VIABILITY OF THE SPEND SAFELY IN RETIREMENT STRATEGY

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Abstract and Overview

This project explores various design and implementation details for the Spend Safely in Retirement Strategy (SSiRS), a strategy identified by our 2017 research project titled *Optimizing Retirement Income by Integrating Retirement Plans, IRAs, and Home Equity: A Framework for Evaluating Retirement Income Decisions*.

The SSiRS is intended as a *baseline* retirement strategy, to be used by middle-income workers and retirees to generate retirement income from their IRAs or employer-sponsored defined contribution (DC) retirement plans, such as 401(k) plans. It uses investment options commonly found in IRA and DC administrative platforms, and does not require the ongoing assistance of a financial adviser.

In summary, the SSiRS includes two key steps:

1. Optimize expected Social Security benefits through a careful delay strategy; in this case, many middle-income retirees may have all the guaranteed lifetime income they need.
2. Generate retirement income from savings using the IRS required minimum distribution (RMD) rules, coupled with a low-cost index fund, target date fund, or balanced fund.

Section 2 of the report starts by describing the features of the SSiRS, its target audience and goals, and the advantages and disadvantages of the strategy. Section 3 then itemizes various implementation details, including establishing a retirement transition fund that can help support an older worker's transition into retirement and optimizing Social Security benefits.

Section 4 explores in detail the considerations for allocating assets between equities and fixed income investments for the RMD portion of retirement income. It demonstrates the potential gain in income amounts with significant equity allocations, as well as the potential risk and volatility. It also illustrates that projected income amounts are significantly higher if you assume investment returns based on historical returns in U.S. capital markets, compared to forward-looking returns that reflect the current low-interest rate environment. It suggests that retirees and their advisers consider the potential consequences of their assumptions turning out to be different from investment experience as it unfolds over the retirement period.

The report includes line graphs that plot the paths of projected retirement income under various economic historical scenarios for 30-year retirements, for these three asset allocations:

- 100% equities, S&P 500
- 100% intermediate term-government bonds (5-year maturities)
- A 50/50 equity/bond portfolio

The graphs also help assess if the projected income amounts would have kept up with inflation, given the specific economic scenario analyzed. These graphs provide a visceral impression of the potential gains and volatility associated with various asset allocations, *based on historical returns*. In summary, these graphs demonstrate that significant investment in stocks has the potential to deliver more income than bonds, *most of the time but not always.*

The graphs also show that a 50/50 portfolio can represent a reasonable compromise between growth and volatility in income.

Section 5 provides analyses that suggest a retiree's health status may not be a primary consideration for whether to adopt a version of the SSiRS. However, a retiree's health status might influence the choice of specific refinements to the strategy, as discussed in Section 6.

Section 6 describes and analyzes a handful of reasonable refinements to the SSiRS to reflect individual goals and circumstances, such as uneven flows of living expenses and other income, and the desire to accelerate income to the early years of retirement when a retiree might be more active and vital. Section 7 analyzes and compares the RMD to alternative retirement income generators (RIGs), such as annuities and systematic withdrawals from invested assets, that might better meet a retiree's desired pattern of expected retirement income.

Section 8 provides examples of the strategy and refinements for two hypothetical retirees. Section 9 contains analyses that demonstrate the significant increase in retirement income that results from delaying retirement, even for a few years.

Section 10 discusses considerations for retirees and their advisers for implementing the strategy, including when refinements might be appropriate, tax considerations, and considerations for the location of investments that support the SSiRS. Section 11 suggests that employers, plan sponsors, and financial institutions can help their older workers, retirees, and customers implement the SSiRS and other reasonable retirement income strategies by offering a retirement income menu in their DC retirement plan or IRA platform. Such a menu would complement the familiar investment menu, and could be implemented with common investment funds and straightforward administrative capabilities.

The authors believe that the SSiRS supports a "retirement plan perspective" on delivering retirement income to middle-income retirees. As such, the SSiRS can be considered as a means to "pensionize" defined contribution retirement plans and IRAs. As a result, older workers and retirees can understand the amount of retirement income they can expect, and then manage or reduce their living expenses accordingly. The authors acknowledge the potential advantages of an alternative approach – a "financial planning perspective" – where a retiree or qualified financial planner builds a customized plan that supports a retiree's desired lifestyle.

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Table of Contents

Exhibits

Appendices

SECTION 1: Acknowledgements

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SECTION 2: Summary of the Spend Safely in Retirement Strategy (SSiRS)

2.1 Target audience

The Spend Safely in Retirement Strategy (SSiRS) is intended to be used by middle-income workers and retirees to generate retirement income from their IRAs or employer-sponsored defined contribution (DC) retirement plans, such as 401(k) plans. It uses investment options commonly found in IRA and DC administrative platforms, and does not require the ongoing assistance of a financial adviser. For the purpose of this report, we define middle-income retirees as having $1 million or less in retirement savings.

The SSiRS is designed for older workers and retirees who:

- have not accrued significant benefits in defined benefit pension plans,
- have accumulated meaningful balances in DC retirement plans, IRAs, or other savings, and
- might not work with financial advisers.

The SSiRS is intended to be a *baseline strategy*, from which refinements can be made to customize the application to meet individual goals and circumstances. Such refinements could be developed with or without the assistance of an adviser. Retirement advisers can play a significant role by helping workers and retirees understand the strategy, how it compares to other strategies, and developing customized refinements. Employers can offer features in their defined contribution plans that can help their plan participants implement and customize the strategy, possible refinements, and other reasonable retirement income strategies.

Our prior reports, published in 2017, compared the SSiRS strategy to 292 possible retirement income strategies, using eight metrics that measure how a particular strategy might meet specific retirement income goals.[1,2] We used a portfolio approach, estimating the total income generated by Social Security and retirement savings. The strategies analyzed included Social Security optimization, annuities, systematic withdrawal plans (SWPs) with invested assets, and partial annuity/partial SWPs.

The SSiRS compared favorably to the 292 strategies as a reasonable compromise among potentially competing goals, including the expected amount of lifetime income, expected liquidity throughout retirement, and protection against risks associated with longevity, inflation, and investment performance.

The goal of the SSiRS is to provide a framework for helping older workers make important life decisions, including:

- When to retire
- Whether to work part time for awhile
- When to claim Social Security
- How to deploy retirement savings in retirement
- Whether it's necessary to reduce living expenses in retirement

When left o their own devices, retirees tend to fall into two camps when deploying their retirement savings:

- The first camp is reluctant to spend their savings, and they tend to minimize withdrawals from principal.[3,4] They preserve their savings for the proverbial "rainy day."
- The second camp "wings it," spending their money without being aware of sustainable spending rates.5

The SSiRS can help the first camp spend more money in retirement and feel safe, whereas it can help the second camp spend their savings more safely.

Recent focus groups conducted by the Society of Actuaries provide additional insights into how people think about deploying their savings.6 Many older workers decide whether they can afford to retire and generally plan by looking at their regular cash-flow requirements from usual bills for living expenses, but they do not consider unexpected expenses and shocks. They attempt to hold onto their assets and use them if needed (like a large emergency fund, but also a reserve for long-term care and other large unexpected shocks). They withdraw the RMD from their savings, but some do not recognize doing so as an asset withdrawal since it is required.

The SSiRS can help these older workers and retirees develop more robust plans to address both regular cash-flow requirements and reserves for emergencies.

2.2 Features of the strategy

The strategy has two basic components:

1. Develop "retirement paychecks" that are guaranteed for life (and the spouse if married), and are not subject to investment risks. Use these paychecks to pay for basic living expenses, such as housing, medical premiums and costs, utilities, food, and regular transportation.
2. Retirees retain full control over a portion of savings that they invest to pay themselves periodic "retirement bonuses" with the potential for growth in income if investment returns are favorable, but carry investment risk. Use these bonuses to pay for discretionary living expenses such as hobbies and travel. Presumably these expenses can be reduced if investment experience is poor.

Implementing the strategy has two steps:

Step 1: Optimize Social Security benefits through a thoughtful delay strategy.
Step 2: For retirement savings that are used to generate lifetime retirement income, invest in a low-cost target date, balanced, or stock index fund. Use the IRS required minimum distribution rules to determine the amount of annual withdrawals. See Appendix 1 for a table of the RMD withdrawal percentages calculated in accordance with the RMD rules.

Subsequent sections of this report discuss these steps in more detail, as well as straightforward methods for customizing the strategy to meet individual goals and circumstances.

2.3 Optimizing Social Security benefits

Regarding Step 1, optimal strategies for claiming Social Security benefits often call for delaying the start of benefits as long as possible (but no later than age 70) for a single retiree or the primary wage-earner of a married couple. The optimal strategy for the other spouse, or for unmarried couples, can vary considerably with individual circumstances. We suggest that older workers and retirees develop an optimal claiming strategy by working with a qualified retirement adviser or using commonly available soft are.[7]

If a worker decides to retire before the optimal age to start Social Security benefits, then a substantial amount of research supports using savings to fund a "Social Security bridge payment."[8] Such a payment uses retirement savings to replace the Social Security benefit that is being delayed until the optimal claiming age. In this case, the retiree would set aside a "retirement transition fund" that equals the total amount of the Social Security bridge payments that are expected to be withdrawn until actual Social Security benefits start.

The retirement transition fund would be segregated from the retirement savings that are being used to fund Step 2, because the retirement transition fund would have a different withdrawal strategy and asset allocation compared to the savings that are being deployed for Step 2. See Section 3 of this report for more considerations for establishing a retirement transition fund.

Another possibility for implementing Step 1 – optimizing Social Security -- is for the worker to work part time, just enough to replace the Social Security benefit that is being delayed. This would not require setting up a retirement transition fund, and helps preserve retirement savings for generating lifetime income under Step 2.

Analyses from our prior reports show that when Social Security benefits are optimized for middle-income retirees, they might comprise two-thirds to over 80% of the total retirement income.[1,2] This means that the same percentage of total income is protected against common retirement risks, such as longevity, inflation, investment, mistakes, and cognitive decline. The dominance of Social Security benefits in the total retirement income portfolio has profound implications on the methods used for investing and taking withdrawals from retirement savings to complement Social Security benefits.

2.4 Decisions for Step 2 – the RMD portion of income

Retirees must make two decisions to implement the RMD portion of retirement income under Step 2:

1. The asset allocation that applies to the portion of retirement savings that are generating the RMD income. Section 4 discusses considerations for this decision.
2. Whether to withdraw and spend the actual RMD withdrawal amount each year, or instead whether to adjust the annual withdrawal and spending amount to reflect anticipated uneven flows of expenses or income amounts, or to reflect personal spending goals for retirement. Section 6 discusses possible refinements for adjusting the annual withdrawal amounts.

Note that retirees are not required to *spend* the RMD portion of income when it's withdrawn. They have the option to pay income taxes on these withdrawals and invest part or all of the after-tax proceeds.

2.5 Advantages and disadvantages of the strategy

All retirement income strategies have their advantages and disadvantages. When considering any strategy, the retiree should weigh the advantages and disadvantages of the various strategies they may be considering, and whether the advantages and disadvantages are important to them.

Here are the primary advantages of the SSiRS:

- Simplicity of understanding and ability to implement within most IRA and DC platforms, without requiring the ongoing involvement of a financial adviser.
- Optimized Social Security benefits form a large portion of total retirement income, thereby protecting against common retirement risks, including longevity, inflation, asset declines, mistakes, fraud, death of a spouse, and cognitive decline.
- The RMD portion of income automatically adjusts the annual withdrawals to reflect emerging investment experience and the continued longevity of the retiree, which increases the probability that retirement savings and income will last for the life of the retiree.
- The SSiRS helps protect against cognitive decline by automating payment of both Social Security and the RMD portion of income.
- The strategy enables participants to leave their savings in employer-sponsored DC plans, which gives them fiduciary protection that is often not available at IRA providers and financial institutions.
- Retirees retain full control of remaining assets that generate the RMD portion of income; these assets can always be redeployed if necessary in response to life events, such as death of a spouse or divorce.
- The RMD, coupled with the qualified default investment alternative (QDIA) for the plan, could be offered as the default payout strategy under an employer-sponsored DC plan. This could give plan sponsors some protection from fiduciary liability.

Here are the primary disadvantages of the strategy:

- The RMD portion of income has the potential for significant fluctuations in year-to-year amounts if assets are substantially invested in stocks (see Section 4 for investment considerations). Whether that is a serious drawback depends in part on the amount of the RMD withdrawal relative to the amount of Social Security income.
- The strategy may not reflect uneven flows of living expenses and income amounts during retirement (but see Section 6 on refinements to the strategy to address this issue).
- Using a portion of savings for a retirement transition fund might rapidly use up that portion of savings, thereby reducing liquidity.

- The older worker or retiree may still need help from a financial adviser to understand and implement the strategy. For example, help might be needed to establish the amount of a retirement transition fund or determine the appropriate asset allocation for the RMD portion of income.
- The SSiRS as described in this paper calls for two separate pieces of retirement income paid for workers who retire before age 70-1/2. Some 401(k) or IRA administrators may not have the administrative capability to make two separate payments. In addition, these administrators may not be able to calculate a withdrawal amount that uses the RMD methodology before age 70-1/2, as described in Section 3.1. Section 3.2 describes a reasonable "work-around" to address this situation.
- Social Security benefits are subject to political risk – benefits could be reduced in the future if the system's funding deficiencies aren't addressed. For example, the 2018 Social Security Trustees Report projects that the Social Security Trust Fund will be depleted in 2034. In that case and at that time, under current law, Social Security benefits could be reduced to the level supported by the FICA taxes paid at that time by workers. According to the 2018 Social Security Trustees report, Social Security benefits could be reduced in aggregate by 21% to 26% in the succeeding years. If an older worker believes that Congress will not intervene to prevent such benefit reductions, that older worker may want to accelerate the start of their Social Security income.

There's another important feature of the SSiRS that can be perceived as an advantage or disadvantage, depending on the retiree's goals and circumstances. The RMD portion of income has the potential to backload that portion of income to later years of retirees' lives, depending on the asset allocation of the underlying retirement savings. For example, Figures 1 and 3 in Section 4.1 illustrate the potential for the RMD portion of income to increase in real terms over the retiree's life with an asset allocation to stocks of 50% or higher. Whether this anticipated result is perceived as an advantage or disadvantage depends on the retiree's goals and circumstances:

- Some retirees may want to spend more money in the early years of their retirement, while they are still active and vital. In this case, they may perceive backloading of their retirement income to be a disadvantage. To address this possibility, Section 6 discusses straightforward methods for modifying the SSiRS for such retirees. Alternatively, such retirees could deploy an alternative retirement income generator (RIG) as discussed in Section 7.2.
- Other retirees may want more income in their later years to help pay for anticipated higher costs for medical and long-term care. In this case, they may perceive backloading as an advantage.

Finally, in situations where the RMD portion of income is quite small compared to optimized Social Security benefits, the extent to which the RMD portion of income is backloaded may not be a source of concern to the retiree. For example, the RMD portion of many middle-income retirees might be less than one-third to one-fifth of their otal retirement income, when Social Security benefits are considered.[1,2] In this case, any backloading will only apply to that portion of their total retirement income.

SECTION 3: Implementation Details

3.1 Implementing the RMD portion of income before age 70-1/2

The IRS required minimum distribution (RMD) mandates that minimum amounts be withdrawn from all tax advantaged IRA and DC accounts except for Roth IRAs, starting at age 70-1/2. The minimum amount withdrawn for a calendar year equals the account balance at December 31 of the preceding calendar year, divided by the remaining distribution period of the plan participant according to Table III of IRS Publication 590-B.

The remaining distribution periods can be used to generate a series of withdrawal percentages, starting with a withdrawal percentage of 3.6496% at age 70 and increasing for each age thereafter. See Appendix D for a table of the RMD withdrawal percentages.

Since the SSiRS calls for using the RMD to determine annual withdrawals, we need withdrawal percentages that apply before age 70 if the retiree wishes to use savings to generate income before that age. Table 1 shows the withdrawal percentages that would apply from age 60 to 69, using the same methodology used by the IRS for the actual RMD rules:

Table 1. "RMD" withdrawal percentages before age 70

Age	Distribution period	Withdrawal percentages
60	36.8 years	2.7174%
61	35.8	2.7933
62	34.9	2.8653
63	33.9	2.9499
64	33.0	3.0303
65	32.0	3.1250
66	31.1	3.2154
67	30.2	3.3113
68	29.2	3.4247
69	28.3	3.5336
70	27.4	3.6496

3.2 Developing a retirement transition fund

Older workers who are approaching retirement can set aside a portion of their retirement savings to begin building a retirement transition fund within their IRA or 401(k) plan to enable their transition into retirement.

This fund can provide several advantages:

- It enables retirees to delay drawing down their retirement resources, such as Social Security and 401(k) accounts, for as long as possible, hopefully until age 70.
- It can supplement their wages as they transition from working full time to working part time, and to eventual full retirement.
- In the period leading up to their full retirement, it can provide a resource they can draw upon if they're laid off or can't find the work they need.
- It can provide a buffer against significant stock market declines during this time, so retirees don't need to withdraw from long-term savings while asset values are depressed.

The "right" transition into retirement – whether full retirement or part-time work – will depend on a worker's goals and circumstances. As a result, determining the amount of savings in a retirement transition fund will involve some judgement. For instance:

- Some workers might decide it should be a large enough amount to cover their estimated living expenses for a specified period, say two to five years.
- Another use for a retirement transition fund is to set aside enough savings to cover the amount of the Social Security benefit they plan to delay for as long as needed. As such, their strategy to optimize their Social Security can influence the amount of their retirement transition fund. If the older worker is married, the amount should consider if the spouse's benefit is also being delayed beyond the retirement date, and for how long.
- There are two methods for reflecting Social Security benefits in the calculation of the retirement transition fund:
    1. The retirement transition fund replaces the Social Security benefit that could have started at the time of retirement. The rationale is that if the retiree hadn't decided to delay Social Security, he or she would have been satisfied with the Social Security benefit at retirement. In this case, the retiree will realize an increase in retirement income when the actual Social Security benefit starts that reflects the delayed retirement credits.
    2. The retirement transition fund replaces the estimated Social Security benefit that reflects the anticipated delayed retirement credits when the actual Social Security benefit will start. This requires a larger retirement transition fund than the first method, but will provide a smoother transition in income when the actual Social Security benefit starts.
- On the other hand, if workers expect they will be able to continue working enough to cover their living expenses for several years, until they retire full time or until age 70, then they might need a much smaller retirement transition fund.

The retirement transition fund could be set up as a separate account in a worker's IRA or 401(k) plan, separate from the savings that are used for Step 2 that will generate lifetime retirement income. Alternatively, they can use other investment accounts for this purpose. Since the investing horizon for the retirement transition fund is short, they could invest it in stable, liquid investments, such as a short-term bond fund, a money market fund, or the 401(k) plan's stable value fund, if it has such a fund.

The remainder of their retirement savings would be invested under Step 2, and would have a longer investment horizon that might justify a substantial investment in stocks.

Note that if a worker retires before age 70, the SSiRS as described in this section potentially calls for two pieces of income paid from savings until age 70:

- a Social Security bridge payment, and
- the RMD portion of income that uses the RMD methodology before age 70-1/2.

Some 401(k) and IRA administrators may not have the capability to process one or both of these types of payments. In this case, the retiree could set up one temporary payment stream until age 70 that is intended to pay both the Social Security bridge payment and the RMD stream of income. This would require a larger retirement transition fund compared to a fund that just paid the Social Security bridge payment.

3.3 Establishing an emergency fund

It's desirable for retirees to set aside an emergency fund to cover unexpected expenses that cannot be paid from their monthly retirement income. Common examples include home and car repairs and dental bills. The goal of the emergency fund is to prevent needing to withdraw from savings that are being used under Step 1 for the retirement transition fund or under Step 2 for the RMD portion of retirement income.

During working years, an emergency fund is often advocated to protect against unexpected interruption of wages. Often rules of thumb call for an emergency fund that might equal three to six months of wages.

The amount of the emergency fund might shift at retirement, since the need to protect against interruption of wages is reduced or eliminated. The desired amount of an emergency fund involves some judgement, and could approximate deductibles under insurance policies, other out-of-pocket medical expenses, and anticipated home or car repairs.

Some retirees may feel more comfortable with an emergency fund that is larger than needed to handle the above expenses, as a potential buffer to protect against reductions in the RMD portion of income due to investment volatility.

