Optimal Retirement Income Solutions in DC Retirement Plans
Phase 3: Using QLACs to Design Retirement Income Solutions

Interim results and commentary
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Acknowledgments

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Project Goals

- Illustrate an analytical framework for determining retirement income generators (RIGs) that could be offered in a DC retirement plan, using stochastic forecasts and efficient frontiers for hypothetical retirees.

- Determine the RIGS or combination of RIGs that could be considered optimal according to specified criteria.

- Encourage plan participants, plan sponsors, and advisors to adopt a portfolio approach to developing retirement income strategies.

- Follow up a prior SOA/SCL report that analyzed the characteristics of stand-alone RIGs:
  - *The Next Evolution in Defined Contribution Retirement Plans: A Guide for DC Plan Sponsors to Implementing Retirement Income Programs*

- See Appendix A for definition of certain terms, and see the above report for additional definition of terms and descriptions of RIGs.

Summary of Analyses – All Phases

- Phase 1 analyzes RIGs that are currently available in DC retirement plans and are straightforward to implement. Phase 1 establishes a baseline for comparing to future phases.

- Phase 2 determines if projected outcomes can be improved over results in Phase 1 by using retirement savings to enable delaying Social Security benefits.

- Phase 3 analyzes strategies that combine systematic withdrawal plans (SWPs) with deferred income annuities starting at advanced ages, otherwise known as qualified longevity annuity contracts (QLACs), to determine if the additional complexity improves projected outcomes.

- Phase 4 will analyze strategies that protect retirement income in the period leading up to retirement with target date funds, deferred income annuities and guaranteed lifetime withdrawal benefits (GLWBs).

- This is the interim report for Phase 3. When the analyses for all phases have been completed, a final report will integrate all four phases.

Executive Summary of Phase 3 Results and Conclusions

- Using a portion of retirement savings to purchase a QLAC has received much attention lately, including Treasury guidance in 2014 that defines a QLAC and exempts it from IRS required minimum distribution (RMD) rules. Appendix B summarizes the key features of this guidance on QLACs.

- The potential attraction of a strategy that combines SWPs and QLACs is to try to realize the best features of both systematic withdrawals and annuities. To achieve this goal, a large portion of assets remain invested to generate retirement income and are accessible and liquid. A relatively small portion of initial assets are devoted to the QLAC to guarantee a lifetime payout, no matter how long the retiree lives.

- This report analyzes a key question: Can SWP/QLAC strategies produce higher expected income with the same amount of risk or accessible wealth, compared to other strategies that try to realize the best features of SWPs and annuities (namely, SWP/SPIA combinations or GLWB annuities).

Executive Summary of Phase 3 Results and Conclusions (continued)

- We analyzed the following approaches to combining SWPs with QLACs:

    1. The SWP exhausts savings by a specified advanced age, for example age 80 or 85. This report uses age 85 for this purpose. After age 85, the retiree receives income just from the QLAC. In this report we call this strategy "20-year spend-down+QLAC."
    2. The SWP is intended to generate retirement income for the life of the participant, and is not expected to stop at any specified age. After age 85, the retiree would receive income from both the QLAC and invested assets. In this report we call this strategy "lifetime SWP+QLAC."

- We acknowledge that some retirees may not want to adopt a pure form of the first method, whereby assets are completely exhausted by age 85. We analyzed this solution because it's being suggested by some analysts and financial institutions. Also, some participants may consider adopting such a solution with just a portion of their assets.
- These strategies have an inherent challenge: a potentially significant disruption in retirement income between ages 84 and 85. This challenge would also exist for QLACs that have a starting age different from age 85.

Executive Summary of Phase 3 Results and Conclusions (continued)

- In addition to the SWP/QLAC strategies listed on the previous page, other possible uses of QLACs exist, such as:
  - A combination of both approaches listed previously.
  - Devote a specified portion of starting assets to a QLAC, and devise a strategy for continuously adjusting the SWP withdrawal and asset allocation strategies to minimize disruptions in income between ages 84 and 85.
  - Some retirees might just want to define the absolute minimum amount of retirement income they need at an advanced age as a form of insurance against living a long time. They would then work or draw on financial assets until that age, and would be willing to tolerate the potential disruption in income at the advanced age.
  - Buy a deferred annuity with an earlier starting age, such as age 75, and work and/or deploy minimum required withdrawals from savings until that age.
  - A version of the second strategy that layers on additional income from a QLAC at the advanced age, to help pay for increased medical and/or long-term care costs.

Executive Summary of Phase 3 Results and Conclusions (continued)

- Integrated SWP/QLAC strategies are "easier said than done." They do not lend themselves well to being assembled by retirees who do not have training in structuring retirement income solutions. Key decisions are the portion of initial retirement assets to devote to the QLAC, and the withdrawal method and asset allocation used by the SWP. To work most effectively, these strategies may need to be packaged by a qualified financial advisor or the retirement plan.

- A substantial challenge is avoiding significant increases or decreases in income between ages 84 and 85.

- To minimize these potential increases or decreases in income, most likely SWP/QLAC strategies will require ongoing monitoring and adjustments by the retiree or an advisor to the SWP withdrawal amount and/or asset allocation. SWP/QLAC strategies may not be appropriate for retirees who don't want to periodically revisit their retirement decisions.

Executive Summary of Phase 3 Results and Conclusions (continued)

- We analyzed QLACs with no death benefit and no liquidity before age 85. Such an annuity will produce the highest expected retirement income, compared to QLACs that pay a death benefit before age 85. Our efficient frontier analyses devoted 15% of initial assets to the QLAC. We assumed that most retirees would not want to dedicate more than this portion of starting assets to an illiquid QLAC.

- Our efficient frontier analyses indicate that it may be possible that SWP/QLAC strategies could deliver higher expected average annual retirement income for the same amount of risk or accessible wealth.

- As a result, plan sponsors or participants who can handle the additional complexity of these strategies may want to investigate these solutions.

Executive Summary of Phase 3 Results and Conclusions (continued)

- Key challenges for retirees and their advisors include:
  - Determining the percentage of initial assets devoted to the QLAC.
  - Developing a SWP withdrawal and asset allocation that minimizes disruptions in the amount of income between ages 84 and 85.
  - Deciding whether the QLAC pays a death benefit before age 85, with the resulting drop in expected retirement income.
- Key challenges for plan sponsors include:
  - QLACs pose communication challenges due to the potential for disruptions in income between ages 84 and 85, and if there is no pre-85 death benefit.
  - Should plan sponsors just make QLACs available to plan participants and their advisors to utilize on their own, or should they attempt to package SWPs and QLACs into an integrated retirement income solution for retirees to elect?
  - Any type of annuity presents a challenge to explain to participants, and QLACs may provide an additional communications challenge. Due to the complexity of QLACs, plan sponsors who offer QLACs may want to offer through the plan the option for accessing financial advisors who are qualified to provide advice on QLACs.

Retirement Income Solutions Investigated in Phase 3

- Phase 1 established a baseline by analyzing the following solutions:
  - All cases include estimated Social Security benefits that start at the same time as the retirement income solution (parallel Social Security claiming strategy).
  - Four stand-alone annuity solutions were considered – three versions of single premium immediate annuities (SPIA), and one guaranteed lifetime withdrawal benefit (GLWB).
  - Four SWP solutions were analyzed, each with five possible asset allocations, for a total of 20 possible SWP solutions.
  - The three SPIA strategies were each combined with the 20 SWP solutions for a total of 60 possible strategies that combined SWPs and SPIAs.
  - In total, 84 possible retirement income solutions were analyzed and plotted on two efficient frontiers.
- Phase 3 analyzes 36 SWP/QLAC combinations to determine if such strategies can extend the efficient frontier compared to the Phase 1 baseline strategies described above. These strategies are deployed at age 65; we did not combine Phase 3 strategies with Phase 2 strategies that use savings to enable delay of Social Security benefits.

Retirement Income Solutions Investigated in Phase 3 (continued)

- Our efficient frontier analyses assumed that 15% of initial assets were devoted to a QLAC. We assume that with no pre-85 death benefit, most retirees would not want to dedicate more than this amount to an illiquid QLAC.

- We also projected retirement incomes with 10% and 20% of starting assets devoted to a QLAC, to better understand the issues with designing a smooth transition in retirement income between ages 84 and 85.

- Two types of Phase 3 solutions analyzed:
  - SWP stops at age 85 ("20-year spend-down + QLAC")
  - SWP extends beyond age 85 ("lifelong SWP + QLAC")

Retirement Income Solutions Investigated in Phase 3 (continued)

- 20-year spend-down + QLAC solutions analyzed:
  - Annual income is 1/n applied to remaining assets each year, n is years remaining until age 85.
  - Asset allocations for SWP are 0%, 50%, and 100% to stocks.
  - Three types of QLACs are analyzed: fixed dollar amount, income is increased by 3% annually after age 85, and income is adjusted for inflation after age 85.

- Lifelong SWP + QLAC solutions analyzed:
  - SWPs have 0%, 50%, and 100% allocation to stocks
  - Three SWP programs analyzed that apply percentage applied to remaining assets each year to calculate SWP retirement income for the year: 5%, 7%, and IRS required minimum distribution (RMD).
  - Same three types of QLACs as described above.

Retirement Income Solutions Investigated in Phase 3 (continued)

- Phases 1, 2, and this Phase 3 analyze various retirement income solutions for three hypothetical retirees:

1. Single female retiring at age 65 with $250,000 in assets.
2. Married couple both age 65, retiring with $400,000 in assets.
3. Married couple both age 65, retiring with $1,000,000 in assets.

- The efficient frontier analyses and graphs discussed in the body of this report pertain to Retiree #1, while the analyses for the other two retirees are included in the Appendices.

Retirement Income Solutions Investigated in Phase 3 (continued)

- See Appendix C for details on methods, assumptions for hypothetical retirees, and capital market assumptions. Assumptions regarding expected returns and inflation reflect low-interest rate environment prevalent in 2014 and 2015.
  - Arithmetic mean real return: 5.1% for stocks, 0.3% for bonds.
  - Arithmetic mean inflation rate: 2.1%.
  - Annuity purchase rates in April, 2014.

- This report displays the values graphically. For a table of the numbers underlying the graphs, visit: http://longevity3.stanford.edu/phase2.htm

Hypothetical Retiree #1

- Single female retiring at age 65
- $250,000 of assets
- Social Security @ 65 = $16,895/year

- Annuity product pricing (annual income as a percent of assets at the beginning of retirement):
  - Inflation-adjusted SPIA: 4.82%
  - Fixed SPIA: 6.76%
  - SPIA with 3% growth rate: 4.88%
  - GLWB: 5%
  - Fixed QLAC starting at age 85: 51.04% (age 85 income equals 51.04% of age 65 assets)
  - QLAC with 3% growth after age 85: 44.05%
  - QLAC adjusted for inflation after age 85: 42.94%
- Above rates in effect during April, 2014 for institutionally priced GLWB products and using competitive annuity bidding for SPIAs and QLACs.

