52%
Average Bequest	$49,581	$55,631	$167,396	$110,469	$88,049	$92,879
Downside Volatility	-0.9%	-1.0%	-1.3%	-1.5%	-1.3%	-1.3%
Probability of Shortfall	0%	0%	0%	0%	0%	0%
Magnitude of Shortfall	$0	$0	$0	-$9,550	$0	$0

Table 2-1 Retirement Income Metrics: Deploy Home Equity
65 year-old female with $250,000 in savings and $200,000 in home equity

Use #4: Open a reverse mortgage LOC to be used to fill in spending shortfalls

	100% FIA, SS@70	100% GLWB, SS@70	3% SWP, 100% stocks, SS@70	RMD, 100% stocks, SS@70	30% SPIA/RMD, 100% stocks, SS@70	30% FIA/RMD, 100% stocks, SS@70
Initial Social Security Benefit	$23,491	$23,491	$23,491	$23,491	$23,491	$23,491
Initial Income from Financial Assets	$5,738	$6,375	$3,825	$4,113	$5,236	$4,601
Initial Tenure Payment	$0	$0	$0	$0	$0	$0
Total Initial Retirement Income	$29,229	$29,866	$27,316	$27,604	$28,727	$28,092
Average Income, All Sources	$29,533	$29,082	$27,899	$29,247	$29,326	$29,292
Direction of Income	101%	97%	102%	106%	102%	104%
Average Accessible Wealth	$195,758	$207,945	$275,227	$252,666	$225,041	$238,105
Direction of Wealth	78%	83%	110%	101%	90%	95%
Average Bequest	$202,164	$213,521	$309,938	$259,798	$243,048	$246,947
Downside Volatility	-0.6%	-0.7%	-0.8%	-1.3%	-1.2%	-1.1%
Probability of Shortfall	0%	0%	0%	0%	0%	0%
Magnitude of Shortfall	$0	$0	$0	$0	$0	$0

Table 2-2 Retirement Income Metrics: Deploy Home Equity
65 year-old married couple with $400,000 in savings and $350,000 in home equity

Use #1: Add home equity without reverse mortgage

	100% FIA, SS@70	100% GLWB, SS@70	3% SWP, 100% stocks, SS@70	RMD, 100% stocks, SS@70	30% SPIA/RMD, 100% stocks, SS@70	30% FIA/RMD, 100% stocks, SS@70
Initial Social Security Benefit	$43,309	$43,309	$43,309	$43,309	$43,309	$43,309
Initial Income from Financial Assets	$8,972	$10,094	$6,729	$7,236	$8,746	$7,757
Initial Tenure Payment	$0	$0	$0	$0	$0	$0
Total Initial Retirement Income	$52,281	$53,403	$50,038	$50,545	$52,055	$51,066
Average Income, All Sources	$52,819	$52,074	$50,319	$53,334	$53,212	$53,216
Direction of Income	101%	98%	101%	106%	102%	104%
Average Accessible Wealth	$92,632	$114,043	$245,447	$194,031	$139,408	$163,473
Direction of Wealth	23%	29%	61%	49%	35%	41%
Average Bequest	$360,534	$384,558	$582,997	$465,096	$435,498	$438,212
Downside Volatility	-0.5%	-0.6%	-1.2%	-1.5%	-1.1%	-1.1%
Probability of Shortfall	0%	0%	14%	4%	1%	0%
Magnitude of Shortfall	$0	$0	-$22,443	-$17,699	-$24,791	-$11,982

Table 2-2 Retirement Income Metrics: Deploy Home Equity
65 year-old married couple with $400,000 in savings and $350,000 in home equity

Use #2: Open a reverse mortgage LOC as a contingency for emergencies

	100% FIA, SS@70	100% GLWB, SS@70	3% SWP, 100% stocks, SS@70	RMD, 100% stocks, SS@70	30% SPIA/RMD, 100% stocks, SS@70	30% FIA/RMD, 100% stocks, SS@70
Initial Social Security Benefit	$43,309	$43,309	$43,309	$43,309	$43,309	$43,309
Initial Income from Financial Assets	$8,972	$10,094	$6,729	$7,236	$8,746	$7,757
Initial Tenure Payment	$0	$0	$0	$0	$0	$0
Total Initial Retirement Income	$52,281	$53,403	$50,038	$50,545	$52,055	$51,066
Average Income, All Sources	$52,819	$52,074	$50,319	$53,334	$53,212	$53,216
Direction of Income	101%	98%	101%	106%	102%	104%
Average Accessible Wealth	$353,388	$377,431	$511,403	$455,775	$404,074	$428,596
Direction of Wealth	88%	94%	128%	114%	101%	107%
Average Bequest	$338,575	$362,423	$559,430	$442,672	$412,669	$415,537
Downside Volatility	-0.5%	-0.6%	-1.2%	-1.5%	-1.1%	-1.1%
Probability of Shortfall	0%	0%	14%	4%	1%	0%
Magnitude of Shortfall	$0	$0	-$22,443	-$17,699	-$24,791	-$11,982