The emergency fund would have a short investing horizon, and could be invested in the same types of funds as the retirement transition fund, such as money market funds, CDs, short-term bond funds, and stable value funds. If a retiree spends money in the emergency fund, it would be desirable, if possible, for the retiree to replenish the fund throughout retirement from future retirement paychecks and bonuses.

3.4 Administrative details

The RMD amount can be calculated shortly after the end of the calendar year, once year-end asset amounts are reported. The retiree will then know the amount of RMD income to expect for the coming calendar year. At that time, the retiree also would know the amount of their Social Security benefit that has been adjusted by the cost-of-living increase, so they could adjust their spending accordingly.

Most IRA and 401(k) administrators are able to calculate the RMD amount for the accounts that they hold, and many may also pay it in the frequency elected by the retiree (monthly, quarterly, or in one lump sum). For planning purposes, the retiree may wish to transfer the withdrawal amount to an account that protects principal shortly after the beginning of the year, to avoid disruptions from investment volatility during the coming year.

We anticipate that most IRA and 401(k) administrators are not currently set up to calculate withdrawal amounts using the RMD methodology for payments before age 70-1/2. They may need to refine their payout methodology, using the withdrawal percentages in Table 1 that would apply before age 70-1/2.

The IRS publication *Retirement Topics – Required Minimum Distributions* (RMDs) contains many details on the application of the RMD. Here's a summary of the rules that need to be considered when implementing the SSiRS:

- RMD rules apply to deductible and Roth 401(k), 403(b), and 457 accounts.
- RMD rules apply to deductible IRAs but not Roth IRAs.
- RMDs can be avoided by rolling over Roth 401(k), 403(b), or 457 accounts to Roth IRAs.
- Deductible 401(k), 403(b), and 457 accounts could be converted to Roth accounts (with accompanying payment of income taxes), and then rolled over to a Roth IRA to avoid RMD rules.
- If a retiree has multiple 401(k), 403(b), or 457 accounts, each account must comply with the RMD rules.
- If a retiree has multiple deductible IRA accounts, these accounts can be aggregated for the purposes of complying with the RMD rules, and the total RMD withdrawal can be made from one IRA account.

Savings that are converted to Roth IRAs can give retirees more flexibility to plan their spending. Retirees could apply the RMD percentage to determine their annual withdrawal amount from Roth IRAs and continue the SSiRS strategy, if that meets their needs. Or they could decide to defer withdrawals, since the RMD rules do not apply to Roth IRAs.

SECTION 4: Investment Considerations for the RMD Portion of Income

Asset allocation of the RMD piece of income is a significant planning decision. To state the obvious, significant allocation to equities will increase *expected* investment returns, which in turn will increase *expected* retirement income over the retirement period. However, higher equity allocations also increase the volatility in investment returns, as well as the volatility in retirement income.

Our prior report demonstrated that for middle-income retirees who use the SSiRS to build a retirement income portfolio, Social Security benefits represent a significant portion of total retirement income – from two-thirds to over 80%.[1,2] This means that the same portion of retirement income is protected against investment volatility, which could justify significant investment in equities in the RMD portion of retirement income. The dominance of Social Security benefits in the retirement income portfolio dampens volatility in total retirement income generated by the SSiRS.

Nevertheless, many retirees may focus on the amount of income from the RMD portion of income and the year-to-year fluctuations, since this piece is calculated and delivered separately from Social Security benefits. This section illustrates the potential gains in retirement income and also expected volatility for different allocations to equities.

First, we illustrate the tradeoff b tween risk and return using stochastic forecasts of the RMD portion of income. With these forecasts, we use two different sets of assumptions regarding future returns, to demonstrate the sensitivity of forecasts to investment assumptions.

Later in this section, we illustrate the tradeoff b tween risk and return on the RMD piece of income using historical returns.

4.1 Significant allocation to equities increases expected retirement income and also volatility in income

To illustrate the impact on the RMD portion of income of different equity allocations, we prepared stochastic forecasts of the annual real RMD income amounts. We developed line graphs showing the annual real retirement income over the retirement period, for the following stochastic percentiles: 90%, 75%, 50%, 25%, and 10%. This projection is for a married couple, both age 65, with $400,000 of assets at retirement.

To demonstrate the possible range of real investment returns and real retirement incomes, we used two sets of assumptions for real investment returns, as follows:

- Assumption Set 1: Forward-looking real returns averaging 5.0% per year for equities and 1.0% for intermediate government bonds. Assumed average annual inflation rate is 2.0%. This assumption set reflects the current low interest rate and economic environment.
- Assumption Set 2: Annual real historical returns averaging 9.04% for equities and 2.26% for intermediate government bonds (based on Ibbotson data). Assumed average inflation rate is 2.97%.

Figure 1 shows the projected median amounts of RMD income in the stochastic forecast using Assumption Set 1 (forward-looking returns) for three asset allocations: 100% equities, 100% intermediate-term government bonds, and a 50/50 equity/bond allocation. Figure 1 and the figures that follow show real estimates of annual income, so a flat line of retirement income keeps up with inflation, an increasing line implies real growth in income, and a declining line does not keep up with inflation.

Figure 1. Comparison of real annual retirement income under median forecast for three asset allocations, using forward-looking assumptions.

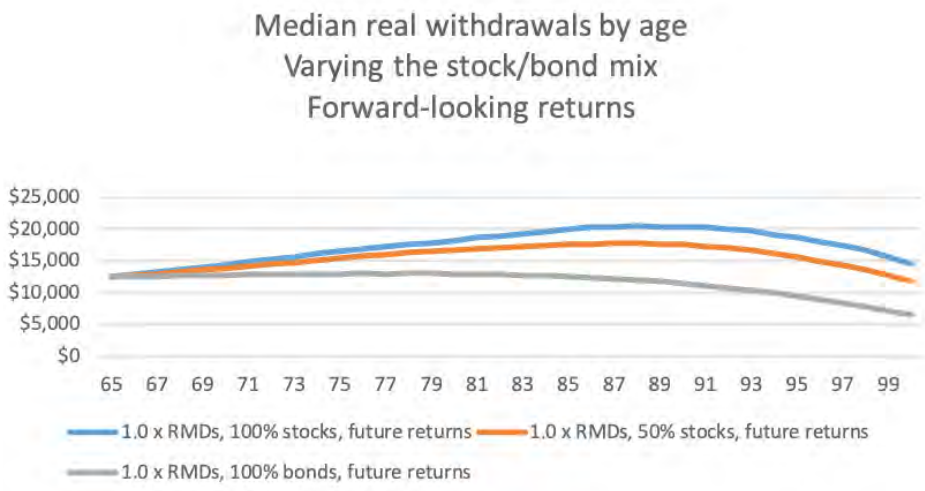


Figure 1 illustrates the *expected* result, that stocks produce higher retirement incomes over time compared to bonds. It also illustrates the expected pattern of real incomes – rising in real terms until the late 80s for allocations of 100% and 50% stocks, but declining in real terms in the 80s with the 100% bond allocation.

Figure 2 shows results from the same forecast as Figure 1, but using the 10th percentile of retirement income in the stochastic forecast, to illustrate the potential risk with significant equity allocations.

Figure 2. Comparison of real annual retirement income under 10th percentile forecast for three asset allocations, using forward-looking assumptions.

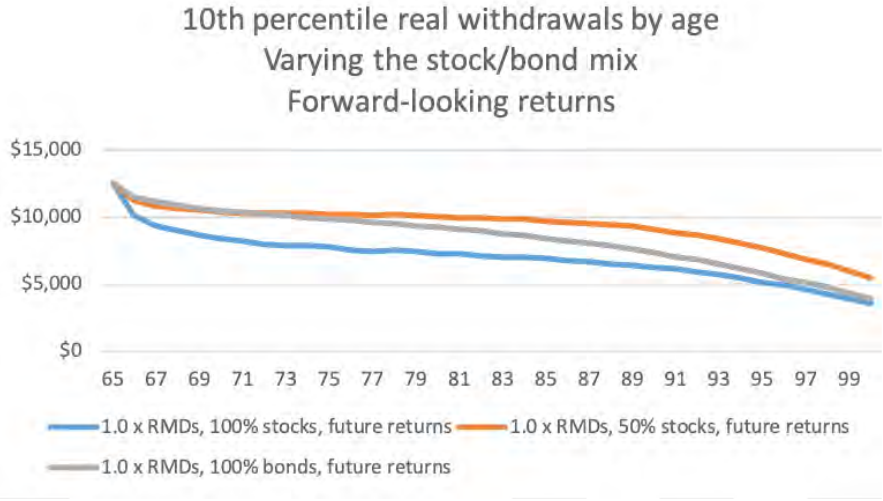
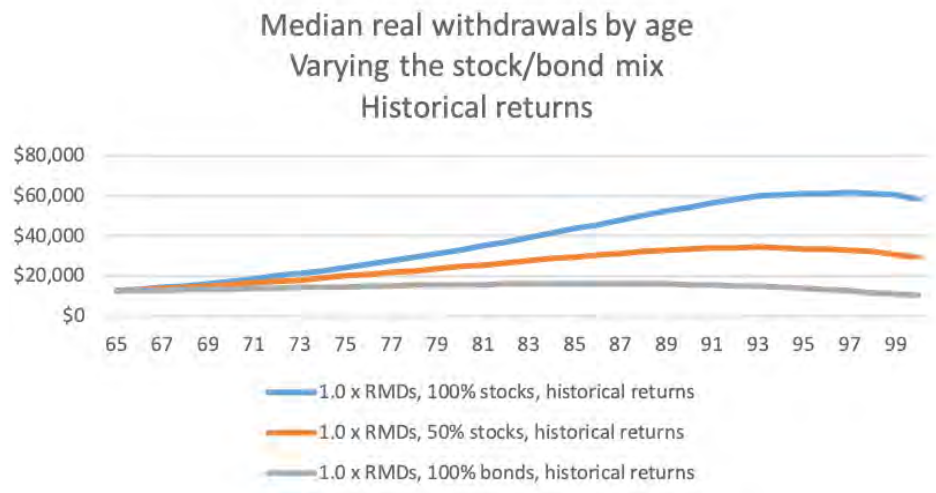


Figure 2 illustrates that stocks produce lower retirement incomes over time compared to bonds under poor investment scenarios. In this case, the 50/50 portfolio produced the most amount of income over the retirement period.

Figure 3 shows the projected median amounts of RMD income in the stochastic forecast using Assumption Set 2 (historical returns) for three asset allocations: 100% equities, 100% intermediate bonds, and a 50/50 equity/bond allocation.

Figure 3. Comparison of real annual retirement income under median forecast for three asset allocations, using historical assumptions.



Assumption Set 2 (historical returns) generates a much higher advantage to investing in stocks vs. investing in bonds, compared to Assumption Set 1 (forward-looking returns). Also, the projected retirement income under Assumption Set 2 increases in real terms for a longer period compared to Assumption Set 1.

Figure 4 shows results from the same forecast as Figure 3, using Assumption Set 2, but using the 10th percentile of retirement income in the stochastic forecast.

Figure 4. Comparison of real annual retirement income under 10th percentile forecast for three asset allocations, using historical assumptions.

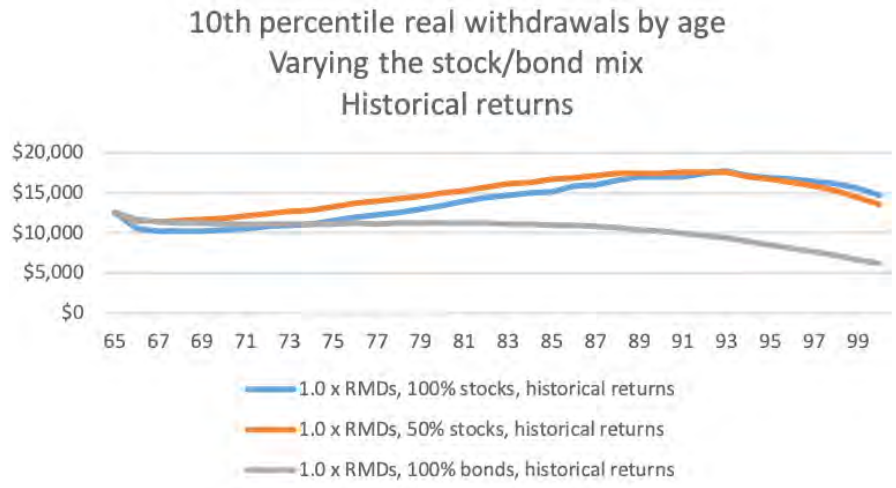


Figure 4 shows that even in unfavorable scenarios, investment in stocks produce higher incomes than investment in bonds. This conclusion is opposite of the conclusion from Assumption Set 1, which showed that bonds produce higher incomes in unfavorable investment scenarios. This result demonstrates the sensitivity of results to investment return assumptions, and in particular the assumed average equity premium that stocks earn over bonds.

Next, we compare results from the same stochastic forecasts for the two investment return assumption sets, drawing attention to the observation that choice of investment return assumptions has a significant impact on projected investment returns and retirement income.

4.2 Illustration of impact of assumptions regarding future investment returns

To illustrate the impact of different assumptions regarding investment returns, we prepared line graphs that compare the median retirement incomes under the stochastic forecasts for Assumption Sets 1 and 2.

Figure 5 compares the annual amounts of retirement income using the two sets of assumptions under the median scenario from the stochastic forecast, for portfolios invested 100% in equities and a 50/50 equity/bond portfolio. These forecasts show significant differences in projected retirement incomes after the 10th year in retirement under the two sets of assumptions.

For example, at age 85, with a 100% equity allocation, the projected real annual income is $43,784 using Assumption Set 2 (historical returns), compared to $19,921 using Assumption Set 1 (forward-looking returns). With the 50/50 asset allocation, the projected real retirement income at age 85 is $29,630 for Assumption Set 2 and $17,626 for Assumption Set 1.

Figure 5. Comparison of real annual retirement income under median forecast, comparing historical vs. forward-looking return assumptions.

Retirees and their advisers will need to consider the degree of optimism they build into their forecasts when making asset allocation decisions, which in turn can influence retiree decisions regarding their spending power throughout retirement.

4.3 Illustration of potential gains and volatility in RMD portion using historical returns

We prepared a series of line graphs to provide a visceral feel for the potential volatility and relative magnitudes of the RMD portion of income under different asset allocations. Figure 6 is a line graph that illustrates the nominal year-to-year amounts of retirement income for a 30-year retirement starting at age 65 in 1988 (the latest possible 30-year retirement). This graph uses the RMD methodology to calculate annual income amounts. It assumes a starting asset value of $400,000, with three possible asset allocations:

- 100% stocks, using the total return on the S&P 500 index
- 100% intermediate-term government bonds (5-year maturities)
- 50% stocks/50% bonds

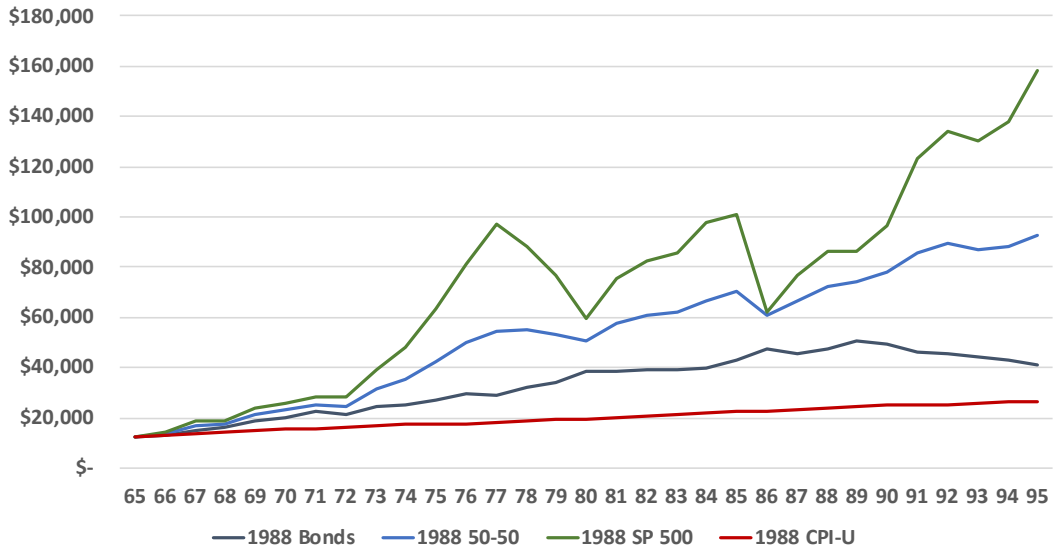
We added a fourth line that starts with the RMD withdrawal amount of $12,500 at age 65 and adjusts it each year for the change in the Consumer Price Index (CPI-U). This helps assess how the retirement incomes under the three asset allocations would have kept up with inflation.

Figure 6 shows there is considerable fluctuation in the estimated year-to-year retirement income amounts with 100% allocation to stocks. There were two periods of significant decreases in retirement income following the stock market declines in 2000-2002 and 2008. However, in spite of this volatility, for the 30-year retirement period beginning in 1988, the RMD methodology coupled with 100% stock investments projected much more income than an allocation of 100% to bonds or even the 50/50 portfolio.

The 50/50 portfolio represents a compromise between the 100% stock and 100% bond portfolios. The 50/50 portfolio projects less volatility than the 100% stock portfolio, and also more income than the 100% bond portfolio.

Note that all three asset allocations outpaced inflation during this period.

Figure 6. Annual amount of nominal RMD income for 30-year retirement starting in 1988, for three asset allocations. Married couple age 65 with $400,000 in starting assets.



Here is one example from Figure 6 that provides more details on the potential rewards and volatility with a 100% allocation to stocks, compared to the two other asset allocations.

Table 2 compares the retirement income amounts resulting from investment returns during the significant stock market decline during the 2000-2002 period.

Table 2. Comparing volatility in nominal retirement income amounts during 2000-2002

Age	Annual income with 100% equity allocation	Annual income with 50/50 equity/bond allocation	Annual income with 100% bond allocation
77	$97,418	$54,499	$28,712
78	$88,117	$55,179	$32,168
79	$76,843	$53,444	$34,264
80	$59,221	$50,446	$38,280

Which income would you rather have at age 80 – an annual income under the 100% stock allocation of $59,221 that followed significant decreases in income in just three years from the far higher starting point of $97,418 at age 77, or an income under the 100% bond allocation of $38,280 at age 80 that followed steady increases throughout retirement? Admittedly these are extreme results; however, they illustrate that investment in stocks provide the potential for significantly more retirement income delivered over retirement compared to a 100% bond portfolio, accompanied by significant fluctuations in retirement income amounts, *using historical rates of return*.

The 30-year period from 1988 to 2018 included the significant stock market runups in the late 1990s and following the Great Recession of 2008-2009. As such, this period represents a favorable view of investing in stocks during retirement. Next, let's look at one of the worst possible historical periods to invest in stocks during retirement.

Figure 7 provides the same type of analyses as Figure 6, but for a 30-year retirement starting in 1929, possibly the worst possible period in recent history for investing in the U.S. stock market during retirement.

During this retirement period, investment in bonds would have produced a higher retirement income than 100% stocks or the 50/50 portfolio until the early 80s. After the mid-80s, the 100% stock and 50/50 portfolios significantly outperformed the 100% bond portfolio. However, note that many retirees may not have survived to those ages. The 100% bond portfolio also outpaced inflation until age 92.

Figure 7. Annual amount of nominal RMD income for 30-year retirement starting in 1929, for three asset allocations. Married couple age 65 with $400,000 in starting assets.