Defining Optimal with Retirement Income Efficient Frontiers

- We used two types of efficient frontiers (same as in Phases 1 and 2).
  - Efficient frontier #1: Emphasize retirement income.
  - Efficient frontier #2: Illustrate tradeoff between amount of expected retirement income and accessible savings.
- We anticipate that many retirees will emphasize the ability to access savings throughout retirement, and may place more importance on efficient frontier #2. This is particularly relevant for retirees who may be attracted to a SWP/QLAC strategy, since access to savings is an important feature of such a strategy.
- Stochastic forecasts produce retirement income projections under a range of expected, unfavorable and favorable scenarios.

Defining Optimal with Retirement Income Efficient Frontiers

- "Optimal" is in the eye of the beholder
  - Different definitions of optimal will produce different solutions that could be considered optimal.

- Other possible analyses of optimal could consider:
  - Volatility in retirement income amount from year to year.
  - The chance that savings will be exhausted.
  - The chance that retirement income could fall below a specified threshold.

- Plan sponsors should define criteria for optimal solutions that best meet their participants' goals and characteristics.

Details on Efficient Frontier #1

- Participant's most important goal: Maximize lifetime income that maintains purchasing power.
  - Tradeoff: Return vs. risk, defined in terms of retirement income.

- Measure of return (Y-axis): Average annual real retirement income from the retirement income solution under the median stochastic forecast throughout retirement. This average is calculated using the projected amount of income at each future age, multiplied by the probability of survival to each future age and adjusted for projected inflation.

- Measure of risk (X-axis): Average annual amount of real income shortfall throughout retirement relative to an inflation-adjusted SPIA under the unfavorable economic scenario, adjusted for survival probabilities.

- Rationale: An inflation-adjusted SPIA represents a guaranteed lifetime income with inflation-protection. Analyze if another solution can be expected to generate a higher amount of annual income by assuming some additional risk compared to the SPIA.

Details on Efficient Frontier #1 (continued)

- Note that there are other measures of risk that may be reasonable to use, such as the probability of running out of money. This report purposely analyzes RIGs that have no chance of running out of money – annuities and systematic withdrawal strategies where the annual withdrawal is a percentage of remaining assets. With such systematic withdrawal strategies, however, it is possible that the amount of withdrawal can decrease substantially, a risk that is addressed in this report.

- Note that with the measure of risk used in this analysis, there are two ways that a particular SWP can develop shortfalls compared to an inflation-adjusted annuity. If withdrawals are too conservative, then the annuity will produce higher amounts of income. If the withdrawals are too aggressive, then eventually the assets will decline significantly and resulting income will also fall short relative to the inflation-adjusted annuity.

- See Appendix C for details on the methods used for the efficient frontiers and stochastic forecasts.

Commentary on Efficient Frontier #1 Comparing Phases 1 and 3

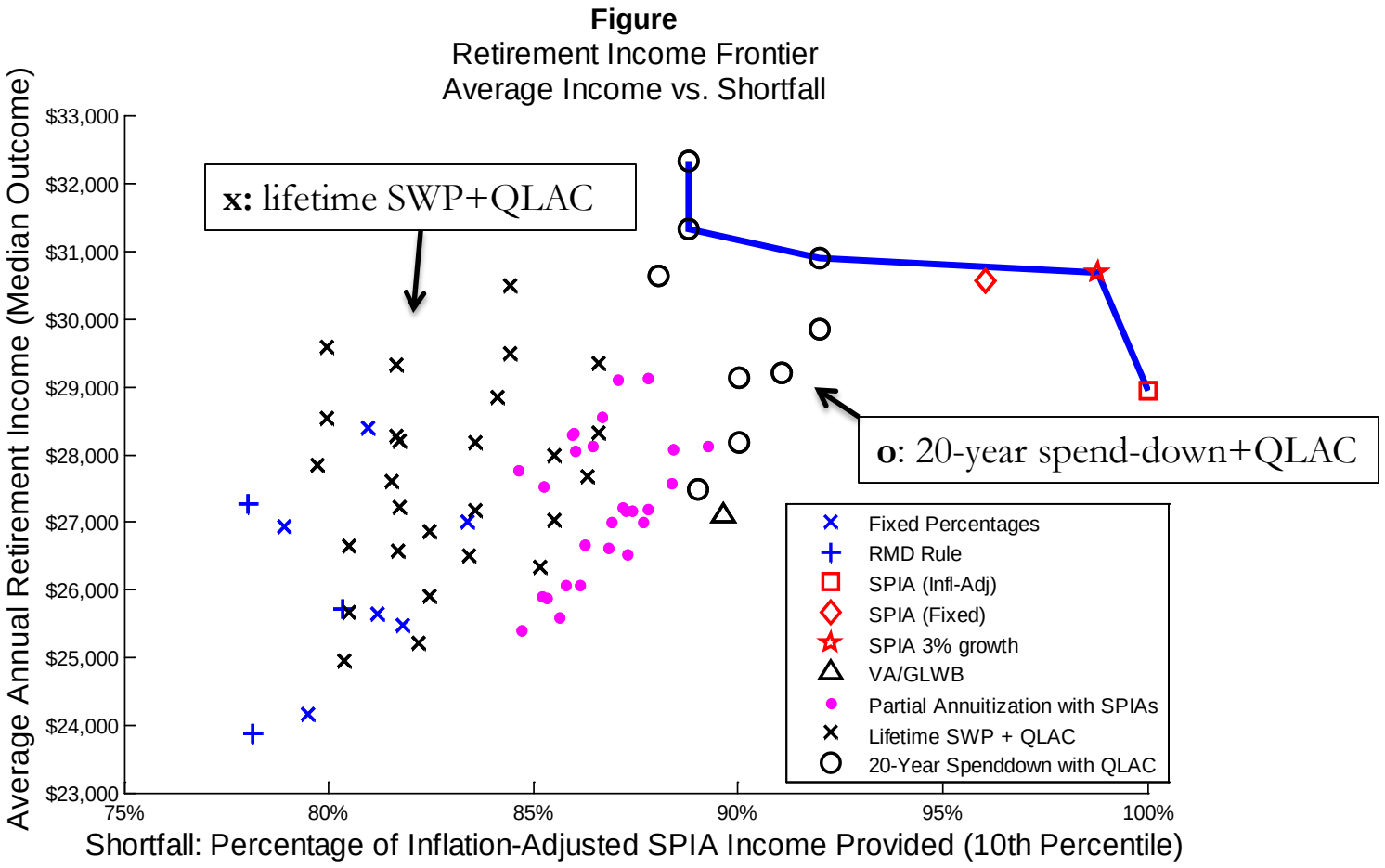
- The efficient frontier graph on the following page shows selected retirement income solutions from Phase 1 with the solutions analyzed in Phase 3.

- The Phase 3 solutions are represented as follows:
  - Black circles show the 20-year spend-down+QLAC solutions
  - Black x's show the lifetime SWP+QLAC solutions

- Colored symbols represent Phase 1 solutions, plus the black triangle for GLWBs.

- A first glance of the graph shows that many SWP/QLAC strategies provide higher retirement income with the same or lower amount of risk, compared to Phase 1 solutions that aren't on the efficient frontier. This is illustrated by the positioning of the SWP/QLAC strategies represented by black circles and x's, compared to Phase 1 strategies represented by pink dots, a black triangle, and blue crosses.

Efficient Frontier Analysis #1: Emphasize Retirement Income
Hypothetical Retiree #1: Single female age 65 with $250,000
15% of assets devoted to QLAC



Average income increases

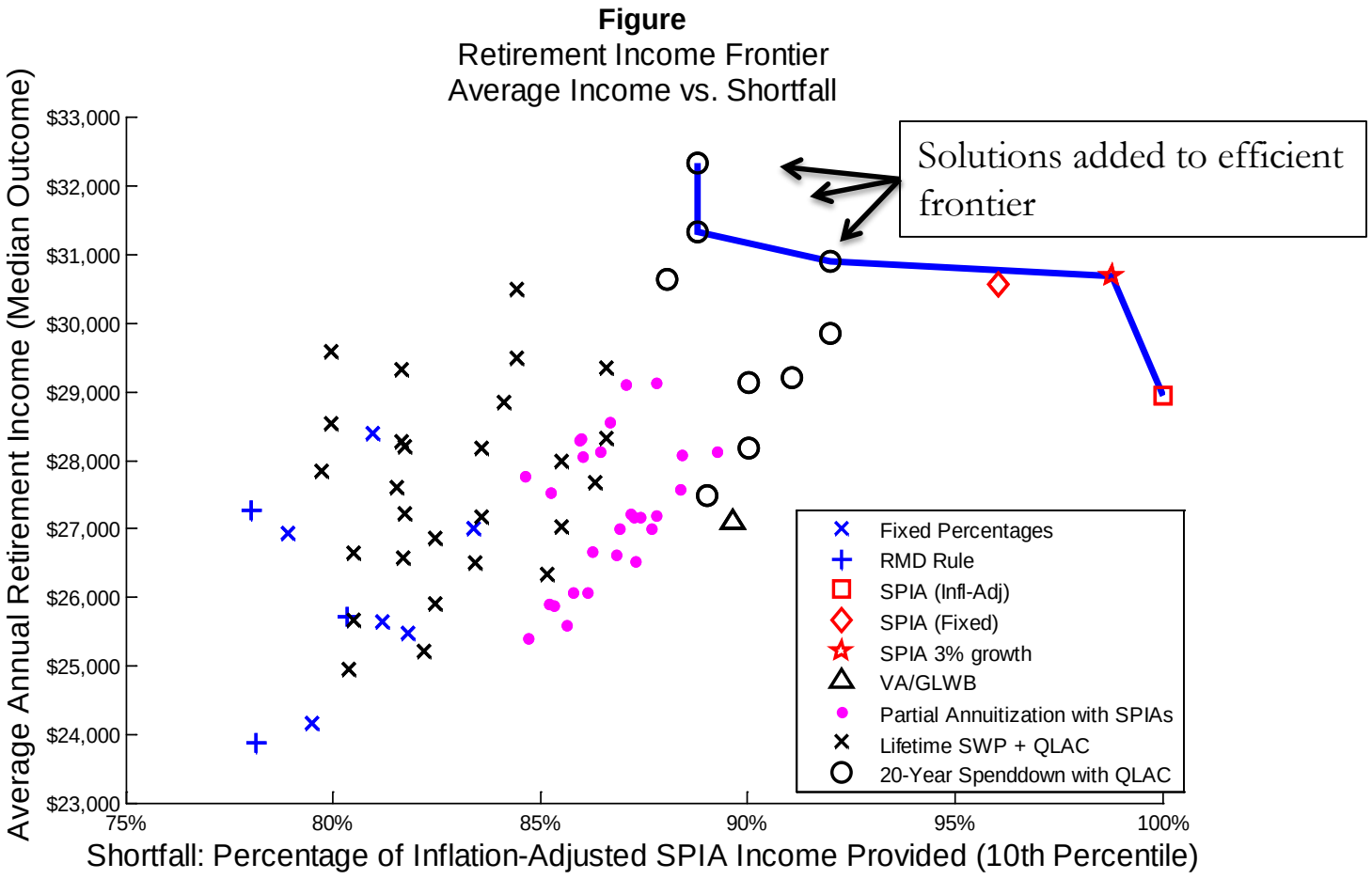
Risk decreases

Commentary on Efficient Frontier #1 Comparing Phases 1 and 3 (continued)

- Compared to Phase 1, the graph on the following page shows that three SWP/QLAC strategies are added to the efficient frontier. These solutions provide higher expected average retirement income than the Phase 1 SPIAs on the efficient frontier, although they also project higher risk. The three SWP/QLAC strategies on the frontier are:

  - 20-year spend-down with 100% equity stock allocation, combined with 3% growth QLAC
  - 20-year spend-down with 100% equity stock allocation, combined with an inflation-adjusted QLAC
  - 20-year spend-down with 50% equity stock allocation, combined with 3% growth QLAC

Efficient Frontier Analysis #1: Emphasize Retirement Income
Hypothetical Retiree #1: Single female age 65 with $250,000
15% of assets devoted to QLAC



Average income increases

Risk decreases

Commentary on Efficient Frontier #1 Comparing Phases 1 and 3

- Note that for the SWP/QLAC solutions on the efficient frontier, our projections of retirement income show significant potential disruptions in retirement income between ages 84 and 85. In particular, two solutions on the efficient frontier assume a 100% allocation to stocks that can generate a highly variable amount of retirement income. These analyses are shown later in this report.