Table 2-2 Retirement Income Metrics: Deploy Home Equity
65 year-old married couple with $400,000 in savings and $350,000 in home equity

Use #3: Open a reverse mortgage LOC for a monthly tenure payment

	100% FIA, SS@70	100% GLWB, SS@70	3% SWP, 100% stocks, SS@70	RMD, 100% stocks, SS@70	30% SPIA/RMD, 100% stocks, SS@70	30% FIA/RMD, 100% stocks, SS@70
Initial Social Security Benefit	$43,309	$43,309	$43,309	$43,309	$43,309	$43,309
Initial Income from Financial Assets	$8,972	$10,094	$6,729	$7,236	$8,746	$7,757
Initial Tenure Payment	$11,964	$11,964	$11,964	$11,964	$11,964	$11,964
Total Initial Retirement Income	$64,245	$65,367	$62,002	$62,509	$64,019	$63,030
Average Income, All Sources	$61,963	$61,460	$59,501	$62,502	$62,351	$62,342
Direction of Income	96%	94%	96%	100%	97%	99%
Average Accessible Wealth	$145,195	$168,028	$299,960	$246,850	$191,748	$215,540
Direction of Wealth	36%	42%	75%	62%	48%	54%
Average Bequest	$27,663	$35,908	$248,217	$121,873	$90,642	$93,406
Downside Volatility	-0.8%	-0.9%	-1.2%	-1.4%	-1.2%	-1.2%
Probability of Shortfall	0%	0%	0%	0%	0%	0%
Magnitude of Shortfall	$0	$0	$0	$0	$0	$0

Table 2-2 Retirement Income Metrics: Deploy Home Equity
65 year-old married couple with $400,000 in savings and $350,000 in home equity

Use #4: Open a reverse mortgage LOC to be used to fill in spending shortfalls

	100% FIA, SS@70	100% GLWB, SS@70	3% SWP, 100% stocks, SS@70	RMD, 100% stocks, SS@70	30% SPIA/RMD, 100% stocks, SS@70	30% FIA/RMD, 100% stocks, SS@70
Initial Social Security Benefit	$43,309	$43,309	$43,309	$43,309	$43,309	$43,309
Initial Income from Financial Assets	$8,972	$10,094	$6,729	$7,236	$8,746	$7,757
Initial Tenure Payment	$0	$0	$0	$0	$0	$0
Total Initial Retirement Income	$52,281	$53,403	$50,038	$50,545	$52,055	$51,066
Average Income, All Sources	$52,819	$52,078	$50,465	$53,411	$53,214	$53,221
Direction of Income	101%	98%	101%	106%	102%	104%
Average Accessible Wealth	$353,374	$377,263	$507,560	$453,816	$403,793	$427,468
Direction of Wealth	88%	94%	127%	113%	101%	107%
Average Bequest	$338,164	$362,404	$552,838	$438,970	$411,374	$414,235
Downside Volatility	-0.5%	-0.6%	-1.0%	-1.4%	-1.1%	-1.1%
Probability of Shortfall	0%	0%	0%	0%	0%	0%
Magnitude of Shortfall	$0	$0	$0	$0	$0	$0

Table 2-3 Retirement Income Metrics: Deploy Home Equity
65 year-old married couple with $1,000,000 in savings and $500,000 in home equity

Use #1: Add home equity without reverse mortgage

	100% FIA, SS@70	100% GLWB, SS@70	3% SWP, 100% stocks, SS@70	RMD, 100% stocks, SS@70	30% SPIA/RMD, 100% stocks, SS@70	30% FIA/RMD, 100% stocks, SS@70
Initial Social Security Benefit	$59,711	$59,711	$59,711	$59,711	$59,711	$59,711
Initial Income from Financial Assets	$30,311	$34,100	$22,733	$24,444	$29,546	$26,204
Initial Tenure Payment	$0	$0	$0	$0	$0	$0
Total Initial Retirement Income	$90,022	$93,811	$82,444	$84,155	$89,257	$85,915
Average Income, All Sources	$91,775	$89,181	$83,530	$93,269	$92,970	$93,073
Direction of Income	102%	95%	101%	111%	104%	108%
Average Accessible Wealth	$288,322	$360,484	$803,880	$630,876	$446,879	$527,840
Direction of Wealth	29%	36%	80%	63%	45%	53%
Average Bequest	$582,969	$644,232	$1,324,819	$920,893	$814,510	$824,142
Downside Volatility	-0.7%	-1.0%	-2.1%	-2.8%	-2.0%	-2.0%
Probability of Shortfall	0%	10%	48%	18%	7%	8%
Magnitude of Shortfall	$0	-$50,116	-$150,952	-$109,432	-$84,233	-$61,141