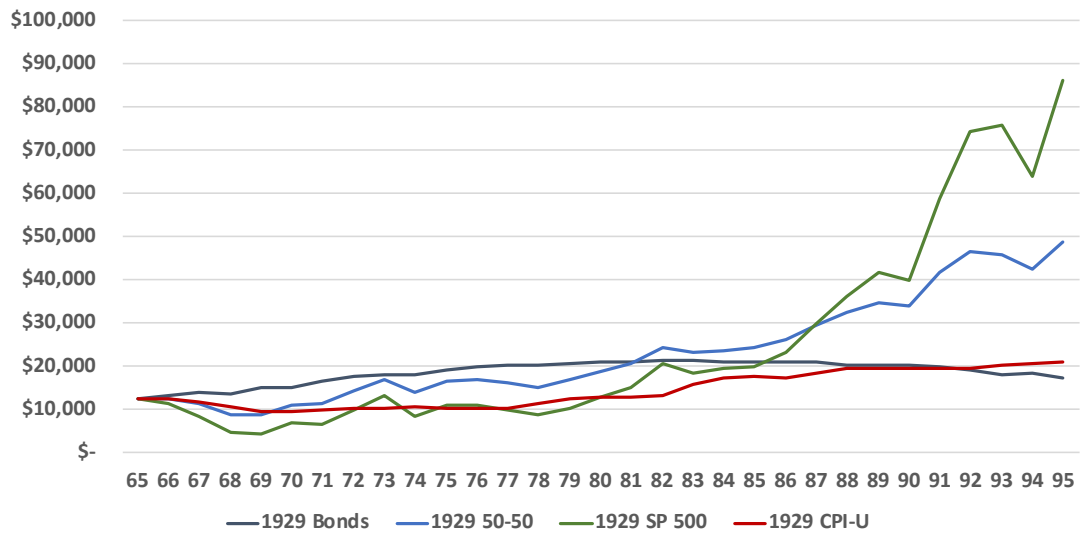


Table 3 compares the dollar amounts of retirement income for selected ages following retirement at age 65 in 1929, for the three asset allocations. Note that in all cases, the starting annual retirement income at age 65 is $12,500.

Table 3 shows the significant decreases in retirement income under the 100% stock portfolio, following the stock market declines during 1929-31, 1937, and 1940-41. This retirement period also reflected the stock market runup in the period following WWII, which resulted in increasing retirement incomes late in the retirement period.

Table 3. Comparing volatility in nominal retirement income amounts for 30-year retirement starting in 1929

Age	Annual income with 100% equity allocation	Annual income with 50/50 equity/bond allocation	Annual income with 100% bond allocation
70	$6,793	$10,964	$15,097
75	$11,051	$16,623	$19,185
80	$12,799	$18,900	$20,892
85	$19,983	$24,097	$21,066
90	$39,940	$33,957	$20,086

Exhibit 1 contains a series of similar graphs for 30-year retirements beginning in 1978, 1968, 1958, 1948, 1938, and 1928. These periods represent a variety of investment scenarios, including periods of high inflation, deflation, stock market declines and stock market runups. Some of these scenarios happened early in the retirement period, and some happened late in retirement.

The last graph in the series contains the same analysis for 12-year retirement starting in 2008, just before the Great Recession.

Here are some general observations and conclusions from this series of graphs, *based on historical returns since 1926*:

- *Most of the time but not always*, a 100% allocation to stocks produced more income than a 100% investment in bonds or the 50/50 portfolio. For some 30-year retirements, stocks produced dramatically higher incomes.
- *Most of the time but not always*, the 50/50 portfolio produced more income than the 100% bond portfolio and less income than the 100% stock portfolio. For all the retirement periods analyzed, the 50/50 portfolio produced a less volatile pattern of retirement income than the 100% stock portfolio. This suggests that a balanced portfolio might represent a compromise between the two extreme asset allocations.
- *Most of the time but not always*, the 100% bond portfolio outpaced inflation.

One potential disadvantage of using historical returns to illustrate potential volatility is that they may not be representative of future returns, given the current state of interest rates, inflation, and stock market valuations. The stochastic forecasts discussed in Sections 4.1 and 4.2 address these disadvantages.

4.4 Implications for retirement planning regarding asset allocation and assumed investment returns

The analyses in this section illustrate a few basic investment tradeoffs facing retirees and their advisers:

- Significant allocation to equities provides the potential for delivering much higher retirement income compared to investing in bonds. However, there's no guarantee of that outcome, and retirees incur the risk of realizing lower retirement incomes if stock market returns are poor in the early years of retirement.
- The degree of optimism vs. pessimism reflected in the assumptions regarding expected investment returns significantly impacts the expected amounts of retirement income received over the retirement period.

When selecting assumptions, retirees and their advisers may want to consider the implications of their assumptions on the retiree's expectations regarding spending. Here are two ways of thinking about this decision, contrasting the ramification of investment returns in retirement turning out to be different from the assumptions:

- If retirees base their planning on optimistic assumptions regarding investment returns, and actual returns through retirement fall short of these assumptions, they may need to reduce future spending. Some people may accept this situation, rationalizing that they would rather spend more money in their early years of retirement, and they're willing to run the risk of later needing to reduce their income. Other retirees might think they would be unable to reduce their future spending, particularly in their later years when they might need to increase spending on medical and long-term care. In this case, they may prefer the scenario discussed next.
- If retirees base their planning on less optimistic assumptions regarding investment returns, and actual returns through retirement exceed these assumptions, they may be able to increase future spending. Some people may welcome this situation, thinking that they might need to increase spending in their later years for high medical or long-term care costs. Other retirees might lament that they could have spent more in the early years of their retirement. In this case, they might prefer the first scenario.

The analyses in this section support 100% allocation to equities for the RMD portion of the retirement income. We acknowledge that most retirees will feel uncomfortable with such a high allocation to stocks, even though the allocation to stocks of the total retirement income portfolio would be less than 50% when the value of Social Security benefits is considered.

Section 5.2 contains analyses that suggest an equity allocation of 75% might be a reasonable compromise and still compares favorably to other retirement strategies. The line graphs in Figures 6 and 7 and Exhibit 1 suggest a 50/50 portfolio might also be a reasonable compromise. These allocations are close to a balanced fund with a significant allocation to stocks, or a target date fund that applies to retirees.

The analyses in this section demonstrate the advantage of the basic feature of the SSiRS described in Section 2.2 – covering basic living expenses with guaranteed sources of income and covering discretionary living expenses with income generated by invested assets, with a significant investment in stocks (50% allocation or higher). The assumption is that retirees would expect to receive higher incomes over time due to the allocation to stocks, but they could reduce discretionary spending if necessary when investment experience is poor.

Another advantage to this strategy is that it will help retirees ride out significant stock market declines. One of the worst things a retiree can do during a stock market decline is to panic and sell stocks near the market low, locking in losses and preventing the opportunity for gains when the stock market rebounds. But staying invested in stocks during a downturn takes discipline and courage. By having basic living expenses covered by guaranteed sources of income, retirees may feel more comfortable remaining invested in stocks during a market downturn.

SECTION 5: Applicability to Alternative Health Scenarios

One common concern about strategies that delay the start of Social Security benefits and the drawdown of retirement accounts is the retiree's health status. Retirees who perceive themselves to be in poor health might justify starting Social Security early and drawing down savings as soon as possible. In addition, some older workers may not be sufficiently h althy to work longer to enable delaying Social Security benefits or drawing down savings.

Ideally, an informed and conscious decision about working vs. retiring and deploying retirement savings would balance the pure financial implications with the retiree's desired lifestyle and preferences for leisure vs. continued work. It would also consider the retiree's health status and the impact on expected lifespan.

This section examines the purely financial implications of health status on the choice of a retirement income strategy that integrates Social Security claiming with the deployment of retirement savings. Our goal is to determine if the health status – average, good, or poor – might change the retirement income strategy that a retiree might consider to be optimal for their circumstances. This can help retirees and their advisers with the balancing act described in the previous paragraph.

Step 1 of the SSiRS involves optimizing Social Security benefits through a careful delay strategy. Some of the popular online Social Security optimizer programs take into consideration the health status of the retiree and spouse. Workers approaching retirement could use one of these programs to develop a Social Security claiming strategy that reflects their health status, and then implement the SSiRS accordingly to support their Social Security decision.

Note that our report focuses primarily on generating streams of retirement income to cover expected living expenses over the course of retirement. We did not analyze strategies to address the risk of potentially high costs for medical and long-term care, which may require strategies that are separate and distinct from the task of generating retirement income to cover expected living expenses. Such strategies could include:

- purchasing a Medicare Supplement Plan or Medicare Advantage Plan to address medical costs,
- purchasing long-term care insurance,
- holding home equity in reserve,
- dedicated savings in a Health Savings Account (HSA) or other investment vehicles that are not used to generate streams of retirement income, and/or
- purchasing a qualified longevity annuity contract (QLAC).

5.1 Description of stochastic forecasts and efficient frontiers

We prepared stochastic forecasts of average expected real income and average expected real accessible wealth for two hypothetical retirees under three alternative health statuses:

1. "Average" health, using mortality rates from the Society of Actuaries' RP-2014 Mortality Tables for Healthy Annuitants, with the projections identified in Appendix B.
2. "Good" health, adjusting the above mortality rates by a multiplier of 0.8.
3. "Poor" health, adjusting the above mortality rates by a multiplier of 1.25.

Here are the two hypothetical retirees we analyzed:

- Single female retiring at age 65 with $250,000 in retirement savings
- Married couple both retiring at age 65 with $400,000 in retirement savings

For each hypothetical retiree, we prepared efficient f ontier analyses that plotted average expected real income and average accessible real wealth under each of the three health statuses listed above. We analyzed and compared 80 different retirement income strategies, similar to the analyses prepared in our previous retirement income analyses for the Society of Actuaries.1 For these analyses, we combined Social Security benefits with income generated by savings.

We analyzed the following retirement income solutions:

- Start Social Security at age 65
- Start Social Security at age 70
- Fixed single premium immediate annuity (SPIA)
- SPIA escalating at 3% per year
- Systematic withdrawal plans (SWPs) with 3%, 5%, and 7% withdrawal percentages applied to remaining assets at the beginning of each calendar year, combined with asset allocations to stocks of 0%, 25%, 50%, 75%, and 100%
- RMD combined with asset allocations to stocks of 0%, 25%, 50%, 75%, and 100%
- Partial annuitization – 30% of savings devoted to a SPIA and 70% devoted to various systematic withdrawal plans

Appendices A through D describe the methodology and assumptions we used to prepare these forecasts.

5.2 Results of efficient frontier analyses under alternative health scenarios

Figures 8a, 8b, and 8c on the subsequent pages compare the efficient f ontiers for the single female retiree under average, good, and poor health scenarios, respectively. Each symbol on the page represents a unique retirement income strategy. In each case, Social Security benefits are included and start at age 65. In most cases, the strategies on or close to the efficient f ontier are the same for each of the three health statuses. Note in particular that the RMD strategy with 100% investment in stocks (the green cross on the efficient f ontier line) is an inflection point on the efficient f ontier in all three health scenarios.

We acknowledge there are behavioral barriers to investing 100% of assets in stocks. However, note that the green cross below the RMD solution on the efficient f ontier represents 75% investment in stocks; it would be on the efficient f ontier if the RMD solutions with 100% stock investment are ignored. This suggests using a balanced or target date fund with a significant allocation to stocks as a possible solution that balances financial and behavioral considerations.

Figures 9a, 9b, and 9c on the following pages also compare the efficient f ontiers for the single female retiree under average, good, and poor health scenarios, respectively. In each case, Social Security benefits start at age 70 and a portion of savings are used to fund a Social Security bridge payment from age 65 to 70. Once again, in most cases, the strategies on or close to the efficient f ontier are the same for each of the three health statuses. And once again, the RMD strategy with 100% investment in stocks (the green cross) is an inflection point on the efficient f ontier in all three health scenarios. Also once again, the RMD solution with 75% allocation to stocks represents a close runner-up to the RMD solution with 100% allocation to stocks.

In addition, when comparing the results for the three health statuses, the average real income amounts on the efficient f ontier are not significantly different. This suggests that a retiree in good health status can expect to receive approximately the same annual real income over the retirement period as a retiree in average or poor health; the main difference is that the retiree in good health would expect to receive this income for a longer period of time.

The average accessible wealth amounts decline slightly when comparing poor health status to average health to good health, because wealth is depleted for a longer period of time for the healthier retirees. As a result, healthier retirees generally show lower projected bequests at death than retirees in poor health, because the healthier retirees have depleted their savings for a longer period of time.

Finally, note that when comparing the efficient f ontiers for starting Social Security at age 65 vs. using a portion of savings to enable delaying Social Security until age 70:

- the delay strategy produces higher expected average retirement incomes, but
- lower expected average accessible wealth amounts, since a portion of savings is rapidly used up to fund the Social Security bridge payment.

These analyses suggest that a primary consideration for selecting a retirement income strategy would be the tradeoff between maximizing income and maximizing accessible wealth, and that the health statuses would play a secondary role in influencing the choice of a retirement income strategy.

It is beyond the scope of this report to describe the health conditions that would influence whether a retiree is in average, good, or poor health, and to identify the circumstances that would rationalize using poor health as a primary factor that influences the choice of a retirement income strategy. The authors speculate that “poor health” as defined in this report could include moderately unhealthy measurements of body-mass index, blood pressure, cholesterol, and/or blood sugar, for example. We further speculate that if a retiree were to consider poor health as a primary justification for selecting a retirement income strategy, in this circumstance “poor health” might need to be defined as being diagnosed with a life-shortening illness or a lifetime history of smoking.

Exhibits 2 and 3 show the efficient f ontier analyses for the second hypothetical retiree – the married couple both retiring at age 65 with $400,000 in retirement savings. Many of the same conclusions described previously for the single female apply for the married couple. Most notably, the RMD solution with 100% stocks is an inflection point on the efficient f ontiers for all three health statuses and for starting Social Security at age 65 or age 70, and the RMD with 75% allocation to stocks is a close runner-up. However, there are a few differences in solutions on the efficient f ontier between the different health statuses.

Figure 8a – Single female age 65, average health, Social Security starts at age 65

Figure 8b – Single female age 65, good health, Social Security starts at age 65

Figure 8c – Single female age 65, poor health, Social Security starts at age 65

Figure 9a – Single female age 65, average health, Social Security starts at age 70

Figure 9b – Single female age 65, good health, Social Security starts at age 70

Figure 9c – Single female age 65, poor health, Social Security starts at age 70

5.3 Comparison of 8 retirement income metrics

We expanded our analyses of alternative health statuses by analyzing a smaller group of retirement income solutions using eight retirement income metrics. These are the same metrics used in our 2017 report,1 as follows:

- Average real income
- Direction of income (is it keeping up with inflation?)
- Average real accessible wealth
- Direction of wealth (how quickly is wealth being depleted?)
- Average bequest at death
- Downside volatility
- Probability of shortfall
- Magnitude of shortfall

Exhibits 4, 5, and 6 show the results for the single female age 65 for average, good, and poor health statuses, respectively. Exhibits 7, 8, and 9 show the results for the married couple age 65 for average, good, and poor health statuses, respectively. These analyses also support the conclusion that health status might be a secondary influence on the choice of a retirement income strategy, since the relative advantages of the various retirement solutions analyzed do not vary significantly by health status.

However, we have one comment. We note that average bequests at death are usually higher for the poor health status compared to healthier retirees, because wealth will be depleted for a longer period for healthier retirees. As a result, retirees in poor health might be interested in a retirement income strategy with a pattern of retirement income that front-loads the income to help them pay for expected health care costs throughout their retirement. They could accomplish this goal with the SSiRS in either one of two ways:

- by using a multiplier on the RMD portion of benefit, as discussed in Section 6.3, or
- using a SWP percentage of 6% or 7% (or the greater of these percentages or the RMD withdrawal percentage)

These refinements would increase the income paid to a retiree in poor health status, which might be needed to pay for medical or long-term care expenses.

SECTION 6: Refinements to the SSiRS

This section discusses possible refinements to the baseline SSiRS to customize the strategy to address specific goals and circumstances, such as uneven expense or income flows, or alternative patterns of retirement income. We acknowledge that some of these refinements have the potential to increase the complexity of implementing the SSiRS, thereby somewhat reducing its appeal of simplicity.

6.1 Uneven expense flows during retirement

The baseline SSiRS strategy is anticipated to generate a steady flow of total retirement income throughout retirement. Retirees may want to adjust for anticipated additional expense amounts that may only last for limited periods in retirement.

For example, some retirees may anticipate traveling during the initial years of retirement, while they still have the health and vitality for such travel. In this case, they could set aside a "travel bucket" to cover these anticipated expenses, and segregate this bucket from the savings that are being used to generate the RMD portion of income under Step 2.

Note that such a "travel bucket" does not necessarily need to be withdrawn from retirement vehicles such as an IRA or 401(k) plan. It could be established as a separate investment account within the IRA or 401(k) plan.

Note also that when withdrawals in a year from 401(k) plans and deductible IRAs are more than the amounts required by the RMD, there will be no violations of the RMD rules for that year.

Example: Suppose the retiree desires to spend $5,000 per year on travel during the first 10 years of retirement. He or she could then set aside $50,000 to cover these anticipated expenditures, and not use that amount to generate annual withdrawals for the RMD portion under Step 2 of the SSiRS. In this case, the travel bucket would have a relatively short investing horizon, and could be invested in short-term bond funds or conservatively invested balanced or target date funds. Remaining assets would be used to generate the RMD portion of income under Step 2, and would be invested accordingly.

This method could also be used to fund for other living expenses that are anticipated to be temporary. For example, some retirees may be near the end of a mortgage payment schedule, in which case mortgage payments might cease after a known period of years. In this case, the retiree could also set aside a "mortgage payment bucket" to cover these anticipated expenses, and segregate this bucket from the savings that are being used to generate the RMD portion of income under Step 2.

Another example of uneven expense flows could be anticipated additional expenses in a retiree's later years for out-of-pocket medical expenses or long-term care. The retiree could estimate these expenses and their anticipated duration, and set aside this amount from the retirement savings that are being used to generate the RMD portion of income under Step 2.

Example: Suppose the retiree assumes that during the last 10 years of life, he or she will spend an additional $5,000 per year for the penultimate five years on expenses for medical or long-term care, and $10,000 per year for the final five years. To cover this possibility, the retiree could set aside $75,000 from retirement savings that are being used under Step 2 to generate the RMD portion of income.

There are a few important caveats and notes on this strategy:

- It is very difficult o predict out-of-pocket expenses for long-term care, which could easily exceed amounts set aside for this purpose. The retiree may want to adopt other strategies to address the risk of long-term care expenses, such as buying long-term care insurance, holding home equity in reserve, arranging for a reverse mortgage line of credit, or buying a qualified longevity annuity contract (QLAC).
- If the amounts set aside for this purpose are invested in a 401(k) plan or deductible IRA, annual withdrawals are subject to the RMD rules. If the retiree postpones significant withdrawals, he or she might violate the RMD rules and incur substantial penalties. The retiree could use a few strategies to address this possibility:
    - Hold these savings in a Roth IRA or Health Savings Account, both of which aren't subject to the RMD rules.
    - Withdraw the required minimum amounts from savings, include this amount in taxable income for the year, and invest the net amount in an after-tax investment account that is set up for this purpose.
- At the time of retirement, amounts set aside for this purpose may have a long investing horizon. This might justify a substantial investment in stocks for savings dedicated to paying for health care costs late in life, depending on a retiree's risk tolerance. The line graphs in Figures 6 and 7 and Exhibit 1 demonstrate the potential for such a strategy.

6.2 Temporary income flows during retirement

Some retirees might expect temporary income flows in retirement, and they may want to adjust their withdrawals from savings to create a relatively smooth pattern of total income throughout retirement. For example, suppose an older worker retires from full-time employment but expects to earn $20,000 per year for five years from part-time employment. Further suppose this retiree wants to have roughly the same total income before and after the five-year period.

One straightforward way to address this situation is if the retiree also expects temporary additional expenses in their initial retirement years. In the above example, if the retiree also anticipates $5,000 per year of additional travel expenses, then the temporary income could be set aside and dedicated to paying for travel expenses.

Here's another straightforward way to adjust a retiree's withdrawal strategy to accommodate temporary income flows and smooth the pattern of retirement income:

- Step i: Assume the retiree has a phantom "asset" which equals $100,000 (the expected wages for five years). Add this amount to the amount of assets devoted to the RMD piece under Step 2 of the SSiRS strategy.
- Step ii: Calculate a nominal "withdrawal" amount by applying the RMD percentage to the sum of the two assets described in Step i.
- Step iii: From the result of Step ii, subtract actual wage earnings to determine the actual amount that is withdrawn from retirement savings.
-

This method would need to be revisited each year when the RMD withdrawal amount is calculated under Step 2 of the SSiRS, to reflect possible changes in the amount and duration of expected wages.

Note that the retiree would need to monitor actual withdrawals from DC balances and deductible IRAs for compliance with the RMD rules.

6.3 Alternative patterns of retirement income

Some retirees may desire to front-load the retirement income, to deliver more income when they are active and vital. Section 6.1 discussed one method to deliver targeted additional income in the early years of retirement. Here we discuss another potential straightforward adjustment to the RMD portion of income.

A retiree could multiply the RMD portion of income by a factor, such as 1.25 or 1.5. Note that such a factor will guarantee compliance with the RMD rules, since the withdrawal amount will automatically exceed the minimum required amount.