- See Appendix D for efficient frontier graphs for hypothetical retirees #2 and #3. They produce similar results and conclusions as shown here for retiree #1.

Selected comparisons of SWP/QLAC solutions with Phase 1 solutions

- The tables on the following pages compare SWP/QLAC strategies and Phase 1 strategies that have similar amounts of risk (defined as the shortfall of retirement income for Efficient Frontier #1) and have the highest amounts of average retirement income for that level of risk and type of retirement solution.

- This comparison helps quantify the potential advantage of a SWP/QLAC strategy, to determine if the additional complexity is warranted, and to help understand why SWP/QLAC strategies produce higher average expected retirement incomes.

- One explanation for the increase in expected retirement incomes is that SWP/QLAC strategies that project well tend to have more assets devoted to equities, although that's not always the case.

- Note also that the SWP/QLAC strategies will have much different patterns of retirement income compared to the Phase 1 strategies.

Selected comparisons of SWP/QLAC solutions with Phase 1 solutions (continued)

Strategy	Average Annual Retirement Income	Risk Measurement
SWP/QLAC with 20 year-spend-down, 100% in equities, 3% growth QLAC*	$32,334	89%
GLWB annuity, 60% invested in stocks	$27,111	90%
70% of assets to 7% SWP with 50% stock allocation, 30% of assets to 3% growth SPIA	$28,138	89%

* 15% of assets at retirement are devoted to the QLAC

Selected comparisons of SWP/QLAC solutions with Phase 1 solutions (continued)

Strategy	Average Annual Retirement Income	Risk Measurement
SWP/QLAC with 20 year-spend-down, 100% in equities, fixed QLAC*	$30,647	88%
SWP/QLAC with lifetime 7% SWP, 50% stock allocation, 3% growth QLAC	$29,352	87%
70% of assets to 7% SWP with 100% equity allocation, 30% of assets to 3% growth SPIA	$29,127	88%

* 15% of assets at retirement are devoted to the QLAC

Details on Efficient Frontier #2

- Goal is to balance amount of expected retirement income with amount of expected accessible savings throughout retirement.

- Measure of return (Y-axis): Average annual real retirement income from retirement income solution, adjusted for the probability of survival to each future age (same as efficient frontier #1).

- Measure of accessible wealth (X-axis): Average amount of real accessible savings throughout retirement under the median stochastic forecast, adjusted for the probability of survival to each future age.

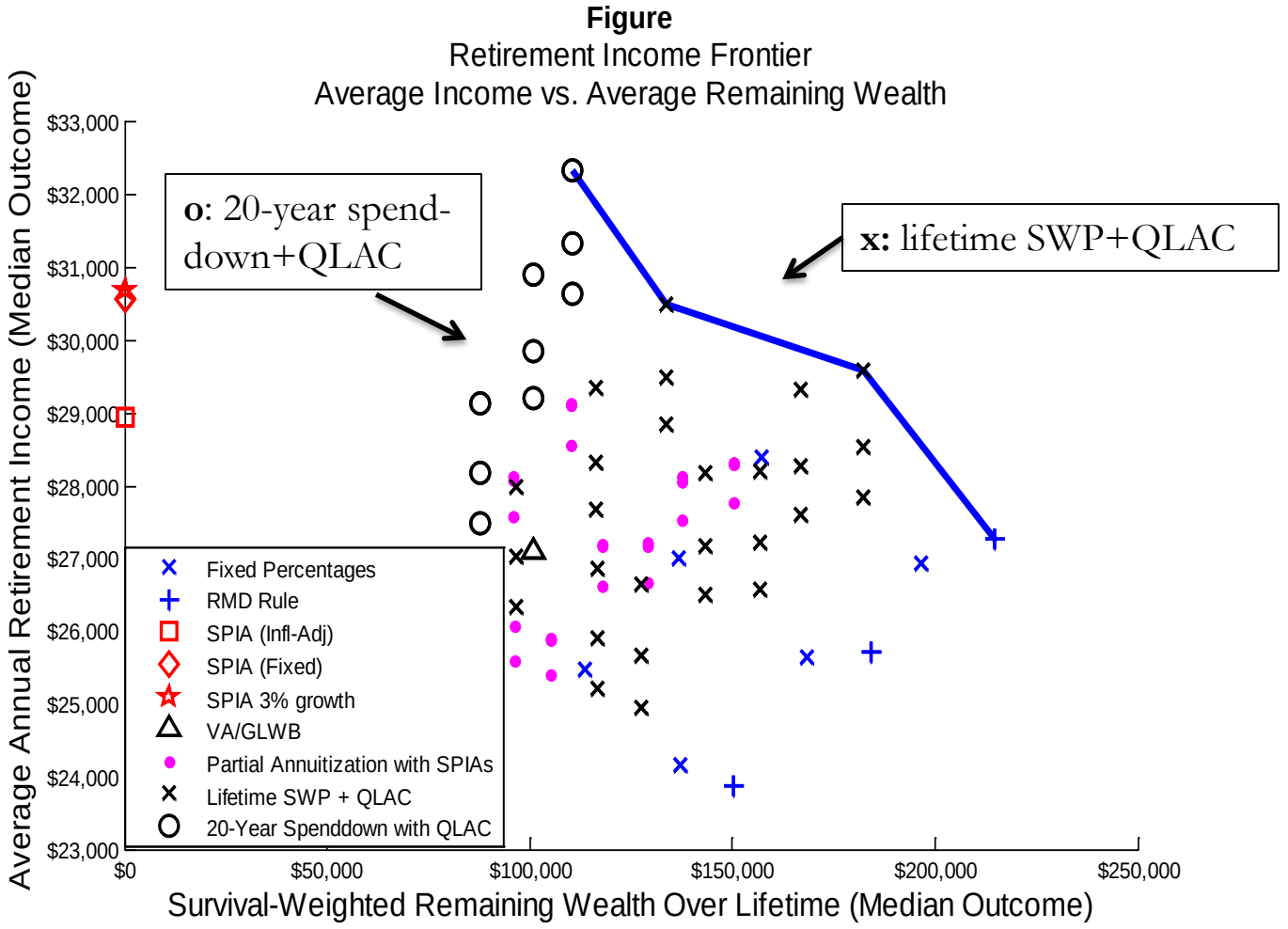
- Rationale: Many participants are hesitant to devote substantial resources to irrevocable annuities, and desire some access to savings and/or legacy. These participants may be willing to accept reduced retirement income in exchange for access to savings.

Commentary on Efficient Frontier #2 Comparing Phase 1 and 3 Results

- The graph on the following page shows that many SWP/QLAC strategies provide higher retirement income with the same or higher amount of accessible wealth, compared to Phase 1 solutions that aren't on the efficient frontier. This is illustrated by the positioning of the SWP/QLAC strategies represented by black circles and x's, compared to Phase 1 strategies represented by pink dots, a black triangle, and blue crosses.

- A common reason for this result is the additional amount of savings invested in equities for SWP/QLAC solutions.

Efficient Frontier Analysis #2: Tradeoff Between Income and Access
Hypothetical Retiree #1: Single female age 65 with $250,000
15% of assets devoted to QLAC



Annual income increases

Accessible wealth increases

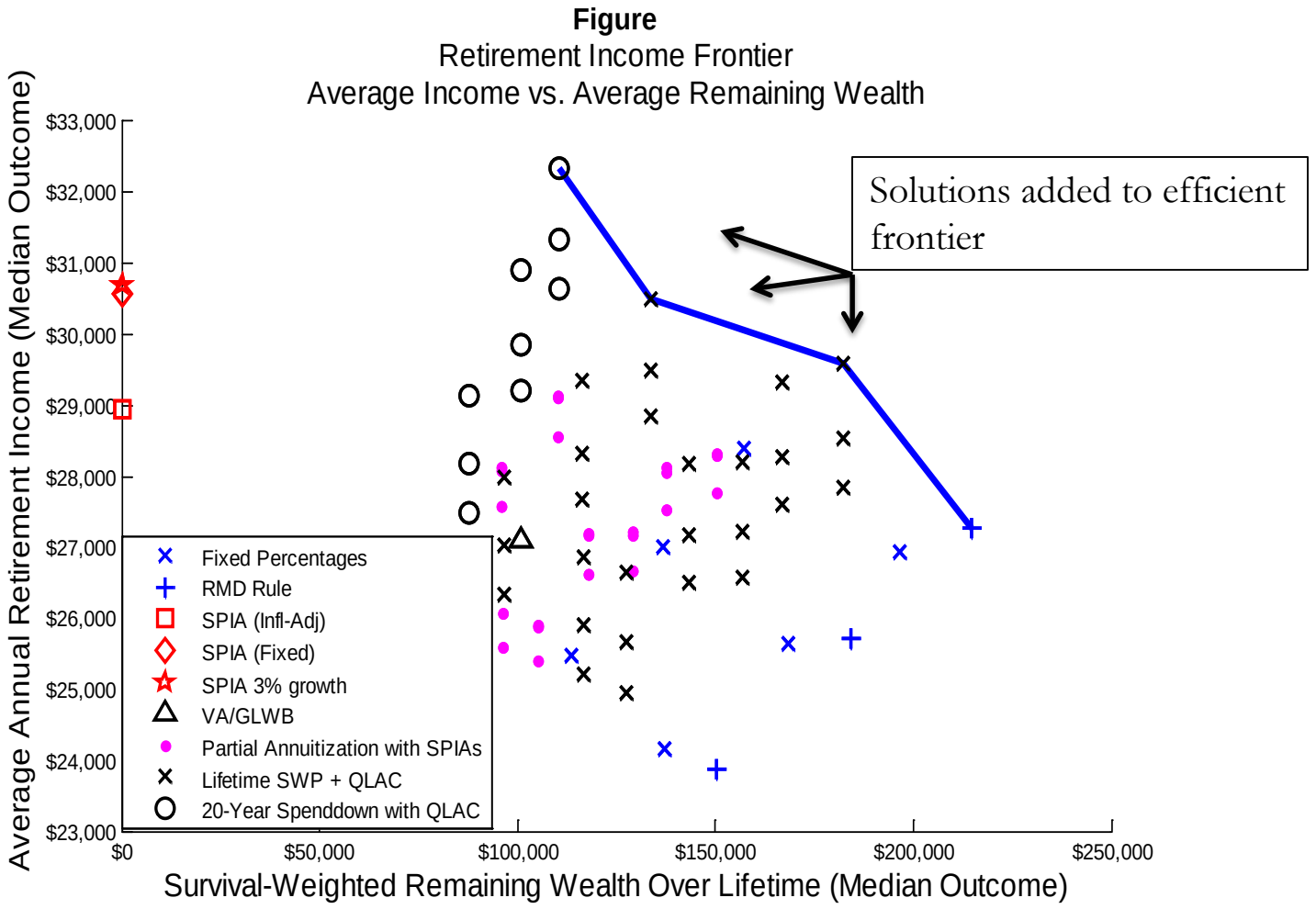
Commentary on Efficient Frontier #2 Comparing Phase 1 and 3 Results (continued)

- The graph on the following page shows that three SWP/QLAC strategies extend the efficient frontier compared to Phase 1 strategies, by delivering higher projected average retirement incomes for similar amounts of expected average amounts of accessible wealth.