Table 2-3 Retirement Income Metrics: Deploy Home Equity
65 year-old married couple with $1,000,000 in savings and $500,000 in home equity

Use #2: Open a reverse mortgage LOC as a contingency for emergencies

	100% FIA, SS@70	100% GLWB, SS@70	3% SWP, 100% stocks, SS@70	RMD, 100% stocks, SS@70	30% SPIA/RMD, 100% stocks, SS@70	30% FIA/RMD, 100% stocks, SS@70
Initial Social Security Benefit	$59,711	$59,711	$59,711	$59,711	$59,711	$59,711
Initial Income from Financial Assets	$30,311	$34,100	$22,733	$24,444	$29,546	$26,204
Initial Tenure Payment	$0	$0	$0	$0	$0	$0
Total Initial Retirement Income	$90,022	$93,811	$82,444	$84,155	$89,257	$85,915
Average Income, All Sources	$91,775	$89,181	$83,530	$93,269	$92,970	$93,073
Direction of Income	102%	95%	101%	111%	104%	108%
Average Accessible Wealth	$705,263	$778,198	$1,231,278	$1,045,319	$863,380	$943,877
Direction of Wealth	71%	78%	123%	105%	86%	94%
Average Bequest	$558,286	$618,001	$1,296,474	$893,840	$786,806	$796,359
Downside Volatility	-0.7%	-1.0%	-2.1%	-2.8%	-2.0%	-2.0%
Probability of Shortfall	0%	10%	48%	18%	7%	8%
Magnitude of Shortfall	$0	-$50,116	-$150,952	-$109,432	-$84,233	-$61,141

Table 2-3 Retirement Income Metrics: Deploy Home Equity
65 year-old married couple with $1,000,000 in savings and $500,000 in home equity

Use #3: Open a reverse mortgage LOC for a monthly tenure payment

	100% FIA, SS@70	100% GLWB, SS@70	3% SWP, 100% stocks, SS@70	RMD, 100% stocks, SS@70	30% SPIA/RMD, 100% stocks, SS@70	30% FIA/RMD, 100% stocks, SS@70
Initial Social Security Benefit	$59,711	$59,711	$59,711	$59,711	$59,711	$59,711
Initial Income from Financial Assets	$30,311	$34,100	$22,733	$24,444	$29,546	$26,204
Initial Tenure Payment	$19,099	$19,099	$19,099	$19,099	$19,099	$19,099
Total Initial Retirement Income	$109,121	$112,910	$101,543	$103,254	$108,356	$105,014
Average Income, All Sources	$106,380	$104,180	$98,301	$108,199	$107,560	$107,731
Direction of Income	97%	92%	97%	105%	99%	103%
Average Accessible Wealth	$371,762	$447,351	$888,647	$713,412	$530,767	$611,461
Direction of Wealth	37%	45%	89%	71%	53%	61%
Average Bequest	$60,961	$87,132	$805,976	$380,490	$274,144	$282,925
Downside Volatility	-0.9%	-1.2%	-2.0%	-2.5%	-1.9%	-1.9%
Probability of Shortfall	0%	0%	0%	0%	0%	0%
Magnitude of Shortfall	$0	$0	-$46,587	-$107,360	-$81,067	-$75,500

Table 2-3 Retirement Income Metrics: Deploy Home Equity
65 year-old married couple with $1,000,000 in savings and $500,000 in home equity

Use #4: Open a reverse mortgage LOC to be used to fill in spending shortfalls

	100% FIA, SS@70	100% GLWB, SS@70	3% SWP, 100% stocks, SS@70	RMD, 100% stocks, SS@70	30% SPIA/RMD, 100% stocks, SS@70	30% FIA/RMD, 100% stocks, SS@70
Initial Social Security Benefit	$59,711	$59,711	$59,711	$59,711	$59,711	$59,711
Initial Income from Financial Assets	$30,311	$34,100	$22,733	$24,444	$29,546	$26,204
Initial Tenure Payment	$0	$0	$0	$0	$0	$0
Total Initial Retirement Income	$90,022	$93,811	$82,444	$84,155	$89,257	$85,915
Average Income, All Sources	$91,775	$89,432	$86,065	$94,305	$93,392	$93,316
Direction of Income	102%	95%	104%	112%	105%	109%
Average Accessible Wealth	$705,159	$774,434	$1,177,191	$1,025,934	$860,526	$938,632
Direction of Wealth	71%	77%	118%	103%	86%	94%
Average Bequest	$557,216	$611,931	$1,194,298	$849,611	$774,170	$782,495
Downside Volatility	-0.7%	-0.8%	-1.3%	-2.4%	-1.9%	-1.8%
Probability of Shortfall	0%	0%	0%	0%	0%	0%
Magnitude of Shortfall	$0	$0	$0	$0	$0	$0

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