This technique would transfer income from later years of retirement to the early years of retirement. A key question is the pattern of expected income with the adjustments compared to the pattern of income expected with no adjustments. The pattern of income expected will significantly depend on the allocation of assets to equities, and on the expected returns for stocks and bonds.

Keep in mind that dominance of Social Security benefits for middle-income retirees will dampen the impact on total retirement income of selecting a multiplier to adjust RMD withdrawal amounts.

Figures 10, 11, and 12 show the expected patterns of real income under a stochastic forecast for different multipliers and asset allocations, as follows:

- RMD multipliers of 1.0, 1.25, and 1.5.
- Allocations of 100% equities (S&P 500) and 50% equities/50% intermediate term government bonds (5-year durations).
- Forward-looking investment return assumptions given the current economic environment (5.0% average annual real return for equities, 1.0% for bonds).

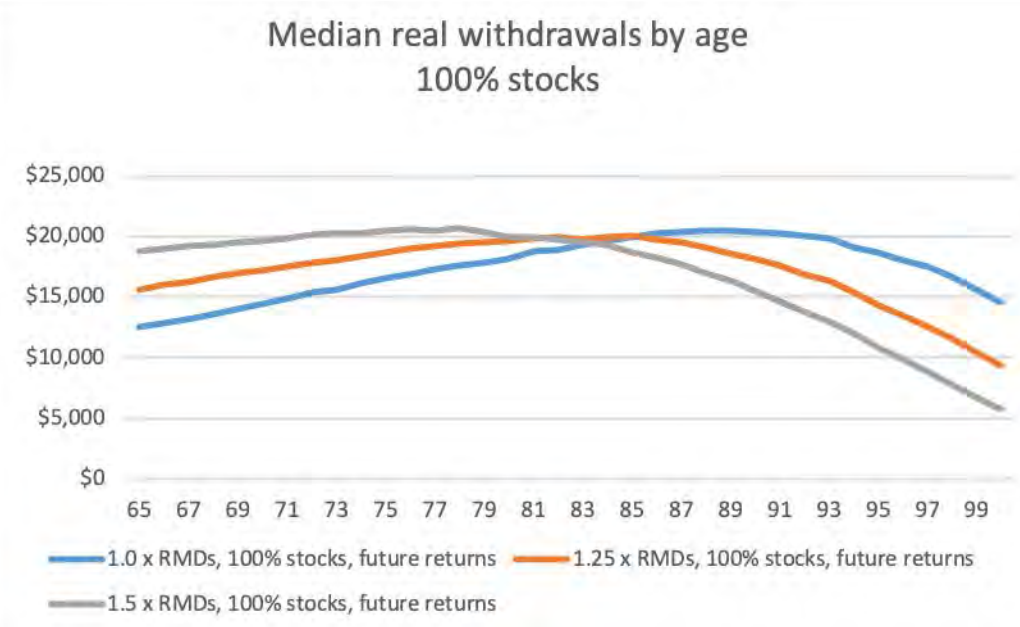
These figures show real estimates, so a flat line of retirement income keeps up with inflation, an increasing line implies real growth in income, and a declining line does not keep up with inflation. Figures 10, 11, and 12 just focus on the RMD portion of retirement income.

The expected impact on the pattern of income using an RMD multiplier depends on the asset allocation, and the expected return on assets under various asset classes.

For a portfolio 100% invested in equities, with forward-looking assumed investment returns, Figure 10 shows that:

- A 1.0 multiplier produces a pattern of real incomes at the median of the stochastic forecast that increases in real terms until age 88, then declines in real terms thereafter.
- A 1.25 multiplier produces a pattern of real incomes that increases slightly until about age 85 at the median level of the stochastic forecast, then declines in real terms thereafter.
- A 1.5 multiplier keeps up with inflation until about age 79 at the median level of the stochastic forecast, then declines in real terms thereafter.

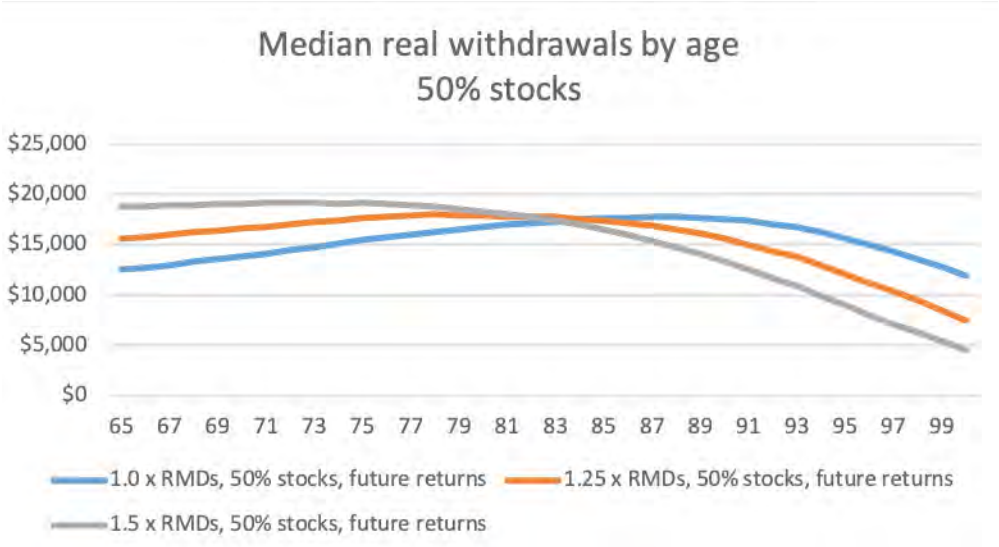
Figure 10. Comparison of 1.0, 1.25, and 1.5 RMD multipliers for 100% equity portfolio.



For a portfolio invested 50% in equities and 50% in intermediate-term government bonds, with forward-looking assumed investment returns, Figure 11 shows that:

- A 1.0 multiplier produces a pattern of income that increases slightly in real terms at the median level of the stochastic forecast until age 87, then declines in real terms thereafter.
- A 1.25 multiplier produces a pattern of real income at the median of the stochastic forecast that keeps up with inflation until about age 79, then declines in real terms thereafter.
- A multiplier of 1.5 produces a pattern of retirement income that declines in real terms after age 72.

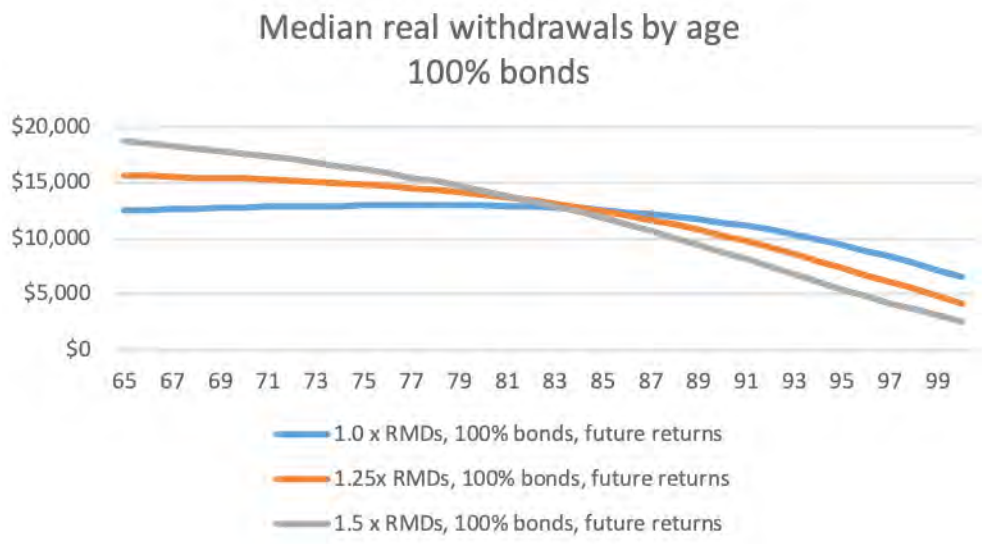
Figure 11. Comparison of 1.0, 1.25, and 1.5 RMD multipliers for 50% equity portfolio.



For a portfolio 100% invested in intermediate-term government bonds, with forward-looking assumed investment returns, Figure 12 shows that:

- A 1.0 multiplier produces a pattern of income that increases slightly in real terms at the median level of the stochastic forecast until age 77, then declines in real terms thereafter.
- 1.25 and 1.5 multipliers produce patterns of real income at the median of the stochastic forecast that decline in real terms throughout the retirement period.

Figure 12. Comparison of 1.0, 1.25, and 1.5 RMD multipliers for 100% government bond portfolio.



Section 4 discusses the implications for choosing investment return assumptions that reflect historical returns vs. assumptions that reflect forward-looking returns.

6.4 Other refinements

Here are a few more straightforward refinements to the SSiRS that retirees may want to consider:

- While delaying the start of Social Security benefits for the primary wage earner until age 70 is often the optimal strategy from a pure economic perspective, there are still advantages to delaying the start of benefits as long as possible, to Full Retirement Age or ages 68 or 69. Also, some retirees may not have sufficient savings to fund a Social Security bridge payment until the latest age to start Social Security benefits, so they have no choice but to start Social Security benefits before age 70. And some retirees may not be willing to spend down their savings to fund a Social Security bridge payment that is paid until age 70. Starting Social Security benefits at ages 66 to 69 may be a realistic "compromise" strategy compared to starting Social Security benefits at age 70. This compromise might appeal to retirees who perceive themselves to be in poor health status and/or are unwilling or unable to delay Social Security benefits until age 70.
- Some retirees may want more guaranteed lifetime income than provided by Social Security, or they may not want the potential volatility in the amount of income that the RMD delivers. In this case, they can use a portion of their savings to purchase a single premium immediate annuity (SPIA) instead of investing and drawing down their savings. Most likely a SPIA will deliver higher immediate income than the RMD. The comparison of income amounts in subsequent years would depend on investment returns under the RMD method. See Section 7 for a discussion and analysis of alternative retirement income generators including fixed and increasing SPIAs.
- Some retirees may not be able to generate sufficient etirement income with their savings. In this case, they will want to explore deploying other assets to generate income, such as reverse mortgages or annuities funded with cash values of whole life insurance policies. In both cases, these solutions would deliver "retirement paychecks" that aren't impacted by investment performance and would be paid for life (although reverse mortgages are paid for life only if the retiree stays in the home and meets maintenance and tax requirements).
- Some retirees could use a reverse mortgage line of credit to help fund a Social Security bridge payment.
- Some retirees may want to use a portion of retirement savings to pay down mortgage, credit card, or student loan debt as a way to reduce the amount of income they need to meet their basic living requirements. This can be viewed as a "risk-free" method to improve their retirement finances. Paying down debt might be particularly advantageous if the retiree uses retirement savings that are currently invested at a lower interest rate than the rate charged on their debt. For example, if a retiree has significant amounts of savings invested in bonds, stable value, or money market funds, it's possible these investments are earning less than the rates charged on credit cards and student loans, and possibly even mortgages.

We note that some 401(k) and IRA administrators may not be able to administer an RMD multiplier as described in Section 6.3, or pay both the RMD portion of income plus withdrawals for a special "travel bucket" as described in Section 6.1. In this case, the retiree would need to calculate the dollar amount of their total desired withdrawal and make an election each year to withdraw that amount. Of course, this reduces some of the simplicity of the SSiRS method.

SECTION 7: Comparisons of RMD to Other Retirement Income Generators and Strategies

In this section, we compare the SSiRS to other methods and strategies for generating retirement income. This helps retirees and their advisers decide if the SSiRS can apply to their goals and circumstances, and to consider possible refinements or alternatives.

7.1 Actuarial methods

A more sophisticated and complex method for retirees to develop a retirement income strategy is to use an actuarial method. Such a method would solve for regular withdrawals from savings by equating the present value of future retirement income from all sources, including Social Security and pensions, to the present value of future living expenses from all sources.

Such a method would require making a number of actuarial assumptions, including expected longevity of the retiree (and spouse/partner), the time value of money, expected return on assets, expected inflation on living expenses, expected benefits from other sources, such as Social Security and earned income, etc.

Actuarial methods could use either deterministic forecasts that develop one set of results, or stochastic forecasts that develop a range of possible results with associated probabilities of occurrence (calculated in accordance with the assumptions for capital market returns and inflation).

An actuarial method could use an asset smoothing method that would enable the retiree to remain significantly invested in equities, while reducing the volatility in the pattern of annual withdrawals. An actuarial method would periodically adjust the withdrawal amounts to reflect gains and losses that have occurred since the previous valuation.

An actuarial method could be a more sophisticated way to address uneven living expenditures and temporary income amounts, as addressed in Sections 6.1 and 6.2.

The tradeoff b tween the SSiRS and an actuarial method is simplicity/ease of use vs. more sophisticated treatment of the retiree's goals and circumstances. Use of an actuarial method will either require retirees who are willing and able to prepare the calculations on their own, or work with financial advisers who are familiar with actuarial methods. Retirees with significant amounts of retirement savings and/or complex planning objectives and circumstances might appreciate the additional robustness of an actuarial method.

For more details on one application of an actuarial method and a calculator to help implement such a method, see the website http://howmuchcaniaffordtospendinretirement.blogspot.com.

7.2 Alternative retirement income generators

Step 2 calls for generating retirement income by applying the IRS required minimum distribution (RMD) to remaining invested assets at the beginning of each calendar year. There are other viable retirement income generators (RIGs) that have characteristics and retirement income patterns that differ from the SSiRS. A retiree might decide to maximize Social Security under Step 1 of the SSiRS, but choose a RIG or combination of RIGs that are different from the RMD for generating income under Step 2 of the SSiRS.

Here we compare the following RIGs to the RMD portion of the SSiRS:

- Fixed single premium immediate annuity (SPIA)
- SPIA that escalates at 3% per year
- A variable annuity with guaranteed lifetime withdrawal benefit (VA-GLWB)
- A systematic withdrawal plan (SWP) that is invested 75% in stocks and calculates the annual withdrawal as 3% of assets remaining each year (approximates withdrawing interest and dividends while preserving principal)
- RMD with 75% stocks
- A 5% SWP invested 75% in stocks

Note that an inflation-indexed single premium immediate annuity has been proposed by another researcher as a baseline retirement strategy, indicating the market value of what retirement really costs.[9] Inflation-indexed annuities are becoming increasingly rare, so a SPIA that increases at fixed rate of 2% or 3% is the next most reasonable approximation.

Figures 13, 14, and 15 compare the pattern of real retirement income over the retirement period for the 6 RIGs mentioned above, under a stochastic forecast using the forward-looking investment assumptions described in Section 4.1. We show expected results (median forecast), favorable scenario (90th percentile), and unfavorable scenario (10th percentile).

- An increasing line projects that retirement income will increase faster than inflation.
- A flat line illustrates that projected income keeps up with inflation.
- A declining line projects that the spending power of income decreases over time.

Figure 13. Comparison of six RIGs – median stochastic forecast representing expected results.

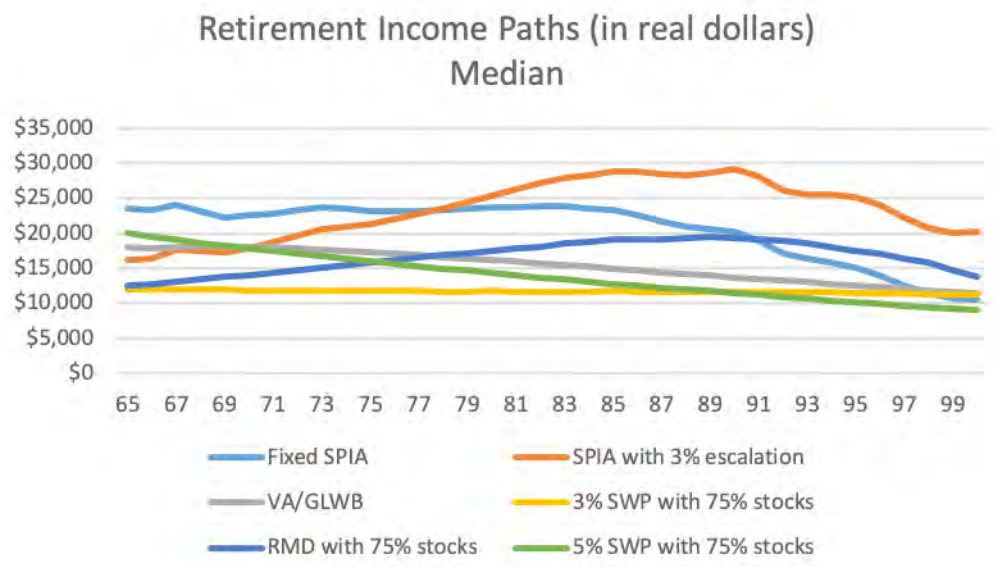


Figure 14. Comparison of six RIGs – 90th percentile, representing a favorable scenario.

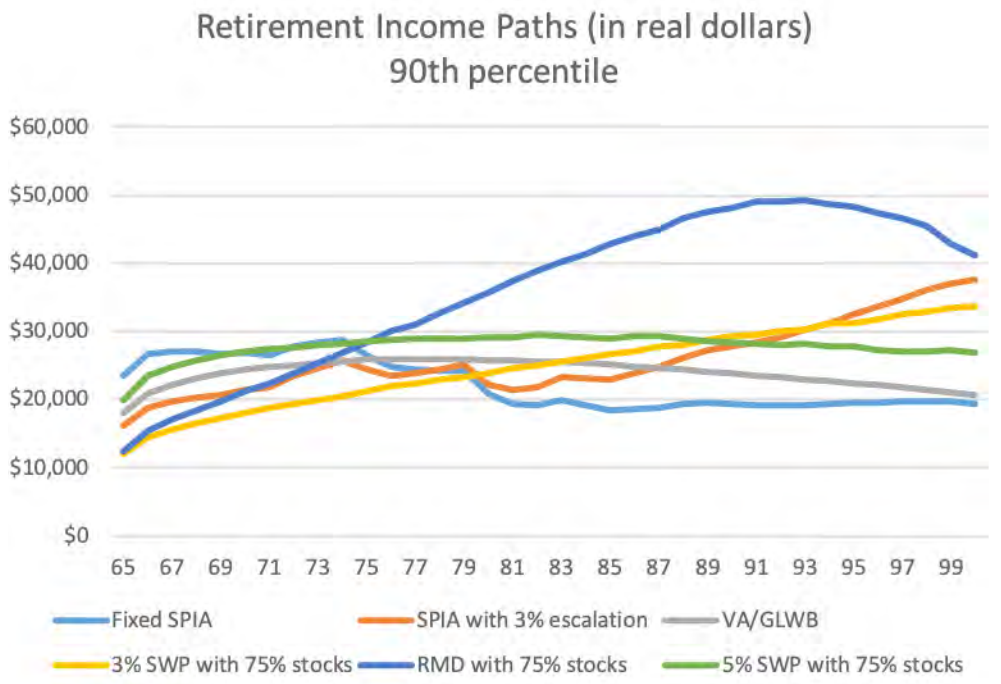
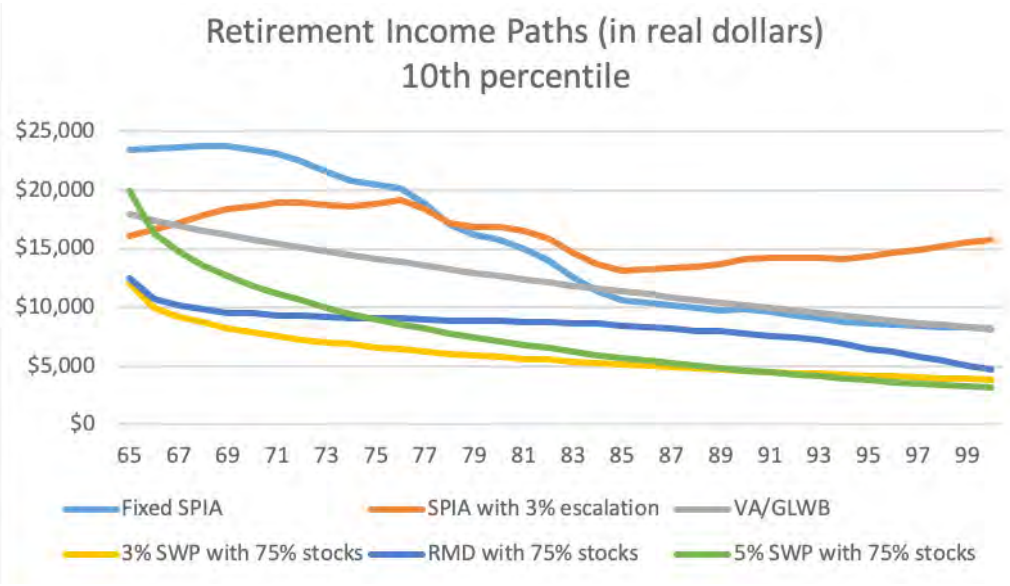


Figure 15. Comparison of six RIGs – 10th percentile, representing an unfavorable scenario.