- Three SWP/QLAC strategies on the efficient frontier are:

  - 20-year spend-down with 100% equity stock allocation, combined with 3% growth QLAC (note this solution is also on efficient frontier #1)
  - 7% SWP with 100% equity stock allocation, combined with 3% growth QLAC
  - RMD SWP with 100% equity stock allocation, combined with 3% growth QLAC

Efficient Frontier Analysis #2: Tradeoff Between Income and Access
Hypothetical Retiree #1: Single female age 65 with $250,000
15% of assets devoted to QLAC



Annual income increases

Accessible wealth increases

Selected comparisons of SWP/QLAC solutions with Phase 1 solutions

- The tables on the following pages compare SWP/QLAC strategies and Phase 1 strategies that have similar amounts of accessible wealth and have the highest amounts of average retirement income for that level of accessible wealth and type of retirement solution.

- This comparison helps quantify the potential advantage of a SWP/QLAC strategy, to determine if the additional complexity is warranted, and to help understand why SWP/QLAC strategies produce higher average expected retirement incomes.

- One explanation for the increase in expected retirement incomes is that SWP/QLAC strategies tend to have more assets devoted to equities, although that's not always the case.

- Note also that the SWP/QLAC strategies will have much different patterns of retirement income compared to the Phase 1 strategies.

Selected comparisons of SWP/QLAC solutions with Phase 1 solutions (continued)

Strategy	Average Annual Retirement Income	Average Amount of Accessible Wealth
SWP/QLAC with 20 year-spend-down, 100% in equities, 3% growth QLAC*	$32,334	$110,599
SWP/QLAC with lifetime 7% SWP, 100% stock allocation, 3% growth QLAC*	$30,492	$133,676
70% of assets to 7% SWP with 100% stock allocation, 30% of assets to 3% growth SPIA	$29,127	$110,086
GLWB annuity, 60% invested in stocks	$27,111	$100,831

* 15% of assets at retirement are devoted to the QLAC

Selected comparisons of SWP/QLAC solutions with Phase 1 solutions (continued)

Strategy	Average Annual Retirement Income	Average Amount of Accessible Wealth
SWP/QLAC with lifetime RMD SWP, 100% stock allocation, 3% growth QLAC*	$29,596	$182,479
Pure RMD SWP, 100% allocation to equities	$27,266	$214,681
Pure 5% SWP, 100% allocation to equities	$26,941	$196,454

* 15% of assets at retirement are devoted to the QLAC

Selected comparisons of SWP/QLAC solutions with Phase 1 solutions (continued)

- Some retirees may not feel comfortable with SWP strategies that have 100% allocated to stocks. The table on the following page compares SWP/QLAC strategies and Phase 1 strategies that have 50% equity allocations for SWPs.
- Note that the overall allocation is different from 50% in equities, due to the portion of initial assets devoted to a QLAC (15%) or SPIA (30%).
- The GLWB annuity is included in the comparison since it invests 60% in equities.
- Note also that the SWP/QLAC strategies will have much different patterns of retirement income compared to the Phase 1 strategies.

Selected comparisons of SWP/QLAC solutions with Phase 1 solutions (continued)

Strategy	Average Annual Retirement Income	Average Amount of Accessible Wealth
SWP/QLAC with 20 year-spend-down, 50% in equities, 3% growth QLAC*	$30,913	$100,778
SWP/QLAC with lifetime RMD SWP, 50% stock allocation, 3% growth QLAC*	$28,191	$156,698
70% of assets to RMD SWP with 50% stock allocation, 30% of assets to 3% growth SPIA	$27,222	$129,045
GLWB annuity, 60% invested in stocks	$27,111	$100,831

* 15% of assets at retirement are devoted to the QLAC

Commentary on Efficient Frontier #2 Comparing Phases 1 and 3

- Note that for the SWP/QLAC solutions on the efficient frontier, our projections of retirement income show significant potential discontinuities in retirement income between ages 84 and 85. In particular, the solutions on the efficient frontier assume a 100% allocation to stocks which will generate a highly variable amount of retirement income. These analyses are shown later in this report.

- See Appendix E for efficient frontier graphs for hypothetical retirees #2 and #3. They produce similar results and conclusions as shown here for retiree #1.

Commentary on Efficient Frontiers #1 and #2 Comparing Phases 1 and 3

- It is important to realize that with our efficient frontier analyses, the best performing SWP/QLAC strategies devote 15% of assets to a QLAC and invest the remaining 85% of assets to a SWP invested 100% in stocks. Such a strategy has a much higher overall asset allocation to stocks compared to partial annuitization strategies analyzed in Phase 1 (these devoted 30% of assets to a SPIA). This is one reason why the SWP/QLAC strategies analyzed in the efficient frontier analyses may appear to deliver higher expected average retirement incomes for similar amounts of risk or accessible wealth, compared to Phase 1 strategies.

- For this reason, the position on the efficient frontier should not be the only criteria for assessing the suitability of a retirement income strategy. The pattern of expected retirement income is also an important factor, as shown in the following pages.

- Retirees may not feel comfortable with high allocations of savings to stocks, and assuming lower allocations to stocks reduces the amount of expected average retirement incomes with a SWP/QLAC strategy.

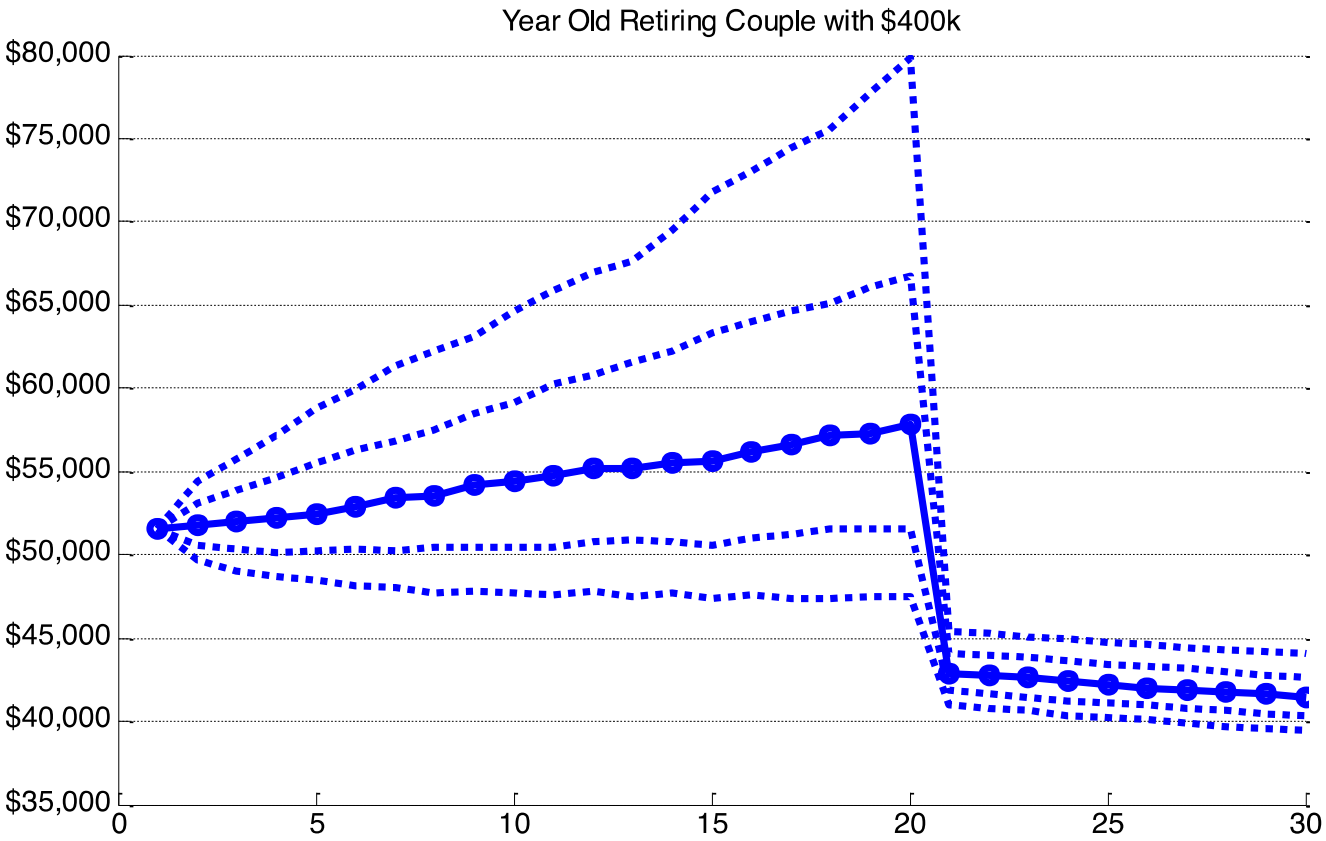
Projection of Retirement Incomes Illustrate Potential for Discontinuities

- The graphs on the following pages show projected retirement incomes for 30 years of retirement for selected SWP/QLAC strategies, to illustrate potential discontinuities in income between ages 84 and 85.
- Social Security incomes are included.
- The results show the retirement incomes under the 10th, 25th, 50th, 75th, and 90th percentiles of a stochastic forecast, to illustrate the potential range of retirement incomes.
- Projections are for hypothetical retiree #2, the 65 year-old couple with $400,000 in assets at retirement.
- All projections assume a 50% asset allocation to equities for SWP strategies. Assuming a higher allocation to stocks would increase expected retirement incomes for the 20 years preceding age 85, while also increasing the range of possible incomes under the various percentiles described above.

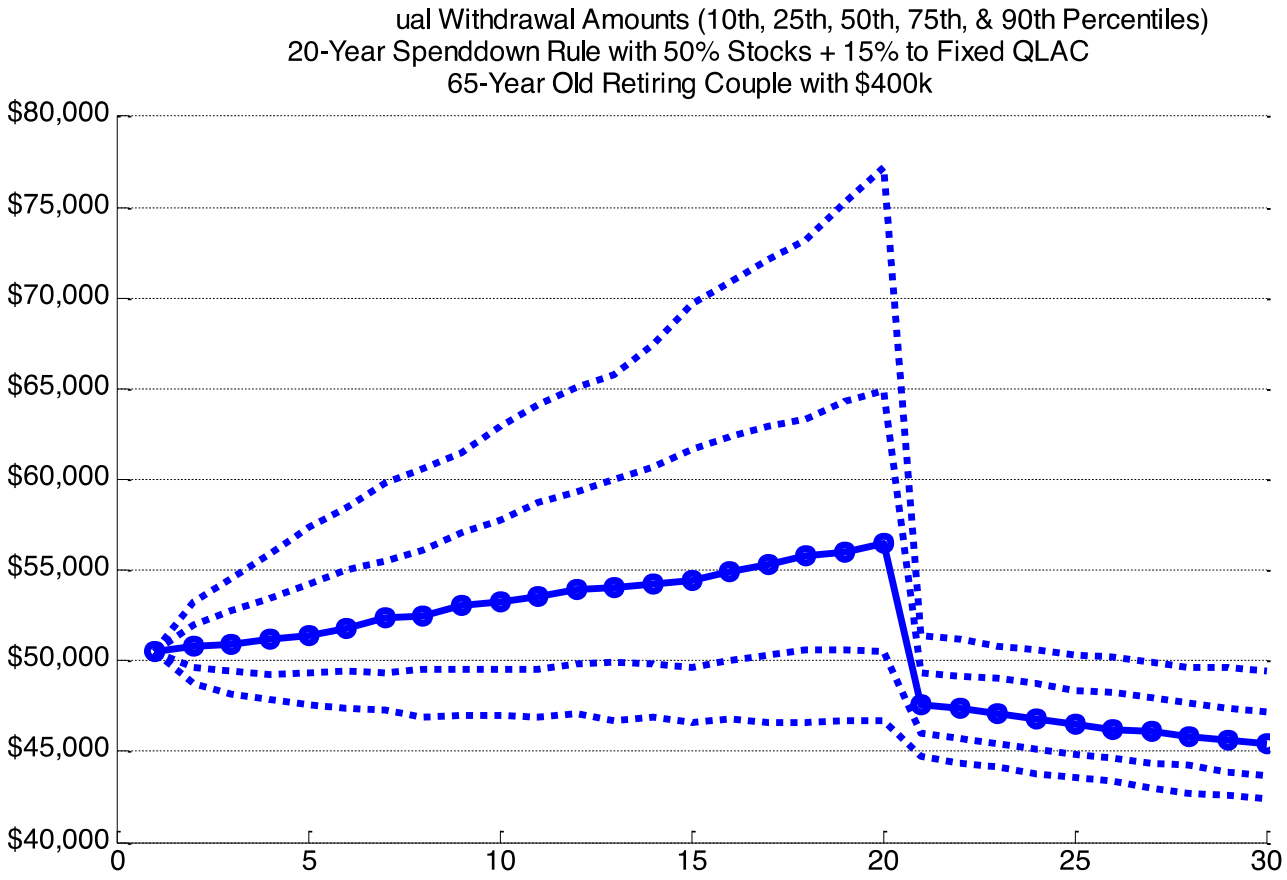
Projection of Retirement Incomes Illustrate Potential for Discontinuities (continued)

- We prepared analyses assuming 10%, 15%, and 20% of starting assets devoted to the QLAC.
- QLAC is fixed in dollar amount at age 85.
- We show the following SWP/QLAC strategies, in order:
  - 20 year spend-down+QLAC. These all show projected decreases in retirement income at age 85, the biggest decrease with 10% of initial assets devoted to the QLAC.
  - Lifetime SWP+QLAC, using RMD withdrawal strategy. These all show projected increases in retirement income at age 85, the biggest increase with 20% of initial assets devoted to the QLAC.
  - We also produced retirement income projections for lifetime SWP+QLAC strategies, using a 5% and 7% withdrawal of assets remaining at each future age. These graphs show significant increases in income at age 85 similar to the increases for the RMD SWP strategy.

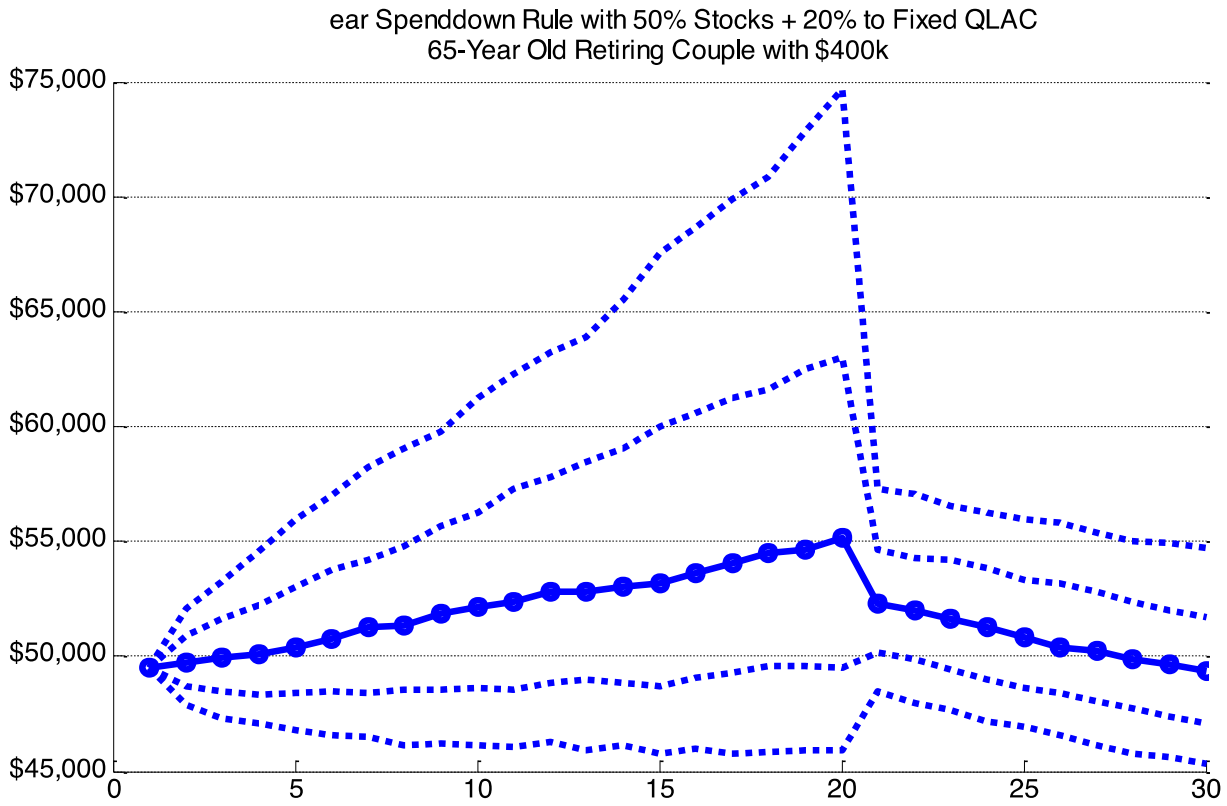
20 year spend-down with 10% of assets devoted to QLAC produces significant decreases in income under all percentiles



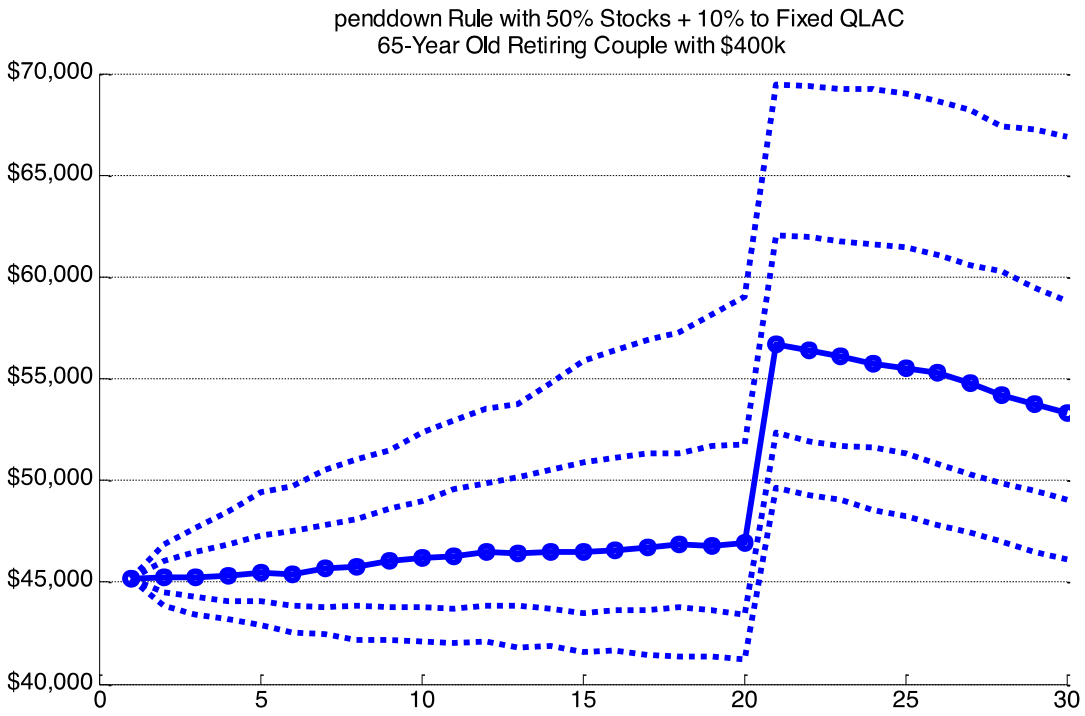
20 year spend-down using 15% of assets devoted to QLAC instead of 10% produces smaller decreases in income, slightly smaller initial income