Here are some general conclusions by comparing these graphs:

- The six RIGs have varying degrees of front-loading or back-loading income. They illustrate the tradeoff of " ay me now or pay me later," as well as the tradeoff of enerating cash-flow for spending vs. preserving assets for a legacy or high health care expenses late in retirement. For example, a fixed SPIA delivers the highest initial income, but does not preserve any assets, and the income falls below other RIGs by the late 70s.
- Under the median stochastic scenario, RMD starts with the lowest amount of initial income compared to the other RIGs, but surpasses the income amounts of three of the RIGs analyzed by the mid to late 70s. RMD also preserves more assets early in the retirement period, compared to all but one (the 3% SWP) of the other RIGs analyzed.
- The six RIGs also have varying degrees of accessible wealth. The SPIAs have no accessible wealth, whereas the 3% SWP preserves the most principal but also delivers the lowest amount of retirement income throughout most of the retirement period.
- Annuities (SPIAs and the VA-GLWB) deliver more retirement income than SWPs and RMD under unfavorable investment scenarios.
- The RMD and 5% SWP deliver more retirement income than annuities under favorable investment scenarios.

A retiree could use these analyses and observations to decide to direct a portion or all of remaining assets to a RIG other than the RMD.

These analyses also support the overall strategy to cover basic living expenses with Social Security and annuities, and pay for discretionary living expenses with invested assets.

We note that the conclusions noted above are consistent with prior reports prepared by SCL in collaboration with the Society of Actuaries.[10,11]

SECTION 8: Examples of Implementing the Strategy

Here we present two examples of the Spend Safely in Retirement Strategy (SSiRS) and a few basic refinements. The first example is for a single female age 65, and the second example is for a married couple both age 65.

These examples help illustrate the potential increase in retirement income by deploying a retirement transition fund to enable delaying Social Security benefits. They also show that a very large portion of total retirement income is delivered by Social Security, and is protected from longevity, market, volatility, and inflation risks. In these examples, a small portion of retirement income is delivered by the RMD piece, and is subject to market, volatility, and inflation risks.

The first example also illustrates the potential increase in retirement security of continued employment for a few years, even if such employment is part time.

8.1 Single female age 65

This example applies to the following hypothetical retiree:

- Single female currently age 65
- Current annual salary $50,000
- $250,000 in retirement savings
- Annual Social Security benefit starting at age 65: $19,476
- Annual Social Security benefit starting at age 70: $27,646

Suppose she retires immediately at age 65 and starts both her Social Security benefit and drawdown of savings using the RMD. Then her total retirement income is as follows:

- Social Security: $19,476
- RMD drawdown: $7,813 (3.1250% of $250,000)
- Total: $27,289
- Initial replacement ratiio: 55%

Note: 3.1250% is the RMD withdrawal percentage that would apply at age 65 – see Table 1 of Section 3.1.

- 71% of total income is covered by Social Security and protected from longevity, market, volatility, and inflation risks
- 29% covered by RMD, subject to market, volatility, and inflation risks

Now suppose she wishes to use a portion of her savings to establish a retirement transition fund that will enable her to delay Social Security benefits until age 70, even though she still retires at age 65.

She decides to pay herself from her savings $27,646 per year from age 65 to age 70, the Social Security benefit she expects to receive at age 70. In this case, she sets aside $138,230 (5 years times $27,646) and invests this amount in a money market, short term bond, or stable value fund. She withdraws $27,646 in the first year. Interest earnings can increase her withdrawals in subsequent years.

With the remaining savings ($111,770 = $250,000 – $138,230) she invests in a low-cost balanced or target date fund and uses the RMD to calculate the annual withdrawal. Then her total retirement income at age 65 looks like this:

- Social Security: $27,646 (paid by savings from age 65 to 70)
- RMD drawdown: $3,493 (3.1250% of $111,770)
- Total: $31,139
- Initial replacement ratio: 62%

- 89% of total income is covered by Social Security and protected from longevity, market, volatility, and inflation risks
- 11% covered by RMD, subject to market, volatility, and inflation risks

Using the retirement transition fund, she achieves an increase of 14% in her total retirement income without changing her retirement date. She also increases the percentage of her total income that is protected from longevity, market, volatility, and inflation risks from 71% to 89% of her total income. To "pay" for these increases, she decreases her initial accessible wealth from $250,000 to $111,700 (although she can still access the funds remaining in her retirement transition fund between ages 65 and 70).

Note that if this retiree used RIGs other than RMD to generate retirement income with her remaining savings after optimizing Social Security, the initial retirement income amounts would most likely be higher than shown in this example, and the corresponding percentage increase in total income would most likely be lower.

She then considers a downshifting st ategy, working just enough to enable delaying her Social Security benefit from age 65 to age 70. She works three days per week (60% schedule) and earns $30,000 per year. She doesn't make any additional contributions to her $250,000 savings, but it grows at a real rate of return of 3% per year. In this case, her savings grow to $289,819 by age 70.

Here's how her retirement income adds up at age 70:

- Social Security: $27,646
- RMD drawdown: $10,577 (3.6496% of $289,819)
- Total: $38,223
- Initial replacement ratio: 76%

Note: 3.6496% is the RMD withdrawal percentage that applies at age 70 – see Table 1 of Section 3.1.

- 72% of total income is covered by Social Security and protected from longevity, market, volatility, and inflation risks
- 28% covered by RMD, subject to market, volatility, and inflation risks

In the above example, between ages 65 and 70, her income is $30,000 per year, less than her ultimate retirement income of $38,224 at age 70. If this is a concern, she could have started her RMD drawdown at age 65. In this case, her total income at age 65 looks like this:

- Salary: $30,000
- RMD drawdown: $7,813 (3.1250% of $250,000)
- Total: $37,813
- Initial replacement ratio: 76%

- 79% of total income is covered by salary and protected from longevity, market, volatility, and inflation risks, but subject to employment risk
- 21% covered by RMD, subject to market, volatility, and inflation risks

This information helps her make an informed decision about when to retire, whether she should work part time for a few years, and how to deploy her retirement savings.

8.2 Married couple both age 65

This example applies to the following hypothetical retiree:

- Married couple both currently age 65
- Current annual salaries: $75,000 for husband, $25,000 for wife
- $400,000 in retirement savings
- Annual Social Security benefit for husband
  - Starting at age 65: $25,344
  - Starting at age 70: $35,977
- Annual Social Security benefit for wife
  - Starting at age 65: $12,492
  - Starting at age 66: $13,406 (the approximate age that is optimal for this couple)

Suppose they both retire immediately at age 65 and start both their Social Security benefits and drawdown of savings using the RMD. Then their total retirement income is as follows:

- Social Security: $37,836 ($25,344+$12,492)
- RMD drawdown: $12,500 (3.1250% of $400,000)
- Total: $50,336
- Initial replacement ratio: 50%

- 75% of total income is covered by Social Security and protected from longevity, market, volatility, and inflation risks
- 25% covered by RMD, subject to market, volatility, and inflation risks

Now suppose they wish to use a portion of their savings to establish a retirement transition fund that will enable the husband to delay Social Security benefits until age 70, and the wife to delay Social Security benefits until age 66. They both still retire at age 65.

They decide to pay themselves from their savings $35,977 per year from age 65 to age 70, the Social Security benefit the husband expects to receive at age 70. In addition, they will pay $13,406 from age 65 to 66, the Social Security benefit the wife expects to receive at age 66. In this case, they set aside $193,291 (5 years times $35,977 plus one year of $13,406). They invest the amount in a money market, short term bond, or stable value fund.

They withdraw $49,383 in the first year ($35,977+$13,406). They start the wife's Social Security benefit of $13,406 in the second year of retirement, and pay themselves the husband's Social Security benefit of $35,977 per year from age 66 to age 70. Interest earnings on the retirement transition fund can increase their withdrawals in subsequent years.

With the remaining savings ($206,709 = $400,000 – $193,291) they invest in a low-cost balanced or target date fund and use the RMD to calculate the annual withdrawal. Then their total retirement income at age 65 looks like this:

- Social Security: $49,383 (mostly paid by savings from age 65 to 70)
- RMD drawdown: $6,460 (3.1250% of $206,709)
- Total: $55,843
- Initial replacement ratio: 56%

- 88% covered by Social Security and protected from longevity, market, volatility, and inflation risks
- 12% covered by RMD, subject to market, volatility, and inflation risks

Using the retirement transition fund, they achieve an increase of 11% in their total retirement income, without changing their retirement date. They also increase the percentage of their total income that is protected from longevity, market, volatility, and inflation risks from 75% to 88% of their total income. To "pay" for these increases, they decrease their initial accessible wealth from $400,000 to $206,709.

Suppose in addition to setting up a retirement transition fund, they also want to spend an extra $5,000 per year for 10 years on travel, between ages 65 and 75 while they are still able to travel. In this case, they would set aside a "travel fun bucket" of $50,000, invest the money in a stable value fund or short-term bond fund, and would withdraw $5,000 per year for each of 10 years. Interest earnings could slightly increase the annual withdrawals.

Now they have $156,709 ($206,709 - $50,000) to apply to the RMD piece of retirement income. Here's the amount of regular retirement income they would receive at age 65:

- Social Security: $49,383 (mostly paid by savings from age 65 to 70)
- RMD drawdown: $4,897 (3.1250% of $156,709)
- Total: $54,280
- Initial replacement ratio: 54%

Setting up the travel fund bucket reduces the amount of lifetime, annual retirement income they will receive to cover ongoing living expenses from $55,843 to $54,280.

This information helps them make an informed decision about when to retire, how to deploy their retirement savings, and whether they want to pay for additional travel in the first 10 years of their retirement at the expense of reducing their lifetime income.

SECTION 9: Illustrations of the Power of Delaying Retirement

Here are two examples that illustrate the power of delaying retirement, when retirement income includes Social Security benefits and the RMD methodology applied to savings. The first example is for a 62-year-old married couple with earnings and savings that are somewhat above average, but could be representative of middle-income retirees. The second example is for an affluent 60- ear-old couple.

Both of these examples illustrate the potential increase in retirement security from continued employment for a handful of years, even if such employment is part time.

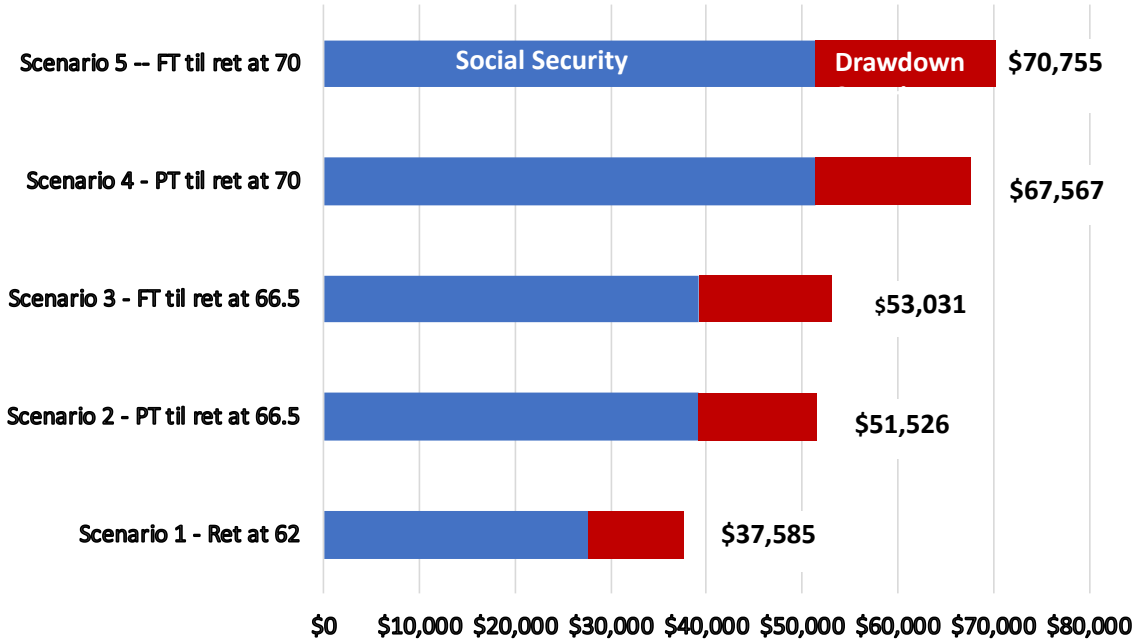
9.1 Example of 62-year-old middle-income couple

With this hypothetical married couple, both were born in 1957 and attain age 62 in 2019. The primary wage earner's annual salary is $75,000, the spouse's earnings are $25,000, for a combined household income of $100,000. They have accumulated $350,000 in retirement savings by age 62.

Figure 16 shows the retirement income under five different retirement scenarios. The retirement income includes both Social Security benefits and systematic withdrawals from savings. Here are the five scenarios illustrated in the graph:

1. Both retire completely at age 62, and start Social Security benefits and the drawdown of retirement savings.
2. Both keep working part time until their Social Security Full Retirement Age (66 and 6 months), then start Social Security and the drawdown of retirement savings.
3. Both keep working full time until their Social Security Full Retirement Age, then start Social Security and the drawdown of retirement savings.
4. Both keep working part time until age 70, then start Social Security benefits and the drawdown of retirement savings.
5. Both keep working full time until age 70, then start Social Security benefits and the drawdown of retirement savings.

Figure 16. Delaying retirement can significantly increase retirement income – middle-income couple.



Here are the assumptions for this example:

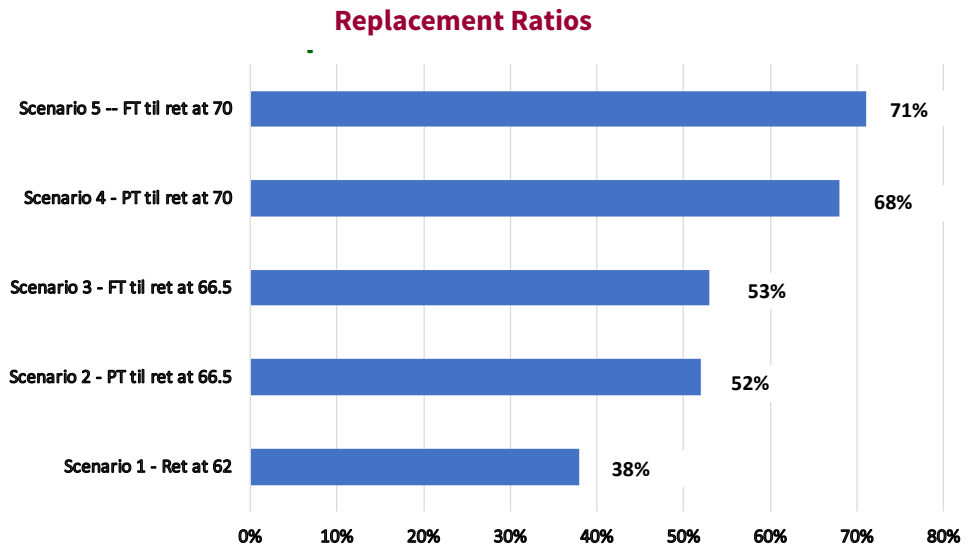
- Amounts shown are in today's dollars, not adjusted for inflation.
- No future nominal wage increases.
- For the full-time working scenarios, they contribute 10% of their income to their retirement savings each year until they retire.
- For the part-time working scenarios, they stop contributing to retirement savings.
- Savings earn a real rate of return of 3% per year.
- Systematic withdrawals from savings use the IRS required minimum distribution, modified for retirements before age 70 as described in Table 1.

Retirement planners often state that workers need a total retirement income that replaces 70% to 80% of their gross pre-retirement income to maintain their pre-retirement standard of living. It's usually not necessary to replace 100% of gross pre-retirement income for a few reasons:

- Retirees no longer pay FICA and Medicare taxes, which for workers equals 7.65% of pay up to the Social Security Wage Base ($132,900 in 2019). Medicare taxes of 1.45% also apply on income above the Social Security Wage Base and up to $200,000 per year, and 2.35% above $200,000.
- Retirees no longer need to save for retirement.
- Retirees pay significantly less federal and state income taxes, since a large portion of Social Security income is exempted from income taxes and taxpayers age 65+ enjoy larger tax deductions.
- Retirees no longer have work-related expenses, such as commuting.

Figure 17 restates the previous example as replacement of the household's pre-retirement pay.

Figure 17. Work Longer or Reduce Your Spendable Income?



Here are some observations from this example:

- Most older workers will fall short of commonly recommended retirement income targets, unless they can work in some manner into their late 60s or 70s. Otherwise, they might need to learn how to live on reduced spendable income compared to their working years.
- Delaying retirement, even if for a few years, can significantly increase the eventual retirement income.
- Most of the increase in retirement income comes from delaying both Social Security benefits and savings drawdown; the additional retirement contributions made between age 62 and retirement only modestly increase the eventual retirement income.

This kind of information can help older workers decide when to retire, and whether to continue working full time or part time until they retire. This information can also help them decide if reducing their standard of living is an acceptable price to pay for their retirement freedom.

This information is also useful to help older workers and their advisers decide how much investment risk to take for their savings in retirement. Social Security benefits protect against longevity, inflation, and market risks, and represent a large portion of the retiree's retirement income portfolio. Only the savings drawdown is subject to these risks, and typically represents a smaller portion of total retirement income. Assuming investment risk on this portion of retirement income may be an acceptable price to pay for the potential for savings to grow in retirement.

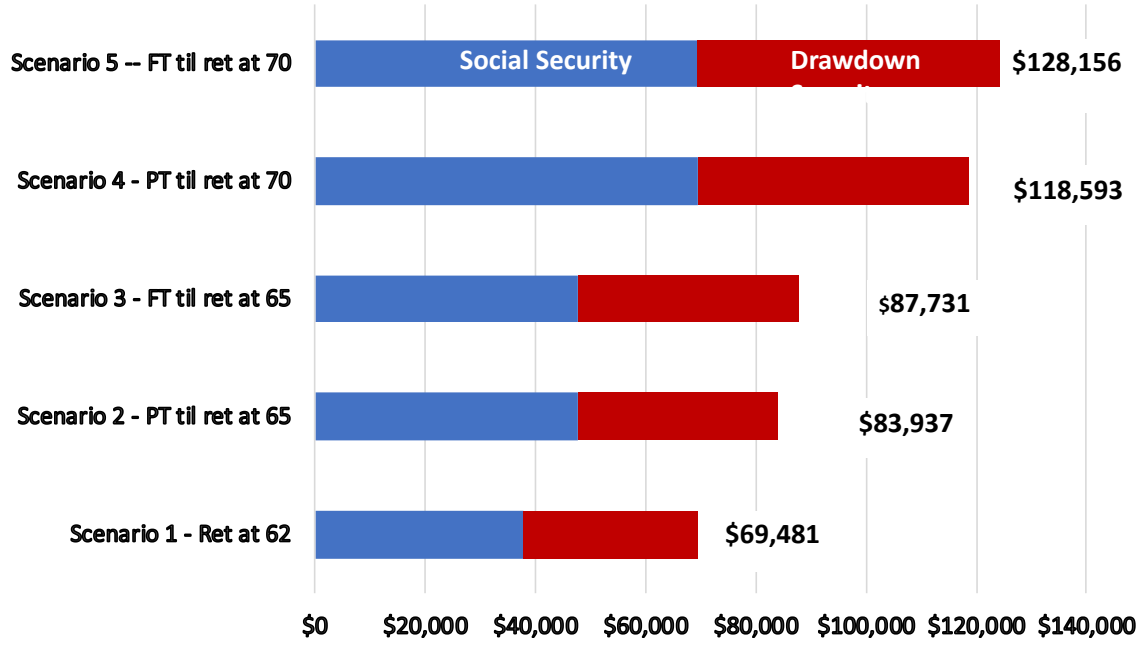
9.2 Example of 60-year-old affluent couple

With this hypothetical married couple, both were born in 1959 and attain age 60 in 2019. The primary wage earner's annual salary is $150,000, the spouse's earnings are $50,000, for a combined household income of $200,000. They have accumulated $1,000,000 in retirement savings by age 60.

Figure 18 below shows the retirement income under five different retirement scenarios. The retirement income includes both Social Security benefits and systematic withdrawals from savings. Here are the five scenarios illustrated in the graph:

1. Work full time until age 62, then both retire completely, and start Social Security benefits and the drawdown of retirement savings.
2. Both keep working part time until age 65, then start Social Security and the drawdown of retirement savings.
3. Both keep working full time until age 65, then start Social Security and the drawdown of retirement savings.
4. Both keep working part time until age 70, then start Social Security benefits and the drawdown of retirement savings.
5. Both keep working full time until age 70, then start Social Security benefits and the drawdown of retirement savings.

Figure 18. Delaying retirement can significantly increase retirement income – affluent couple.

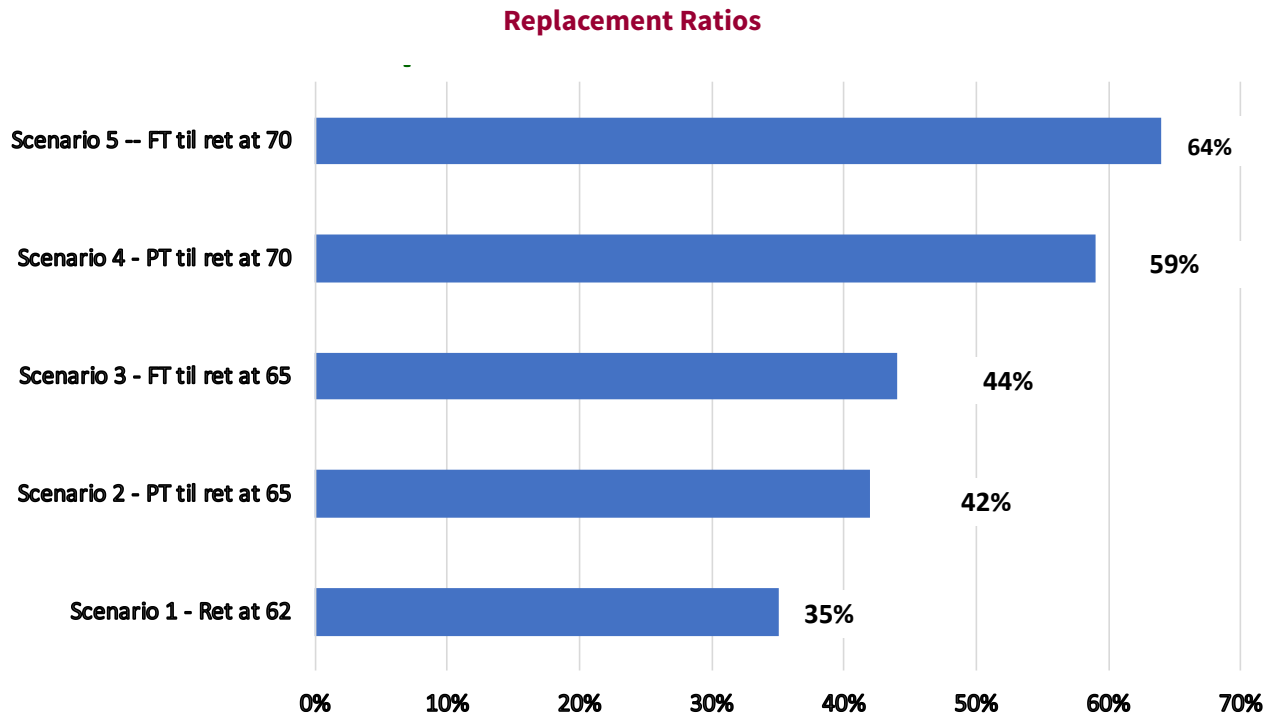


Here are the assumptions for this example:

- Amounts shown are in today's dollars, not adjusted for inflation.
- No future wage increases.
- For the full-time working scenarios, they contribute 15% of their income to their retirement savings each year until they retire.
- For the part-time working scenarios, they stop contributing to retirement savings.
- Savings earn a real rate of return of 3% per year.
- Systematic withdrawals from savings use the IRS required minimum distribution, modified for retirements before age 70 as described in Table 1.

Figure 19 restates the previous example as replacement of the household's pre-retirement pay.

Figure 19. Work Longer or Reduce Your Spendable Income?



Here are some observations from this example:

- Like with the middle-income couple, delaying retirement has a significant impact on the amount of eventual retirement income. They will also fall short of common retirement income targets. Additional contributions produce modest increases in retirement incomes.
- This affluent ouple has proportionately more income coming from drawdown of savings compared to the middle-income couple. As a result, they have more of their income subject to longevity, investment, and inflation risks. They might benefit more by considering refinements or alternatives to the SSiRS.

SECTION 10: Considerations for Retirees

The Spend Safely in Retirement Strategy is a straightforward *baseline* strategy to help retirees decide when to retire, whether to work part time for a few years, and how to deploy their savings in retirement, without necessarily requiring the help of an adviser or purchasing an annuity. It can serve as a benchmark to assess if alternative approaches can better serve the retiree's needs and circumstances.

This section discusses circumstances when retirees may want to consider alternative approaches and possible solutions to explore, tax considerations, and thoughts on investment institutions that might best serve retirees in the implementation of the SSiRS.

10.1 When alternatives and refinements might be appropriate

Development of a retirement transition fund to enable delaying Social Security has the potential to use a significant portion of retirees' savings. In this case, they might instead adopt a compromise and not delay Social Security all the way until age 70.

Retirees who have significant savings remaining after the retirement transition fund might want to consider alternatives to the RMD for developing the retirement income in Step 2 of the SSiRS. Such retirees have more of their total retirement income subject to longevity, investment, and inflation risks. The example in Section 9.2 suggests $1 million in savings might be one cutoff that flags the ad antage of considering more robust strategies.

Many retirees might be approaching their retirement years with inadequate savings. The analyses in Section 4 suggest one possibility to boost their retirement income: a significant investment in equities. This recognizes that a very large portion of their retirement income will be delivered by Social Security. As a result, they have little to lose and potentially much to gain with significant investment in equities. If they invest mostly in fixed income investments, they lock in their modest savings. We acknowledge this suggestion runs counter to conventional wisdom and has behavioral implications.

Some married couples may have large differences in their ages, which might call for alternatives and refinements. Analysis of possible strategies in this situation is beyond the scope of this report.

10.2 Tax considerations

Our prior report demonstrated that retirees with under $1 million in savings will pay very little federal income taxes.1 The hypothetical retirees were typically paying federal income taxes at a 10% or 15% rate under the income tax rates in effect for 2017, before the 2018 tax reductions. Due to the reduced tax rates and increased standard deductions from the 2018 tax changes, future retirees would most likely pay even less federal income taxes. As a result, strategies to manage or reduce income taxes should play a secondary role to other goals, such as maximizing lifetime retirement income and/or maximizing accessible wealth.

There are income tax advantages to using a deductible IRA, 401(k), 403(b), or 457 account to fund a Social Security bridge payment, as described in Section 3.2. Here are the reasons:

- The portion of Social Security benefits that are subject to income taxes depends on the retiree's total taxable income, including taxable withdrawals from the accounts mentioned above.
- By spending down these accounts prior to starting Social Security benefits, the retiree reduces the taxable income in subsequent years that is used to determine the portion of the Social Security benefits that are taxable.

To help reduce the portion of Social Security benefits that is subject to federal income taxes, retirees could also consider converting some or all of their deductible IRA, 401(k), 403(b), or 457 accounts to Roth accounts. However, such a transaction will trigger immediate income taxes on the amount that is converted.

10.3 Investment considerations

A prior SCL/SOA report estimated significant increases in projected retirement incomes and accessible wealth amounts paid from institutionally-priced retirement income solutions compared to solutions with costs that are typical for retail solutions. As a result, retirees who have access to institutionally priced investments and/or annuity solutions might be best served by keeping their savings in their employers' 401(k), 403(b), or 457 plan. Retirees who are considering rolling their accounts to an IRA will want to compare the fees and investment performance of funds and products in the employer-sponsored plans to funds and products they are considering in an IRA or retail environment.

Another advantage to keeping savings in an employer-sponsored plan is that these plans are subject to ERISA's fiduciary rules, giving the retiree some level of protection against fraud and abuse. Retail IRAs are typically not subject to the fiduciary rules, leaving retirees vulnerable to fraud and abuse.

SECTION 11: Considerations for Employers, Plan Sponsors, and Financial Institutions

11.1 The retirement income menu

Employers, plan sponsors, and DC administrators can help retirees implement the SSiRS in DC plans by offering a retirement income menu that complements the familiar investment menu. Retirees could allocate their savings among one or more options offered in the menu. In its simplest form, such a menu could include:

- To implement the RMD portion of income, offer installment payments using the RMD to calculate withdrawal amounts. Combine it with an investment fund such as a target date fund for retirees, a balanced fund, or a stock index fund.
- A period certain payout to fund temporary payments such as a Social Security bridge payment, a travel bucket, or a mortgage payment bucket (discussed in Section 6.2). Combine it with an investment fund with minimum volatility, such as a short-term bond fund, stable value fund, or money market fund.
- A rollover to an annuity bidding platform to purchase a single premium immediate annuity.

Note that the DC administrator would need to be able to offer two or more simultaneous payments that differ in the amount of the payment and the underlying investment. It would also require them to use the RMD methodology before age 70-1/2, to calculate withdrawal amounts. Hopefully these features should be straightforward to implement in most DC administrative platforms. However, if this is not possible, retirees and older workers could use a period certain payout to fund both a Social Security bridge payment and the RMD portion of income, as described in Section 3.2.

More refined retirement income menus could include:

- Installment payments based on a fixed dollar amount or a percentage of remaining assets.
- In-plan annuities including hybrid annuities such as variable annuities with guaranteed lifetime withdrawal benefits (VA-GLWB).
- Managed payout funds or services administered by retirement advisers.

The plan sponsor could designate the RMD as the default payout option, coupled with the qualified default investment alternative (QDIA) that is designated for retirees. Such a default could provide some fiduciary protection to plan sponsors, since significant penalties will be assessed to the retirees if they do not comply with the RMD requirements.

To realize this potential fiduciary protection, the plan sponsor may want to specify the RMD as the default payout option that is associated with the QDIA when the QDIA first becomes effective. When older workers approach retirement, they could then make a positive election if they did not want to deploy all their savings in this default.

Plan sponsors could also offer educational materials to help workers make informed retirement decisions. Media could include printed materials, retirement income statements, online retirement income calculators, links to

commonly available online Social Security optimizer programs, webinars, and workshops. It will be very useful to help older workers make retirement decisions if they can understand the implications to their retirement income of working longer. The types of calculations shown in Section 9, showing the financial impact of delaying retirement, would help significantly.

To implement such a retirement income menu, plan sponsors would need to take the following steps:

- Decide whether a basic retirement income menu meets the needs of their employees, or if their participants would benefit from a more robust menu as described previously.
- Prepare any necessary amendments to the legal plan documents.
- Work with the plan administrator to make the necessary adjustments to their administrative procedures, including procedures for distributing election materials to retiring plan participants and processing their elections.
- Prepare the communications and decision-supporting materials that could include retirement income statements, online calculators, and the other media elements described previously.
- Decide if they want to provide advice to help participants understand their options, and then make and implement their decisions.

The basic retirement income menu could be established with a plan sponsor's current investment funds and administrative capabilities. As a result, hopefully the additional costs borne by the plan sponsor would primarily be for implementation, and ongoing costs wouldn't increase substantially. As such, implementing a retirement income menu could be viewed as an inexpensive benefits improvement.

11.2 Retirement income statements

To help older workers make informed decisions about when to retire, plan sponsors could offer personalized statements that show estimated Social Security benefits and retirement income generated from their DC accounts. One common challenge with preparing these statements is that the plan sponsor or plan administrator must make assumptions about the specific retirement solution or product chosen by the retiree, interest rates, annuity purchase rates, and future investment returns.

Retirement income statements would be simplified if they estimated retirement income using the SSiRS. Such a statement would not require assumptions about products, interest rates, annuity purchase rates, or future investment returns. For example, the rules regarding calculation of Social Security payments are well known, and many plan administrators have access to computer programs that can estimate Social Security benefits.

There are a few limitations to note with estimating an employee's Social Security benefits:

- Most employers do not have access to an employee's complete earnings history; as a result, employer-prepared Social Security estimates are not as accurate as estimates that are based on an employee's complete earnings history.
- Employers will not be able to estimate Social Security benefits of spouses.

Any estimate of an employee's Social Security benefit should be accompanied by messages about these limitations, and they should urge employees to seek more accurate information from the Social Security Administration.

The rules regarding the RMD are well known. The plan sponsor could apply the appropriate RMD percentage to current account balances, assuming no future investment earnings.

Of course, such statements require disclosure of assumptions and methods in the fine print, but that's a requirement of any retirement income statement. Most people are more likely to understand disclosures of the SSiRS than disclosures on interest and mortality rates used to prepare retirement income estimates.

11.3 Supportive benefit features and HR policies

An employer could also help their older workers and retirees implement a retirement income strategy by offering the following benefit features and HR policies:

- In-plan conversion to a Roth account, to help older workers manage their income taxes.
- Retirement planning advice through the DC plan that helps employees develop retirement income, recognizing personal circumstances such as spousal benefits or significant differences in the ages of spouses.
- A managed payout service that develops retirement income payouts.
- Alternative career paths for older workers, so that they can work enough to enable Social Security and financial resources to grow.

SECTION 12: 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 do not address behavioral decision-making factors.

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

There are potential risks that are not directly addressed by this report, including but not limited to the following:

- The U.S. government might reduce Social Security benefits in the future to address funding deficiencies, or change the methods for calculating benefits for future workers.
- Insurance companies that sell annuities might become insolvent, leading to potential forfeiture of annuity payments.

The analyses, 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, or the Stanford Center on Longevity, nor should the material be construed to do so. It 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.

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10. *The Next Evolution in Defined Contribution Retirement Plans: A Guide for DC Plan Sponsors to Implementing Retirement Income Programs*, by Steve Vernon, FSA, Research Scholar, Stanford Center on Longevity, and the Society of Actuaries' Committee on Post-Retirement Needs and Risks. September 2013.
11. *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. Stanford Center on Longevity Stanford Center on Longevity and the Society of Actuaries' Committee on Post-Retirement Needs and Risks, May 2016.
12. *2015 Consumer Expenditure Survey*, Table 1300. Bureau of Labor Statistics.

Exhibits

Exhibit 1-1978. Annual amount of nominal RMD income for 30-year retirement starting in 1978, for three asset allocations. Married couple age 65 with $400,000 in starting assets.

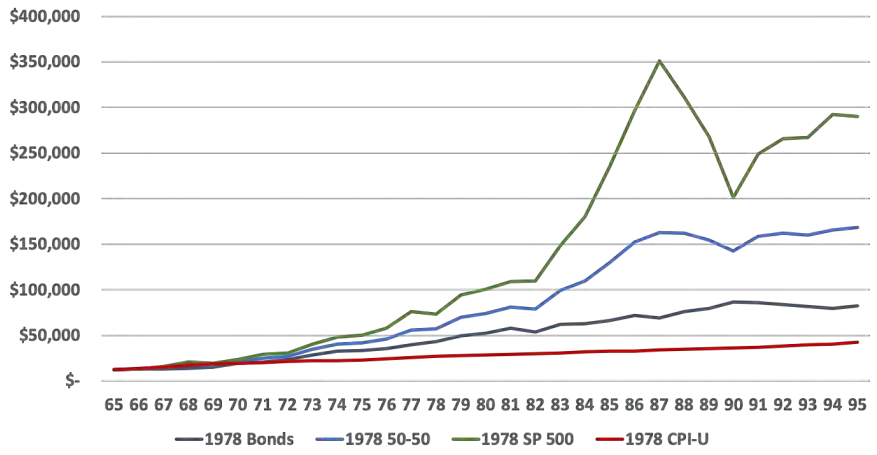

Exhibit 1-1968. Annual amount of nominal RMD income for 30-year retirement starting in 1968, for three asset allocations. Married couple age 65 with $400,000 in starting assets.

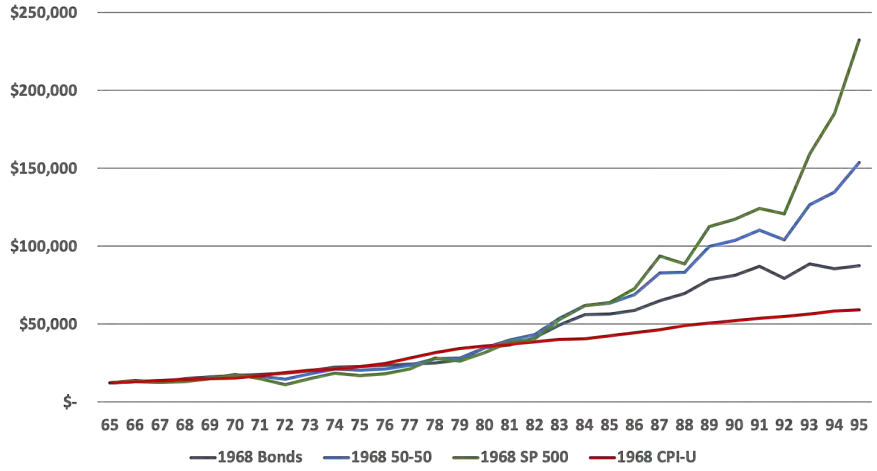

Exhibit 1-1958. Annual amount of nominal RMD income for 30-year retirement starting in 1958, for three asset allocations. Married couple age 65 with $400,000 in starting assets.

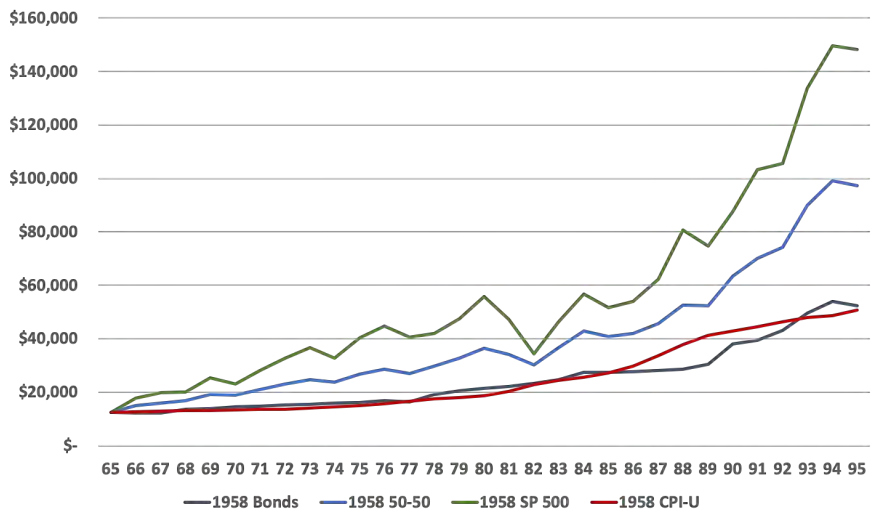

Exhibit 1-1948. Annual amount of nominal RMD income for 30-year retirement starting in 1948, for three asset allocations. Married couple age 65 with $400,000 in starting assets.

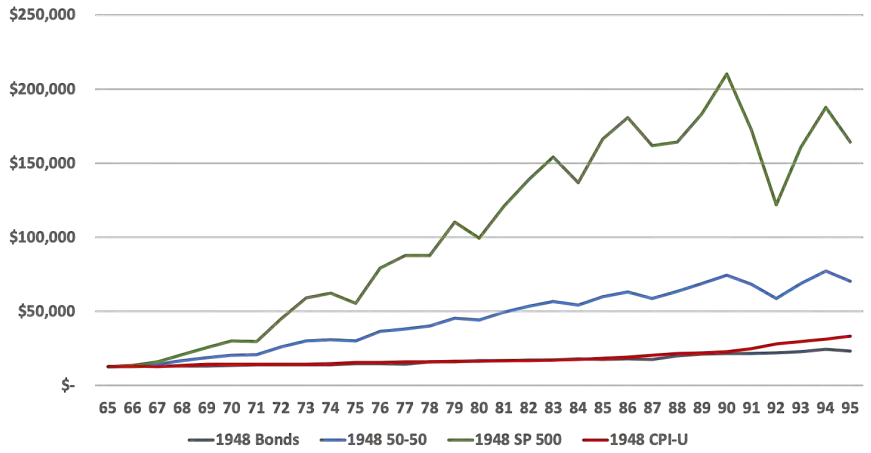

Exhibit 1-1938. Annual amount of nominal RMD income for 30-year retirement starting in 1938, for three asset allocations. Married couple age 65 with $400,000 in starting assets.