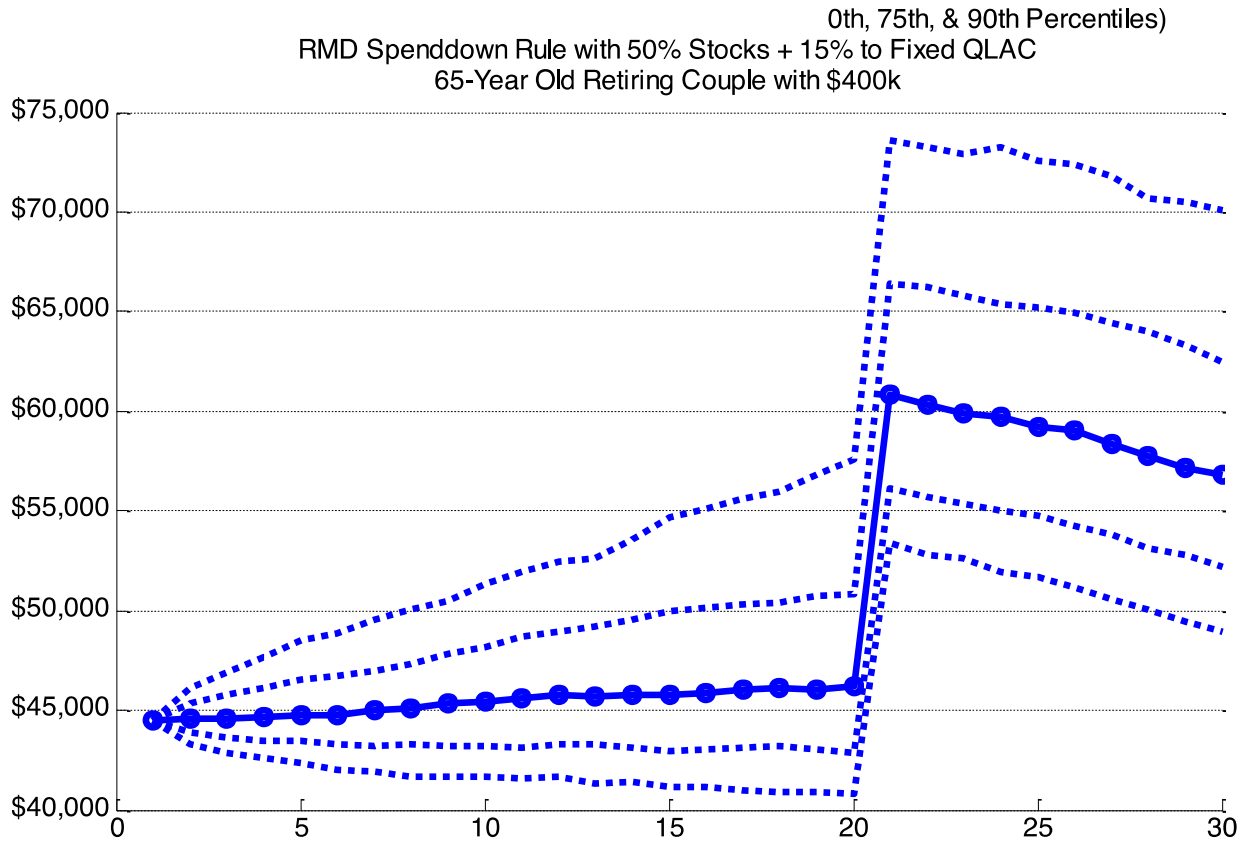
20 year spend-down using 20% of assets devoted to QLAC produces smallest discontinuities in income and lowest initial income



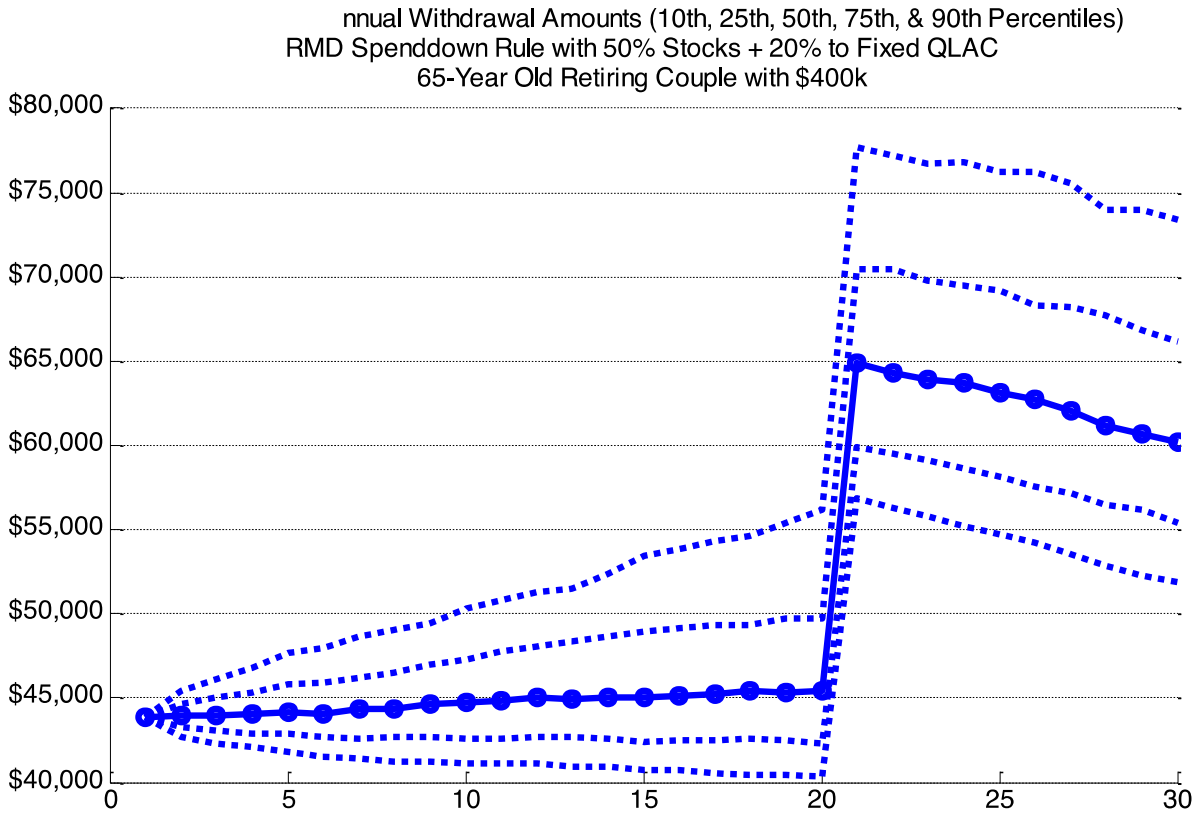
Lifetime RMD Strategy + QLAC using 10% of assets devoted to QLAC produces large increases in income under all percentiles



Lifetime RMD Strategy + QLAC using 15% of assets devoted to QLAC instead of 10% produces larger increases in income under all percentiles



Lifetime RMD Strategy + QLAC using 20% of assets devoted to QLAC produces largest increases in income



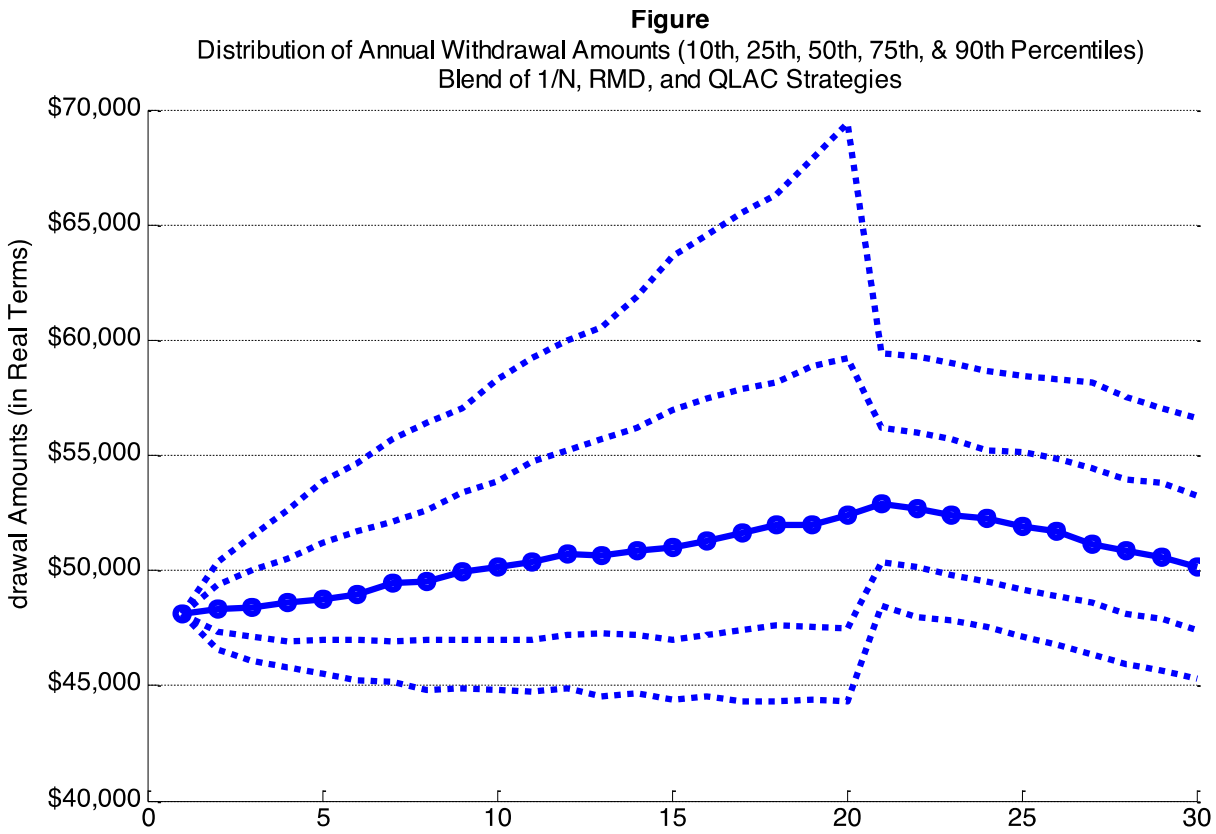
Blending 20 year spend-down and lifetime SWP strategies produces smaller discontinuities in income

- The graph on the next page shows projections of retirement income with a blended strategy that devotes 15% of initial assets to a QLAC, and of the remaining 85% of assets, 60% are devoted to a 20 year spend-down SWP strategy and 40% are devoted to an RMD strategy.

- This projection shows a more smooth transition of income at ages 84 and 85, compared to the previous strategies.

- The purpose of this analysis isn't necessarily to advocate that a plan sponsor offer such a blended strategy in a retirement plan; such a strategy might be difficult to package in a generalized manner for a broad range of plan participants. Instead, it demonstrates that it could be possible to use a SWP/QLAC strategy that produces a tolerable transition at age 85 using mid-course adjustments in withdrawal strategies and/or asset allocation strategies. Most likely such adjustments would require a qualified retirement advisor or a very well-informed retiree.

Blending 20 year spend-down and lifetime SWP strategies produces least discontinuities in income



Comparing SWP/QLAC strategies to SPIAs

- One of the most straightforward methods to generate an income payable for life is to purchase SPIA, which was analyzed extensively in the Phase 1 bench-line analyses.

- One common objection to a typical SPIA is that there is no liquidity and access to savings once the SPIA has been purchased.

- Another possible objection is if there is no death benefit payable if both the retiree and joint annuitant (if applicable) die prematurely, although this objection can be addressed with a period certain and life annuity.