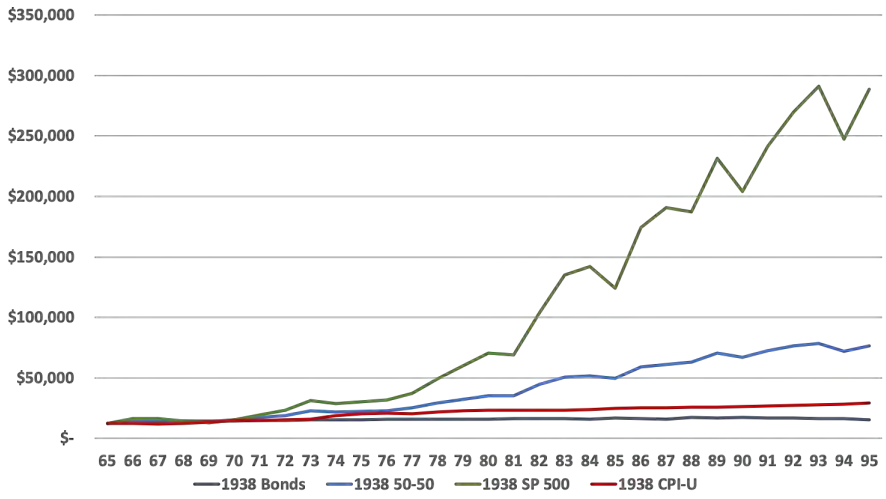

Exhibit 1-1928. Annual amount of nominal RMD income for 30-year retirement starting in 1928, for three asset allocations. Married couple age 65 with $400,000 in starting assets.

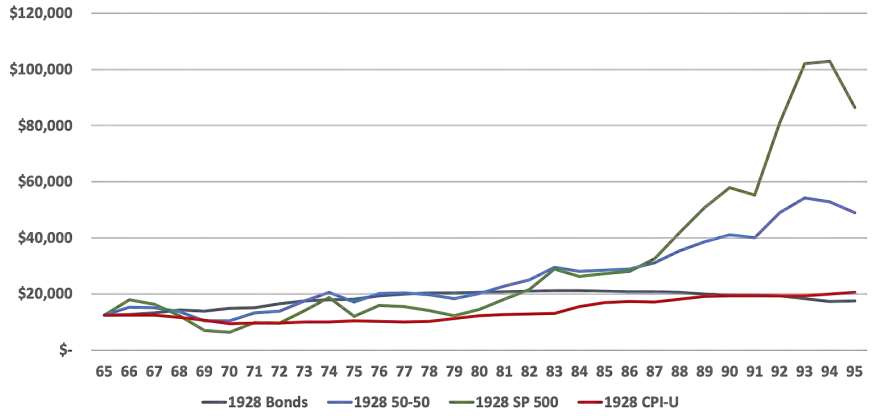

Exhibit 1-2008. Annual amount of nominal RMD income for 12-year retirement starting in 2008, for three asset allocations. Married couple age 65 with $400,000 in starting assets.

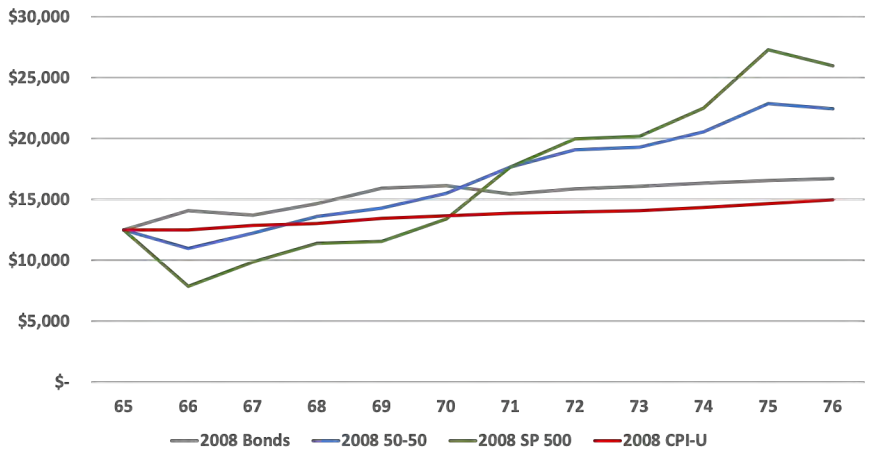

Exhibit 2a – Efficient frontier for married couple age 65, average health, start SS at age 65

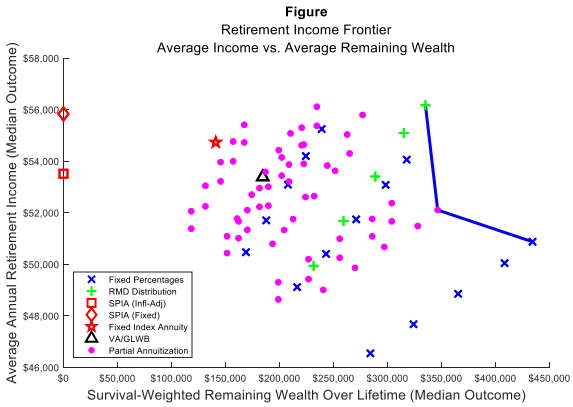

Exhibit 2b – Efficient frontier for married couple age 65, good health, start SS at age 65

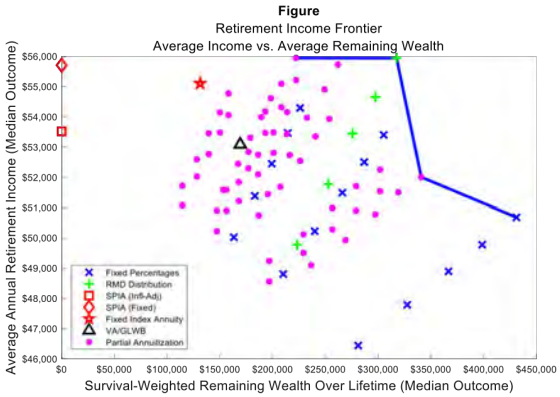

Exhibit 2c – Efficient frontier for married couple age 65, poor health, start SS at age 65

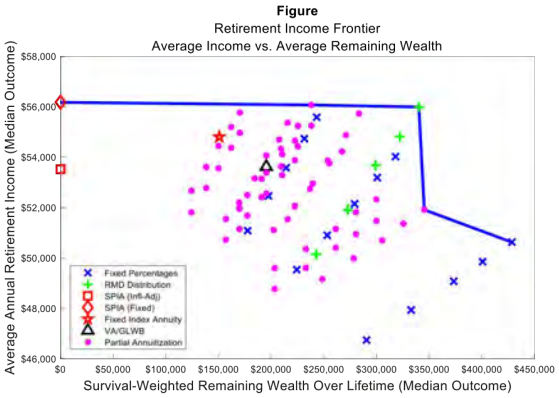

Exhibit 3a – Efficient frontier for married couple age 65, average health, start SS at age 70

Exhibit 3b – Efficient frontier for married couple age 65, good health, start SS at age 70

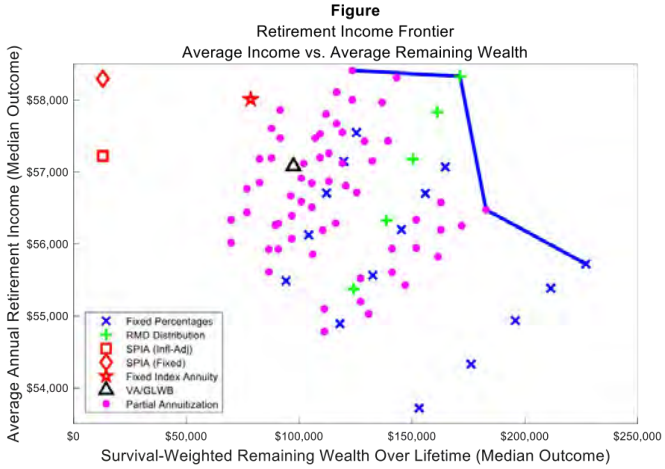

Exhibit 3c – Efficient frontier for married couple age 65, poor health, start SS at age 70

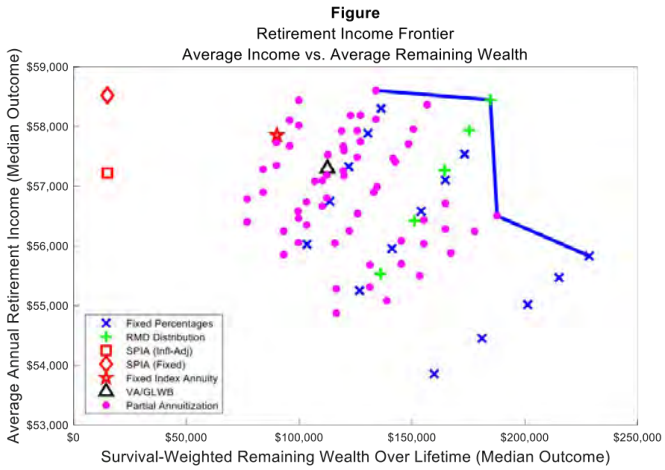

Exhibit 4
65-Year Old Female with $250k -- Average Health

Set 1

	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	$27,646	$27,646	$27,646	$27,646	$27,646	$27,646
Initial Income from Financial Assets	$4,461	$4,461	$4,461	$3,317	$3,317	$3,317
Total Initial Retirement Income	$32,107	$32,107	$32,107	$30,963	$30,963	$30,963
Average Income, All Sources	$32,769	$32,504	$32,273	$32,531	$32,208	$31,799
Direction of Income	102%	101%	101%	105%	104%	103%
Average Accessible Wealth	$75,075	$71,573	$67,039	$102,481	$97,569	$90,913
Direction of Wealth	30%	29%	27%	41%	39%	36%
Average Bequest	$45,512	$42,619	$38,139	$64,447	$60,286	$53,872
Downside Volatility	-1.1%	-0.9%	-0.7%	-1.3%	-1.0%	-0.8%
Probability of Shortfall	10%	9%	9%	27%	25%	26%
Magnitude of Shortfall	-$15,354	-$14,810	-$14,048	-$20,174	-$18,387	-$16,943

Set 2

	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	$19,476	$27,646	$19,476	$27,646	$19,476	$27,646
Initial Income from Financial Assets	$16,800	$7,132	$7,813	$3,317	$7,813	$3,317
Total Initial Retirement Income	$36,276	$34,778	$27,289	$30,963	$27,289	$30,963
Average Income, All Sources	$32,666	$33,283	$27,108	$30,916	$30,892	$32,531
Direction of Income	90%	96%	99%	100%	113%	105%
Average Accessible Wealth	$0	$11,027	$152,977	$76,038	$215,278	$102,481
Direction of Wealth	0%	4%	61%	30%	86%	41%
Average Bequest	$0	$1,368	$89,798	$39,458	$148,678	$64,447
Downside Volatility	-1.0%	-0.7%	-0.9%	-0.6%	-2.8%	-1.3%
Probability of Shortfall	28%	1%	100%	60%	59%	27%
Magnitude of Shortfall	-$37,095	-$5,336	-$97,310	-$15,804	-$78,825	-$20,174

Exhibit 4 (continued)
65-Year Old Female with $250k -- Average Health

Set 3

	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	$19,476	$27,646	$19,476	$27,646	$19,476	$27,646
Initial Income from Financial Assets	$7,813	$3,317	$12,500	$5,306	$11,250	$4,776
Total Initial Retirement Income	$27,289	$30,963	$31,976	$32,952	$30,726	$32,422
Average Income, All Sources	$27,108	$30,916	$30,296	$32,284	$31,304	$32,710
Direction of Income	99%	100%	95%	98%	102%	101%
Average Accessible Wealth	$152,977	$76,038	$113,147	$59,145	$88,748	$48,679
Direction of Wealth	61%	30%	45%	24%	35%	19%
Average Bequest	$89,798	$39,458	$39,445	$18,041	$27,573	$13,086
Downside Volatility	-0.9%	-0.6%	-0.9%	-0.7%	-0.6%	-0.6%
Probability of Shortfall	100%	60%	61%	10%	47%	0%
Magnitude of Shortfall	-$97,310	-$15,804	-$45,519	-$9,602	-$15,263	$0

Set 4

	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	$27,646	$27,646	$27,646	$27,646	$27,646	$27,646
Initial Income from Financial Assets	$4,776	$5,306	$3,184	$3,317	$4,461	$3,754
Total Initial Retirement Income	$32,422	$32,952	$30,830	$30,963	$32,107	$31,400
Average Income, All Sources	$32,710	$32,284	$31,138	$32,531	$32,769	$32,606
Direction of Income	101%	98%	101%	105%	102%	104%
Average Accessible Wealth	$48,679	$59,145	$126,794	$102,481	$75,075	$86,457
Direction of Wealth	19%	24%	51%	41%	30%	35%
Average Bequest	$13,086	$18,041	$115,450	$64,447	$45,512	$49,254
Downside Volatility	-0.6%	-0.7%	-1.1%	-1.3%	-1.1%	-1.0%
Probability of Shortfall	0%	10%	55%	27%	10%	15%
Magnitude of Shortfall	$0	-$9,602	-$22,649	-$20,174	-$15,354	-$14,926

Exhibit 5: 65-Year Female with $250k -- Good Health

Set 1

	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	$27,646	$27,646	$27,646	$27,646	$27,646	$27,646
Initial Income from Financial Assets	$4,461	$4,461	$4,461	$3,317	$3,317	$3,317
Total Initial Retirement Income	$32,107	$32,107	$32,107	$30,963	$30,963	$30,963
Average Income, All Sources	$32,693	$32,509	$32,225	$32,368	$32,123	$31,788
Direction of Income	102%	101%	100%	105%	104%	103%
Average Accessible Wealth	$70,960	$68,055	$63,986	$97,107	$92,873	$86,986
Direction of Wealth	28%	27%	26%	39%	37%	35%
Average Bequest	$41,122	$38,252	$34,351	$58,253	$54,194	$48,615
Downside Volatility	-1.0%	-0.9%	-0.7%	-1.3%	-1.0%	-0.8%
Probability of Shortfall	11%	9%	9%	28%	26%	27%
Magnitude of Shortfall	-$15,001	-$16,770	-$16,623	-$21,746	-$19,319	-$18,684

Set 2

	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	$19,476	$27,646	$19,476	$27,646	$19,476	$27,646
Initial Income from Financial Assets	$16,800	$7,132	$7,813	$3,317	$7,813	$3,317
Total Initial Retirement Income	$36,276	$34,778	$27,289	$30,963	$27,289	$30,963
Average Income, All Sources	$32,565	$33,207	$27,048	$30,905	$30,610	$32,368
Direction of Income	90%	95%	99%	100%	112%	105%
Average Accessible Wealth	$0	$10,207	$148,490	$73,237	$205,064	$97,107
Direction of Wealth	0%	4%	59%	29%	82%	39%
Average Bequest	$0	$1,093	$80,306	$35,175	$134,425	$58,253
Downside Volatility	-1.0%	-0.7%	-0.9%	-0.6%	-2.8%	-1.3%
Probability of Shortfall	29%	1%	100%	57%	62%	28%
Magnitude of Shortfall	-$42,835	-$6,253	-$106,656	-$18,319	-$85,845	-$21,746

Exhibit 5: 65-Year Old Female with $250k -- Good Health (continued)

Set 3

	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	$19,476	$27,646	$19,476	$27,646	$19,476	$27,646
Initial Income from Financial Assets	$7,813	$3,317	$12,500	$5,306	$11,250	$4,776
Total Initial Retirement Income	$27,289	$30,963	$31,976	$32,952	$30,726	$32,422
Average Income, All Sources	$27,048	$30,905	$30,093	$32,234	$31,531	$32,789
Direction of Income	99%	100%	94%	98%	103%	101%
Average Accessible Wealth	$148,490	$73,237	$104,001	$54,531	$83,107	$45,449
Direction of Wealth	59%	29%	42%	22%	33%	18%
Average Bequest	$80,306	$35,175	$31,260	$14,330	$22,362	$10,598
Downside Volatility	-0.9%	-0.6%	-0.9%	-0.6%	-0.6%	-0.6%
Probability of Shortfall	100%	57%	64%	11%	42%	0%
Magnitude of Shortfall	-$106,656	-$18,319	-$53,923	-$10,118	-$14,701	$0

Set 4

	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	$27,646	$27,646	$27,646	$27,646	$27,646	$27,646
Initial Income from Financial Assets	$4,776	$5,306	$3,184	$3,317	$4,461	$3,754
Total Initial Retirement Income	$32,422	$32,952	$30,830	$30,963	$32,107	$31,400
Average Income, All Sources	$32,789	$32,234	$31,054	$32,368	$32,693	$32,555
Direction of Income	101%	98%	101%	105%	102%	104%
Average Accessible Wealth	$45,449	$54,531	$123,235	$97,107	$70,960	$81,225
Direction of Wealth	18%	22%	49%	39%	28%	32%
Average Bequest	$10,598	$14,330	$117,798	$58,253	$41,122	$44,057
Downside Volatility	-0.6%	-0.6%	-1.0%	-1.3%	-1.0%	-1.0%
Probability of Shortfall	0%	11%	57%	28%	11%	15%
Magnitude of Shortfall	$0	-$10,118	-$25,028	-$21,746	-$15,001	-$14,114

Exhibit 6: 65-Year Female with $250k -- Poor Health

Set 1

	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	$27,646	$27,646	$27,646	$27,646	$27,646	$27,646
Initial Income from Financial Assets	$4,461	$4,461	$4,461	$3,317	$3,317	$3,317
Total Initial Retirement Income	$32,107	$32,107	$32,107	$30,963	$30,963	$30,963
Average Income, All Sources	$32,786	$32,570	$32,308	$32,451	$32,182	$31,839
Direction of Income	102%	101%	101%	105%	104%	103%
Average Accessible Wealth	$77,149	$73,805	$69,542	$105,076	$100,306	$94,125
Direction of Wealth	31%	30%	28%	42%	40%	38%
Average Bequest	$50,334	$46,442	$42,567	$71,190	$65,661	$60,028
Downside Volatility	-1.1%	-0.9%	-0.8%	-1.3%	-1.0%	-0.8%
Probability of Shortfall	9%	7%	7%	27%	25%	24%
Magnitude of Shortfall	-$11,545	-$10,052	-$10,281	-$15,604	-$13,658	-$13,248

Set 2

	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	$19,476	$27,646	$19,476	$27,646	$19,476	$27,646
Initial Income from Financial Assets	$16,800	$7,132	$7,813	$3,317	$7,813	$3,317
Total Initial Retirement Income	$36,276	$34,778	$27,289	$30,963	$27,289	$30,963
Average Income, All Sources	$32,865	$33,353	$27,232	$30,972	$30,644	$32,451
Direction of Income	91%	96%	100%	100%	112%	105%
Average Accessible Wealth	$0	$11,908	$159,680	$79,670	$219,136	$105,076
Direction of Wealth	0%	5%	64%	32%	88%	42%
Average Bequest	$0	$1,700	$101,140	$44,723	$163,760	$71,190
Downside Volatility	-1.0%	-0.8%	-0.9%	-0.7%	-2.7%	-1.3%
Probability of Shortfall	24%	1%	100%	57%	62%	27%
Magnitude of Shortfall	-$29,828	-$3,550	-$86,992	-$13,459	-$71,837	-$15,604

Exhibit 6: 65-Year Old Female with $250k -- Poor Health (continued)

Set 3

	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	$19,476	$27,646	$19,476	$27,646	$19,476	$27,646
Initial Income from Financial Assets	$7,813	$3,317	$12,500	$5,306	$11,250	$4,776
Total Initial Retirement Income	$27,289	$30,963	$31,976	$32,952	$30,726	$32,422
Average Income, All Sources	$27,232	$30,972	$30,470	$32,354	$31,343	$32,704
Direction of Income	100%	100%	95%	98%	102%	101%
Average Accessible Wealth	$159,680	$79,670	$119,771	$62,730	$94,604	$52,061
Direction of Wealth	64%	32%	48%	25%	38%	21%
Average Bequest	$101,140	$44,723	$47,108	$21,717	$33,472	$15,953
Downside Volatility	-0.9%	-0.7%	-0.9%	-0.7%	-0.6%	-0.6%
Probability of Shortfall	100%	57%	58%	7%	46%	0%
Magnitude of Shortfall	-$86,992	-$13,459	-$39,805	-$7,093	-$12,832	$0