- It's possible to construct a SWP/QLAC strategy that provides access to savings until age 85, guarantees a retirement income that the retiree can't outlive, pays unused funds to beneficiaries if the retiree dies before the advanced age, and provides relatively stable amounts of retirement income. However, the resulting amount of income will be less than the income from a SPIA, which helps quantify the cost of the desire for liquidity.

Comparing SWP/QLAC strategies to SPIAs (continued)

- We analyzed a SWP/QLAC strategy for hypothetical retiree #1, the 65 year-old female with $250,000 in savings. Using the annuity purchase rates used for this study, she could purchase a life annuity starting at age 65 of $16,900 per year. How can we construct a SWP/QLAC strategy to produce a retirement income of $16,900 per year?

- Using the QLAC purchase rate used for this study, this retiree would need to devote $33,110 to purchase a QLAC of $16,900 per year starting at age 85.

- Assets remaining after purchasing the QLAC are $216,890. Applying this amount to a 20 year spend-down strategy that would pay $16,900 per year, payable monthly, requires a constant investment return of about 4.8% per year.

- While it may be possible to achieve a 4.8% annual rate of return over 20 years, in today's environment a retiree would need to assume significant stock market risk or interest rate risk through a fixed income fund. In other words, the retiree wouldn't achieve a guaranteed fixed retirement income that's offered in a SPIA.

Comparing SWP/QLAC strategies to SPIAs (continued)

- Next, let's look at the amount of retirement income that could be generated if the retiree invested in a stable value fund for the 20 year spend-down period. Stable value funds offered in 401(k) plans feature liquidity, stability of principal, and a stated rate of return. In mid 2015, returns on such funds ranged from 1% to 3% per annum.

- Assuming a 3% rate of return for 20 years and the previously mentioned QLAC purchase rates, the retirement income amount before and after age 85 would be $14,728. In this case, the price for liquidity compared to a SPIA is a reduction in annual income of $2,172, or a 13% reduction.

- Assuming a 2% rate of return for 20 years and the previously mentioned QLAC purchase rates, the retirement income amount before and after age 85 would be $13,562. In this case, the price for liquidity compared to a SPIA is a reduction in annual income of $3,338, or 20%.

Comparing SWP/QLAC strategies to SPIAs (continued)

- While it is possible to construct a SWP/QLAC strategy that approximates the payout of a SPIA, either some investment risk must be assumed with the resulting potential volatility in income amounts, or the retiree must be willing to accept a reduction in the amount of retirement income.

- Note that SPIAs with period certain features address the objection of SPIAs concerning premature death of the retirees, and they will result in a smaller reduction in annual income compared to the above strategies. However, there is still no liquidity or access to savings with such annuities.

Summary and Commentary

- SWP/QLAC strategies have the potential to generate higher retirement income with equal or lower amounts of risk or accessible wealth, compared to many alternatives analyzed in Phase 1.
- In particular, 20 year spend-down strategies are particularly efficient because every last dollar of savings is used to generate retirement income for those retirees who survive 20 years into retirement. With all lifetime SWP strategies analyzed, some portion of savings remain at death and aren't used to generate retirement income.
- The SWP/QLAC strategies that show the best results in the efficient frontier analyses are significantly invested in equities. If retirees cannot accept the potential volatility in retirement income and resulting risk of stock market declines, they could invest more of assets devoted to the SWP strategy in fixed income investments. This will result in forgoing some of the advantages of the SWP/QLAC strategies relative to strategies analyzed in Phases 1 and 2.
- Note that QLACs do not offer inflation protection between the purchase date and the date payments commence. High or variable inflation during this period will erode the value of the QLAC. For this reason, participants and advisors who anticipate high inflation may hesitate to devote substantial amounts of savings to a QLAC.

Summary and Commentary (continued)

- Retirees should decide whether the potential advantages from a SWP/QLAC strategy is worth the extra complexity, and whether they have the ability and interest to monitor and adjust their strategy to minimize potential disruptions in retirement income. If they don't, they will need to determine if they will have access to a qualified professional to help them throughout their retirement.

- Another possible use of a QLAC is simply to consider it as longevity insurance, guaranteeing a minimum income at the specified advanced age. In this case, retirees would use some combination of working and deploying savings to generate retirement income before the advanced age, and they wouldn't be too concerned about potential disruptions in income at that age. In this case, there would be less of a focus on packaging SWPs with QLACs as part of a comprehensive retirement income strategy.

- One more possible use of a QLAC is to combine it with a lifetime SWP strategy, with the goal of providing additional income at an advanced age to help pay for anticipated increases in medical and/or long-term care costs.

Summary and Commentary (continued)

- Similarly, plan sponsors should consider how their retirees might use QLACs.
  - Should they just offer QLACs to retirees who want to buy a form of longevity insurance, and let retirees and their advisors develop retirement income strategies with the component RIGs offered by the plan?
  - Or it is reasonable and desirable to package SWP/QLAC solutions to address the various needs of their retiree population? In this case, such plan sponsors may want to arrange for qualified advisors to provide guidance to their retirees for making mid-course adjustments in the SWP withdrawal and asset allocation strategies.
  - Due to the complexity of QLACs, plan sponsors who offer QLACs may want to consider providing participants with access to qualified advisors who are familiar with deploying QLACs.

Summary and Commentary (continued)

- The results presented in this report reflect the specific circumstances of the hypothetical employees and the assumptions used to produce the stochastic forecasts. Different employees and alternative assumptions will produce different results. For example:
  - Higher assumed real rates of return generally produce more favorable projections, and vice versa.
  - Higher returns of stocks relative to bonds and annuity purchase rates will show more favorable projections for investing solutions, while lower returns of stocks relative to bonds and annuity purchase rates will show more favorable projections for insured solutions.
  - For both investing and insured solutions, low-cost institutionally priced solutions were assumed. Retail solutions would produce less favorable results than shown in this report.
- As such, the results from this report may or may not be generalized to other situations. Nevertheless, important insights may be gained from this report, and in particular, the methods used in this report can be used with alternative assumptions and the circumstances of other retirees.

Summary and Commentary (continued)

The analyses in this report assume no risk of insurance company default. Retirees and advisors 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.

One method to increase guaranteed retirement income from a source commonly assumed to be riskless is to increase Social Security benefits by delaying benefits, and Phase 2 addresses this strategy.

Appendix A
Definitions

- Guaranteed lifetime withdrawal benefit (GLWB) is an insurance product that acts like a systematic withdrawal plan that determines annual income as a specified percentage of assets and guarantees income for life. Future retirement income may increase with favorable investment performance but is guaranteed not to decrease with unfavorable performance. Retirees may also have access to remaining funds. Also called guaranteed minimum withdrawal benefit (GMWB).

- Qualified longevity annuity contract (QLAC) is a deferred income annuity starting at an advanced age, such as age 80 or 85.

- Retirement income generator (RIG) is a stand-alone mechanism that converts savings into retirement income.

- Retirement income solution can be a stand-alone RIG or a packaged combination of RIGs, where retirement savings are allocated among two or more RIGs.

Appendix A
Definitions

- Single premium immediate annuity (SPIA) is an insurance product that guarantees a lifetime retirement income. Amount of income can be fixed in dollar terms, adjusted for inflation, or adjusted at a specified rate (such as 3% per year). Joint and survivor annuities continue income as long as one beneficiary is alive.

- Systematic withdrawal plan (SWP) invests retirement savings and uses a method for determining periodic retirement income; there is no lifetime guarantee and it is not an insurance product.

  - Endowment SWP calculates the annual retirement income as a fixed percentage of remaining assets at each future year.
  - RMD SWP uses the IRS required minimum distribution to calculate retirement income, and equals remaining assets divided by remaining life expectancy at each future year. The RMD requirements start at age 70-1/2, with an initial payout rate of 3.65%. For the analyses in this report, we assumed a 3.5% payout between ages 65 and 70.

Appendix B
Key Features of Treasury Guidance on QLACs

- Funds devoted to a QLAC must be applied in a qualified retirement plan or IRA
- Assets devoted to a qualified longevity annuity contract (QLAC) are exempt from the required minimum distribution (RMD) rules that apply to tax-qualified retirement plans or deductible IRAs. The RMD rules require minimum withdrawals starting at age 70-1/2 (with a few limited exceptions). Any funds remaining after purchasing a QLAC are subject to the normal RMD rules.
- The amount applied to a QLAC must not exceed the lesser of $125,000 or 25% of the account balance. For the purpose of the $125,000 limit, all qualified retirement accounts are included (IRAs, 401(k) accounts, etc.).
- The form of payment must be a life annuity that starts at an advanced age – it cannot be an investment product. Payments must commence by age 85.
- QLACs cannot be offered through a variable or index annuity. The payment amount must be fixed at the advanced age; a cost-of-living feature can apply after the advanced age.
- Generally there is no cash surrender value or death benefit if the participant dies before the advanced age, except that a lump sum return-of-premium death benefit is allowed even though that feature will reduce the amount of retirement income.
- Joint life QLACs are allowed to continue retirement income payments after the death of the primary retiree.

Appendix C: Assumptions

Table C.1. Assumptions Used for Stochastic Forecasts

	Real Returns			Correlation Coefficients		
	Arithmetic Mean	Geometric Mean	Standard Deviation	Stocks	Bonds	Inflation
Stocks	5.1%	3.1%	20.0%	1.0	0.1	-0.2
Bonds	0.3%	0.2%	7.0%	0.1	1.0	-.6
Inflation	2.1%	2.0%	4.2%	-0.2	-0.6	1.0

Note: Above rates are lower than historical averages. Bond returns reflect low-interest rate environment, and stock returns reflect lower-than-historical premium over bond returns.

Mortality table for survival probabilities: Society of Actuaries' RP-2014 Mortality Tables Draft for Healthy Annuitants

Appendix C
Notes on Assumptions

- Assumptions for payout rates are representative of institutional pricing.
- SWP investment expenses: 50 bps
- GLWB investment and insurance expenses: 150 bps
- SPIA rates based on sex distinct pricing.

For the purpose of this report, annuity payout rates were sampled in April, 2014, using the Income Solutions annuity bidding platform. A sampling of annuity purchase rates in December, 2014, for Retiree #1, showed decreases in payout rates for immediate annuities resulting in dollar amount decreases in retirement incomes ranging from 2.7% to 4.3% compared to the rates used in this report. This was the result of interest rates declining from April to December of 2014. We sampled annuity purchase rates again in July, 2015, and the change in payout rates for immediate annuities compared to April, 2014 resulted in changes in the dollar amount of retirement incomes ranging from a decrease of 3.9% to an increase of 0.2%. This is the result of slight increases in interest rates during 2015.

Many analysts forecast further increases in interest rates during 2015, which could result in annuity purchase rates increasing back to levels in April, 2014 or higher. The authors decided not to chase a moving target and retained the April, 2014 annuity purchase rates.

Appendix C
Details on Efficient Frontier Calculations

The Y axis of both efficient frontiers is the average real retirement income weighted by the survival probability to each future age, labeled the average expected retirement income. This method starts by stochastically projecting the retirement income under a specific RIG to each future age, using a range of potential outcomes in capital markets and adjusted for projected inflation. As a result, the average income amounts are expressed in today's dollars.