Set 4

	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	$27,646	$27,646	$27,646	$27,646	$27,646	$27,646
Initial Income from Financial Assets	$4,776	$5,306	$3,184	$3,317	$4,461	$3,754
Total Initial Retirement Income	$32,422	$32,952	$30,830	$30,963	$32,107	$31,400
Average Income, All Sources	$32,704	$32,354	$31,135	$32,451	$32,786	$32,581
Direction of Income	101%	98%	101%	105%	102%	104%
Average Accessible Wealth	$52,061	$62,730	$125,053	$105,076	$77,149	$89,272
Direction of Wealth	21%	25%	50%	42%	31%	36%
Average Bequest	$15,953	$21,717	$117,369	$71,190	$50,334	$54,795
Downside Volatility	-0.6%	-0.7%	-1.1%	-1.3%	-1.1%	-1.0%
Probability of Shortfall	0%	7%	56%	27%	9%	13%
Magnitude of Shortfall	$0	-$7,093	-$20,535	-$15,604	-$11,545	-$12,388

Exhibit 7
65-Year Old Couple with $400k -- Average Health

Set 1

	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	$49,383	$49,383	$49,383	$49,383	$49,383	$49,383
Initial Income from Financial Assets	$7,872	$7,872	$7,872	$6,230	$6,230	$6,230
Total Initial Retirement Income	$57,255	$57,255	$57,255	$55,613	$55,613	$55,613
Average Income, All Sources	$58,568	$58,145	$57,571	$58,627	$58,039	$57,210
Direction of Income	102%	102%	101%	105%	104%	103%
Average Accessible Wealth	$131,144	$123,788	$114,467	$181,061	$170,940	$157,688
Direction of Wealth	33%	31%	29%	45%	43%	39%
Average Bequest	$64,770	$59,302	$51,863	$92,502	$84,694	$74,066
Downside Volatility	-1.0%	-0.8%	-0.6%	-1.3%	-1.0%	-0.7%
Probability of Shortfall	0%	0%	1%	4%	3%	3%
Magnitude of Shortfall	-$22,257	-$22,347	-$21,552	-$24,251	-$18,035	-$22,329

Set 2

	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	$37,836	$49,383	$37,836	$49,383	$37,836	$49,383
Initial Income from Financial Assets	$23,480	$11,703	$12,500	$6,230	$12,500	$6,230
Total Initial Retirement Income	$61,316	$61,086	$50,336	$55,613	$50,336	$55,613
Average Income, All Sources	$55,835	$58,366	$49,942	$55,415	$56,171	$58,627
Direction of Income	91%	96%	99%	100%	112%	105%
Average Accessible Wealth	$0	$13,934	$231,546	$129,256	$335,094	$181,061
Direction of Wealth	0%	3%	58%	32%	84%	45%
Average Bequest	$0	$59	$96,922	$48,363	$185,468	$92,502
Downside Volatility	-0.8%	-0.6%	-0.8%	-0.6%	-2.5%	-1.3%
Probability of Shortfall	27%	0%	100%	8%	43%	4%
Magnitude of Shortfall	-$59,663	$0	-$104,684	-$27,236	-$101,635	-$24,251

Exhibit 7 (continued)
65-Year Old Couple with $400k -- Average Health
Set 3

	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	$37,836	$49,383	$37,836	$49,383	$37,836	$49,383
Initial Income from Financial Assets	$12,500	$6,230	$18,000	$8,972	$16,000	$7,975
Total Initial Retirement Income	$50,336	$55,613	$55,836	$58,355	$53,836	$57,358
Average Income, All Sources	$49,942	$55,415	$53,389	$57,184	$54,733	$57,865
Direction of Income	99%	100%	96%	98%	102%	101%
Average Accessible Wealth	$231,546	$129,256	$184,464	$105,720	$140,955	$84,248
Direction of Wealth	58%	32%	46%	26%	35%	21%
Average Bequest	$96,922	$48,363	$28,755	$14,395	$14,969	$7,519
Downside Volatility	-0.8%	-0.6%	-0.7%	-0.5%	-0.5%	-0.4%
Probability of Shortfall	100%	8%	49%	0%	21%	0%
Magnitude of Shortfall	-$104,684	-$27,236	-$67,416	$0	-$18,830	$0

Set 4

	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	$49,383	$49,383	$49,383	$49,383	$49,383	$49,383
Initial Income from Financial Assets	$7,975	$8,972	$5,981	$6,230	$7,872	$6,754
Total Initial Retirement Income	$57,358	$58,355	$55,364	$55,613	$57,255	$56,137
Average Income, All Sources	$57,865	$57,184	$55,910	$58,627	$58,568	$58,451
Direction of Income	101%	98%	101%	105%	102%	104%
Average Accessible Wealth	$84,248	$105,720	$230,417	$181,061	$131,144	$151,799
Direction of Wealth	21%	26%	58%	45%	33%	38%
Average Bequest	$7,519	$14,395	$213,432	$92,502	$64,770	$66,788
Downside Volatility	-0.4%	-0.5%	-1.0%	-1.3%	-1.0%	-1.0%
Probability of Shortfall	0%	0%	14%	4%	0%	0%
Magnitude of Shortfall	$0	$0	-$26,812	-$24,251	-$22,257	-$15,191

Exhibit 8: 65-Year Old Couple with $400k -- Good Health

Set 1

	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	$49,383	$49,383	$49,383	$49,383	$49,383	$49,383
Initial Income from Financial Assets	$7,872	$7,872	$7,872	$6,230	$6,230	$6,230
Total Initial Retirement Income	$57,255	$57,255	$57,255	$55,613	$55,613	$55,613
Average Income, All Sources	$58,412	$58,110	$57,531	$58,331	$57,835	$57,183
Direction of Income	102%	101%	100%	105%	104%	103%
Average Accessible Wealth	$123,526	$116,523	$109,234	$171,241	$161,248	$150,390
Direction of Wealth	31%	29%	27%	43%	40%	38%
Average Bequest	$55,569	$51,672	$44,481	$79,368	$73,800	$63,528
Downside Volatility	-1.0%	-0.8%	-0.6%	-1.3%	-1.0%	-0.7%
Probability of Shortfall	1%	1%	2%	4%	3%	4%
Magnitude of Shortfall	-$24,139	-$24,100	-$24,351	-$29,515	-$29,982	-$31,230

Set 2

	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	$37,836	$49,383	$37,836	$49,383	$37,836	$49,383
Initial Income from Financial Assets	$23,480	$11,703	$12,500	$6,230	$12,500	$6,230
Total Initial Retirement Income	$61,316	$61,086	$50,336	$55,613	$50,336	$55,613
Average Income, All Sources	$55,703	$58,297	$49,779	$55,378	$55,943	$58,331
Direction of Income	91%	95%	99%	100%	111%	105%
Average Accessible Wealth	$0	$12,949	$223,094	$124,158	$317,340	$171,241
Direction of Wealth	0%	3%	56%	31%	79%	43%
Average Bequest	$0	$38	$81,280	$40,550	$159,164	$79,368
Downside Volatility	-0.8%	-0.6%	-0.8%	-0.6%	-2.5%	-1.3%
Probability of Shortfall	32%	0%	100%	10%	46%	4%
Magnitude of Shortfall	-$61,196	$0	-$117,774	-$35,584	-$114,393	-$29,515

Exhibit 8: 65-Year Old Couple with $400k -- Good Health
Set 3

	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	$37,836	$49,383	$37,836	$49,383	$37,836	$49,383
Initial Income from Financial Assets	$12,500	$6,230	$18,000	$8,972	$16,000	$7,975
Total Initial Retirement Income	$50,336	$55,613	$55,836	$58,355	$53,836	$57,358
Average Income, All Sources	$49,779	$55,378	$53,082	$57,082	$55,101	$58,011
Direction of Income	99%	100%	95%	98%	102%	101%
Average Accessible Wealth	$223,094	$124,158	$169,225	$97,420	$131,231	$78,503
Direction of Wealth	56%	31%	42%	24%	33%	20%
Average Bequest	$81,280	$40,550	$18,976	$9,494	$10,120	$5,083
Downside Volatility	-0.8%	-0.6%	-0.7%	-0.5%	-0.5%	-0.4%
Probability of Shortfall	100%	10%	52%	0%	18%	0%
Magnitude of Shortfall	-$117,774	-$35,584	-$79,733	-$4,400	-$17,540	$0

Set 4

	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	$49,383	$49,383	$49,383	$49,383	$49,383	$49,383
Initial Income from Financial Assets	$7,975	$8,972	$5,981	$6,230	$7,872	$6,754
Total Initial Retirement Income	$57,358	$58,355	$55,364	$55,613	$57,255	$56,137
Average Income, All Sources	$58,011	$57,082	$55,724	$58,331	$58,412	$58,314
Direction of Income	101%	98%	101%	105%	102%	104%
Average Accessible Wealth	$78,503	$97,420	$227,039	$171,241	$123,526	$143,181
Direction of Wealth	20%	24%	57%	43%	31%	36%
Average Bequest	$5,083	$9,494	$221,536	$79,368	$55,569	$57,022
Downside Volatility	-0.4%	-0.5%	-1.0%	-1.3%	-1.0%	-1.0%
Probability of Shortfall	0%	0%	16%	4%	1%	1%
Magnitude of Shortfall	$0	-$4,400	-$24,949	-$29,515	-$24,139	-$14,498

Exhibit 9
65-Year Old Couple with $400k -- Poor Health

Set 1

	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	$49,383	$49,383	$49,383	$49,383	$49,383	$49,383
Initial Income from Financial Assets	$7,872	$7,872	$7,872	$6,230	$6,230	$6,230
Total Initial Retirement Income	$57,255	$57,255	$57,255	$55,613	$55,613	$55,613
Average Income, All Sources	$58,605	$58,192	$57,669	$58,448	$57,939	$57,267
Direction of Income	102%	102%	101%	105%	104%	103%
Average Accessible Wealth	$133,989	$127,133	$119,546	$184,685	$175,336	$164,395
Direction of Wealth	33%	32%	30%	46%	44%	41%
Average Bequest	$74,099	$68,729	$60,357	$105,819	$98,142	$86,182
Downside Volatility	-1.0%	-0.8%	-0.6%	-1.2%	-1.0%	-0.7%
Probability of Shortfall	0%	0%	0%	4%	1%	1%
Magnitude of Shortfall	-$22,700	-$15,785	-$13,943	-$12,568	-$17,710	-$21,096

Set 2

	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	$37,836	$49,383	$37,836	$49,383	$37,836	$49,383
Initial Income from Financial Assets	$23,480	$11,703	$12,500	$6,230	$12,500	$6,230
Total Initial Retirement Income	$61,316	$61,086	$50,336	$55,613	$50,336	$55,613
Average Income, All Sources	$56,175	$58,524	$50,151	$55,537	$55,988	$58,448
Direction of Income	92%	96%	100%	100%	111%	105%
Average Accessible Wealth	$0	$14,979	$242,656	$136,021	$340,123	$184,685
Direction of Wealth	0%	4%	61%	34%	85%	46%
Average Bequest	$0	$92	$116,955	$58,384	$212,136	$105,819
Downside Volatility	-0.8%	-0.6%	-0.8%	-0.6%	-2.4%	-1.2%
Probability of Shortfall	24%	0%	100%	6%	44%	4%
Magnitude of Shortfall	-$45,851	$0	-$91,569	-$20,896	-$89,562	-$12,568

Exhibit 9 (continued)
65-Year Old Couple with $400k -- Poor Health
Set 3

	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	$37,836	$49,383	$37,836	$49,383	$37,836	$49,383
Initial Income from Financial Assets	$12,500	$6,230	$18,000	$8,972	$16,000	$7,975
Total Initial Retirement Income	$50,336	$55,613	$55,836	$58,355	$53,836	$57,358
Average Income, All Sources	$50,151	$55,537	$53,614	$57,299	$54,798	$57,856
Direction of Income	100%	100%	96%	98%	102%	101%
Average Accessible Wealth	$242,656	$136,021	$195,377	$112,504	$150,720	$90,106
Direction of Wealth	61%	34%	49%	28%	38%	23%
Average Bequest	$116,955	$58,384	$40,402	$20,224	$21,507	$10,811
Downside Volatility	-0.8%	-0.6%	-0.7%	-0.6%	-0.5%	-0.5%
Probability of Shortfall	100%	6%	46%	0%	20%	0%
Magnitude of Shortfall	-$91,569	-$20,896	-$58,230	$0	-$15,121	$0

Set 4

	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/RMI 100% stocks SS@70
Initial Social Security Benefit	$49,383	$49,383	$49,383	$49,383	$49,383	$49,383
Initial Income from Financial Assets	$7,975	$8,972	$5,981	$6,230	$7,872	$6,754
Total Initial Retirement Income	$57,358	$58,355	$55,364	$55,613	$57,255	$56,137
Average Income, All Sources	$57,856	$57,299	$55,831	$58,448	$58,605	$58,366
Direction of Income	101%	98%	101%	105%	102%	104%
Average Accessible Wealth	$90,106	$112,504	$228,542	$184,685	$133,989	$156,691
Direction of Wealth	23%	28%	57%	46%	33%	39%
Average Bequest	$10,811	$20,224	$217,904	$105,819	$74,099	$77,261
Downside Volatility	-0.5%	-0.6%	-1.0%	-1.2%	-1.0%	-0.9%
Probability of Shortfall	0%	0%	15%	4%	0%	0%
Magnitude of Shortfall	$0	$0	-$19,584	-$12,568	-$22,700	-$12,033

Appendices: Assumptions and Methods

Appendix A: Assumptions for Hypothetical Retirees

Retiree #1: Single female retiring at 65 (born in 1956)

Retirement savings at age 65: $250,000
Pre-retirement income: $50,000
Social Security starting at 65: $19,476
Social Security starting at age 70: $27,646

Assumed threshold of annual minimum needed income for retirement income metrics discussed in Section 5.3: $31,051 (62% of pre-retirement income)

Retirees #2: Married 65-year-old couple (born in 1956)

Retirement savings at age 65: $400,000
Pre-retirement income (husband): $75,000
Pre-retirement income (wife): $25,000
Social Security starting at 65:

- Husband's worker benefit: $25,344
- Wife's worker benefit: $12,492

Husband's Social Security worker's benefit at starting at 70: $35,977
Wife's Social Security worker's benefit starting at 66: $13,406

Estimated threshold of annual minimum needed income for retirement income metrics discussed in Section 5.3: $53,516 (54% of combined pre-retirement income for the couple)

Development of guideline expenses

The expense guidelines are rough estimates and we have updated the guidelines that were used in the 2017 study. The development of these guidelines is described below.

For each of Retirees #1 and #2, 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 guidelines used in this study are $31,051 for retiree #1 (single 65-year-old female) and $53,516 for retiree #2 (65-year-old couple).

The reason for assuming Social Security begins at the assumed retirement age of 65 is that this is 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.9

We set the guidelines as level real amounts although there is some evidence that spending decreases over the course of retirement.3 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.

For the purposes of comparison, the 2015 Consumer Expenditure Survey[12] by the 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 for a new average retiree.

Appendix B: Investment Return and Mortality Assumptions

	Real Returns			Correlation Coefficient		
	Arithmetic Mean	Geometric Mean	Standard Deviation	Stocks	Bonds	Inflation
Stocks	5.0%	3.0%	20.0%	1.0	0.1	-0.2
Bonds	1.0%	0.8%	7.0%	0.1	1.0	-0.6
Inflation	2.0%	1.9%	4.2%	-0.2	-0.6	1.0

Note: These return assumptions are similar to those used in our prior study *Optimizing Retirement Income by Integrating Retirement Plans, IRAs, and Home Equity*, but updated to November 2018. They are lower than historical averages. Bond returns reflect the current interest rate environment (as of November 2018), and stock returns reflect a lower-than-historical premium over bond returns. Our inflation assumption is in line with market expectations as measured by the yield difference between Treasury bonds and Treasury inflation-protected securities (TIPS). 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. These estimated returns are after any investment charges, and we note that such charges have been declining over the past few years with the trends toward passive investing and the use of ETFs.

For Figures 13 -15, the real SPIA income patterns reflect inflation-only because 100% of the savings are assumed to be invested in SPIAs. For the SPIAs we modelled year-by-year inflation based on historical patterns adjusted to an average inflation rate of our assumed 2%. The historical patterns contained some blocks of years with higher-than-average inflation and some with lower.

Appendix C: General Investment and Annuity Product Assumptions

In our prior study *Optimizing Retirement Income by Integrating Retirement Plans, IRAs, and Home Equity*, we used separate pricing assumptions for high-performing products and lower-performing products. High-performing products were 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. Lower-performing products were 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. For this study, we have focused only on the high-performing category as high-performing products are becoming more widely available.

We show projected incomes as 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)

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)

Asset allocation: 60% stocks and 40% bonds

Fixed index annuities

Modeling is based on representative FIA products.

Maximum annual credited rate (Cap Rate) of 4.50% based on performance of the S&P 500 minus dividends. Minimum credited rate of 0%.

- GLWB rider charge: 1.05% of the accumulation value.
- Age 65 pay-out percentages: 4.50% single life, 4.00% couple (under Option 2, which provides the opportunity for increasing payments).
- Surrender charges: 8.5% first year, 8% second year, decreasing by 1% each year thereafter, down to 3% for year 7 and 0% for years 8 and after—applied to account value.

Single-premium immediate annuities (SPIAs)

For purposes of this report, annuity pay-out rates were sampled in November 2018 using the CANNEX annuity bidding platform.

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

Inflation-adjusted SPIA: 4.63%
Level payment SPIA: 6.72%

Products for Retiree Couple #2
Joint-life product pricing at age 65 (annual income as a percent of annuity purchase price)

Inflation-adjusted 100% Joint & Survivor SPIA: 3.92%
Level payment SPIA: 5.87%
SPIA with 3% annual growth rate of payments: 4.03%

The above SPIA pay-out rates are 0.3% to 0.5% higher than those used in prior studies reflecting an increase in interest rates since those studies were done.

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: Withdrawal Percentages Under the IRS Required Minimum Distribution

Age	Distribution period in years	Minimum payout rate
60	36.8 years	2.7174%
61	35.8	2.7933%
62	34.9	2.8653%
63	33.9	2.9499%
64	33.0	3.0303%
65	32.0	3.1250%
66	31.1	3.2152%
67	30.2	3.3113%
68	29.2	3.4247%
69	28.3	3.5336%
70	27.4	3.6496%
71	26.5	3.7736%
72	25.6	3.9063%
73	24.7	4.0486%
74	23.8	4.2017%
75	22.9	4.3669%
76	22.0	4.5455%
77	21.2	4.7170%
78	20.3	4.9261%
79	19.5	5.1282%
80	18.7	5.3476%
81	17.9	5.5866%
82	17.1	5.8480%
83	16.3	6.1350%
84	15.5	6.4516%
85	14.8	6.7568%
86	14.1	7.0922%
87	13.4	7.4627%
88	12.7	7.8740%
89	12.0	8.3333%

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.
- The RMD factors for age 70 and above are widely available. A comprehensive table can be found in IRS regulation 1.401(a)(9)

Appendix E: Federal Income Tax Rates and Standard Deductions in 2019

Tax Rate	Taxable Income Single	Taxable Income Married
10%	$0 - $9,699	$0 to $19,399
12%	$9,700 - $39,474	$19,400 - $78,949
22%	$39,475 - $84,199	$78,950 - $168,399
24%	$84,200 - $160,724	$168,400- $321,449
32%	$160,725 - $204,099	$321,450 - $408,199
35%	$204,100 - $510,299	$408,200 - $612,349
37%	Over $510,300	Over $612,350

Note that taxable income is net of deductions from gross income

Standard deductions in 2019:

- Single: $12,200
- Married filing jointly: $24,400

"To the extent that individuals arrive at old age mentally sharp, physically fit, and financially secure, societies will thrive."

- Dr. Laura L. Carstensen, Founding Director, Stanford Center on Longevity

"The work of science is to substitute facts for appearances and demonstrations for impressions."

- John Ruskin, Motto of Society of Actuaries

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