For the purpose of calculating the average real retirement income, the median projected retirement income for each age was used. The median income amount for each future age is then multiplied by the probability that the retiree will survive from the initial retirement date to that future age. The resulting values are averaged over the retirement period to determine the average real retirement income weighted by survival probability.

One result of this methodology is that greater weight is placed on income received in earlier years of retirement compared to later years.

Appendix C
Details on Efficient Frontier Calculations (continued)

There was no discounting of future income amounts to the initial year of retirement. The rationale is that personal discount rates are difficult to define; even if it's possible to define such rates, they are most likely close to zero under the current interest rate environment.

The average real accessible wealth in Efficient Frontier #2 was calculated in the same manner as described above, except that remaining wealth under each RIG was projected stochastically to each future age. Again, greater weight is placed on accessible wealth in earlier years of retirement compared to later years.

Note that average accessible wealth as calculated here is different from average legacy at death. While the projected remaining wealth amounts would be the same, the average legacy at death would be weighted by the probability of dying at each future age. As a result, the average legacy at death would weight later ages more than earlier ages. For middle income retirees, it was assumed that average accessible wealth would be more important than average legacy at death.

Appendix C: Hypothetical Retiree #2

- Married 65-year old couple
- $400,000 of assets
- Social Security @ 65
  - $22,493/year for primary earner
  - $11,054/year for spouse
- Annuity product pricing (annual income as percent of assets at beginning of retirement):
  - Inflation-Adjusted 100% J&S SPIA: 4.06%
  - 100% J&S fixed SPIA: 6.02%
  - 100% J&S SPIA with 3% growth rate: 4.29%
  - GLWB: 4.5%
  - Fixed 100% J&S QLAC starting at age 85: 34.58% (age 85 income equals 34.58% of age 65 assets)
  - 100% J&S QLAC with 3% growth after age 85: 29.66%
  - 100% J&S QLAC adjusted for inflation after age 85: 28.91%
  - Above rates in effect during April, 2014 for institutionally priced GLWB products and using competitive annuity bidding for SPIAs and QLACs.

Appendix C: Hypothetical Retiree #3

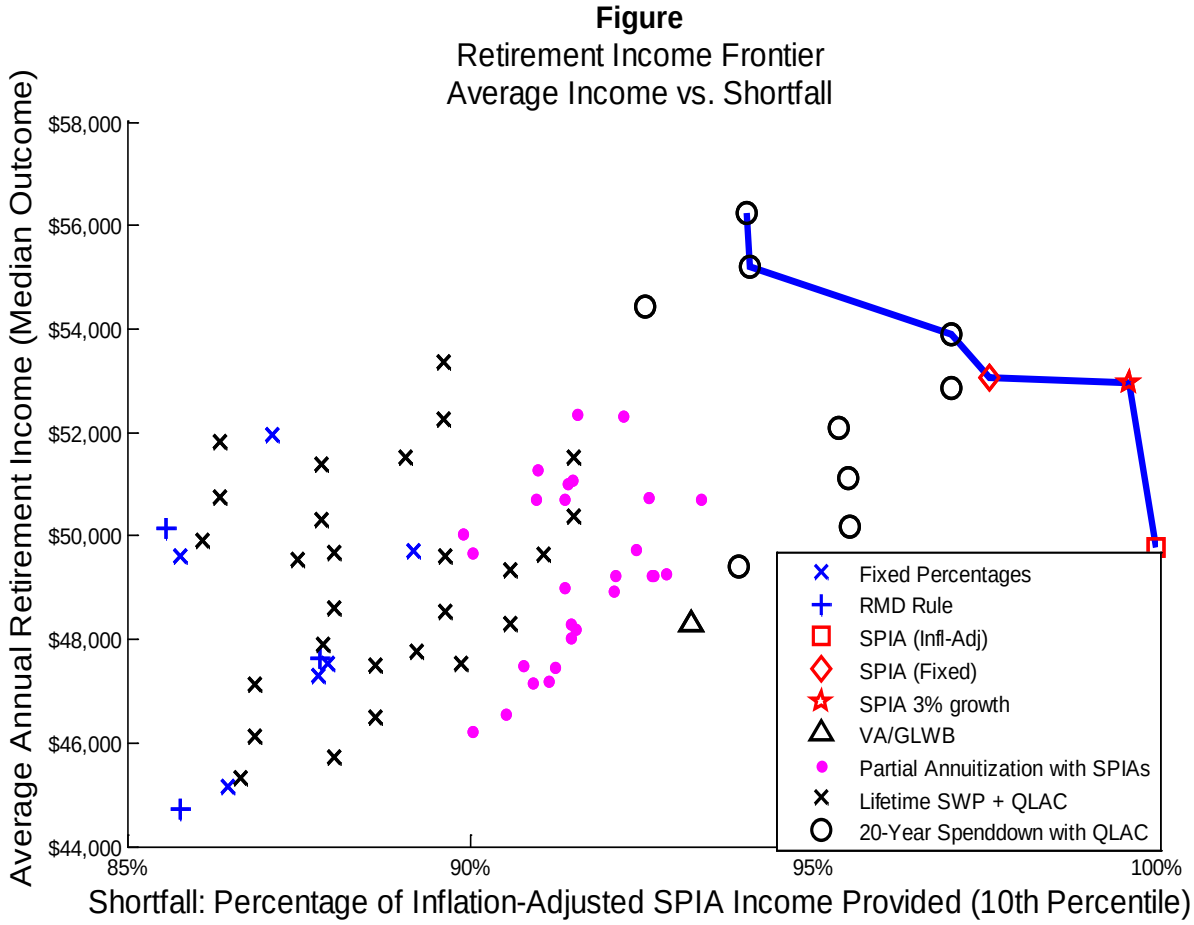
- Married 65-year old couple
- $1,000,000 of assets
- Social Security @ 65
  - $29,042/year for primary earner
  - $14,272/year for spouse
- Annuity product pricing (annual income as percent of assets at beginning of retirement):
  - Inflation-Adjusted 100% J&S SPIA: 4.06%
  - 100% J&S fixed SPIA: 6.02%
  - 100% J&S SPIA with 3% growth rate: 4.29%
  - GLWB: 4.5%
  - Fixed 100% J&S QLAC starting at age 85: 34.58% (age 85 income equals 34.58% of age 65 assets)
  - 100% J&S QLAC with 3% growth after age 85: 29.66%
  - 100% J&S QLAC adjusted for inflation after age 85: 28.91%
  - Above rates in effect during April, 2014 for institutionally priced GLWB products and using competitive annuity bidding for SPIAs and QLACs.

Appendix D
Efficient Frontier #1 Results for Additional Hypothetical Retirees

- Married couple both age 65, retiring with $400,000 in assets
- Married couple both age 65, retiring with $1,000,000 in assets

- Note: For the graphs on the following pages, the axis scales change for different hypothetical retirees.

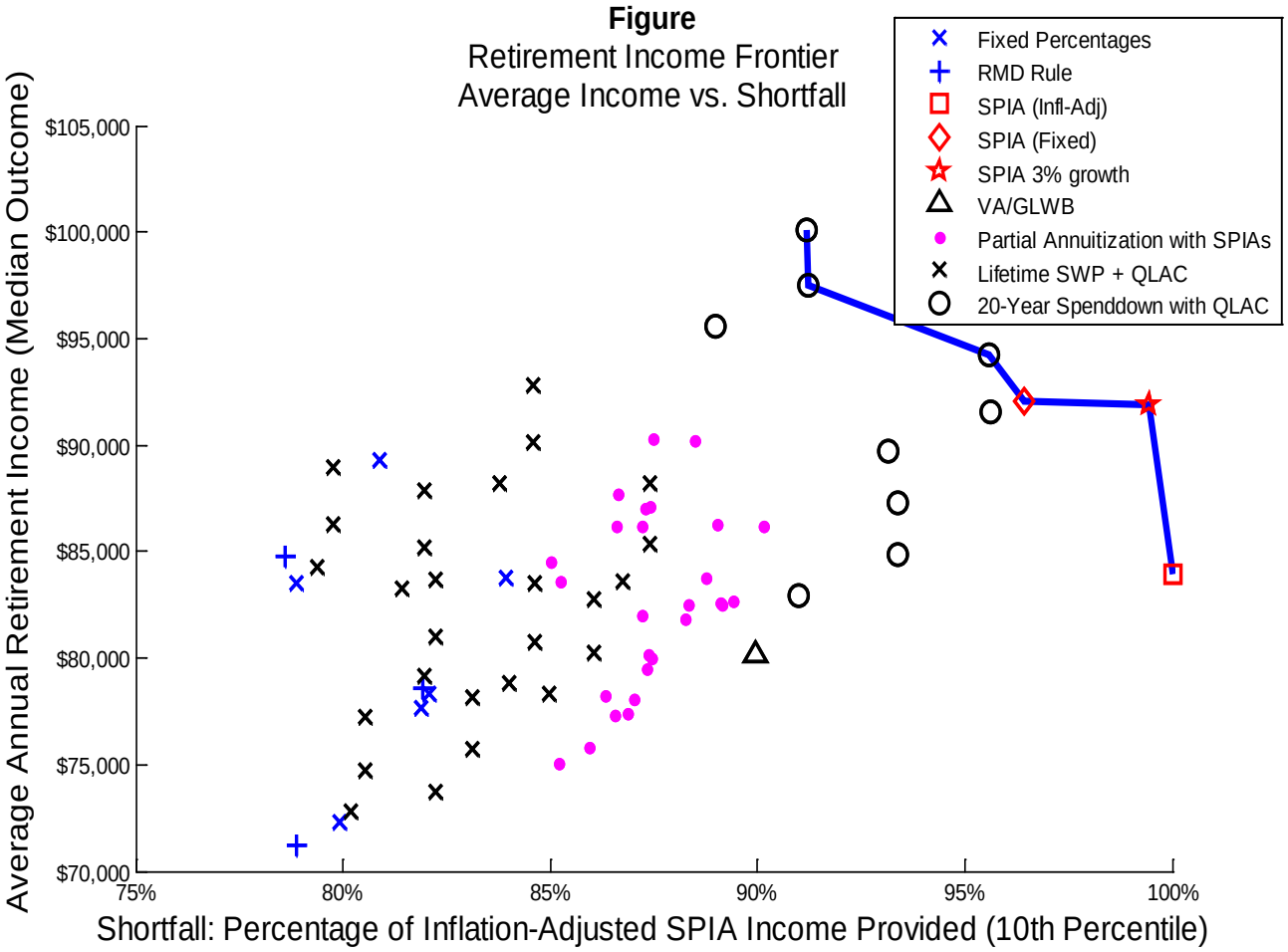
Efficient Frontier Analysis #1: Emphasize Retirement Income
Hypothetical Retiree #2: Married couple age 65 with $400,000
15% of assets devoted to QLAC



Average income increases

Risk decreases

Efficient Frontier Analysis #1: Emphasize Retirement Income
Hypothetical Retiree #3: Married couple age 65 with $1,000,000
15% of assets devoted to QLAC



Average income increases

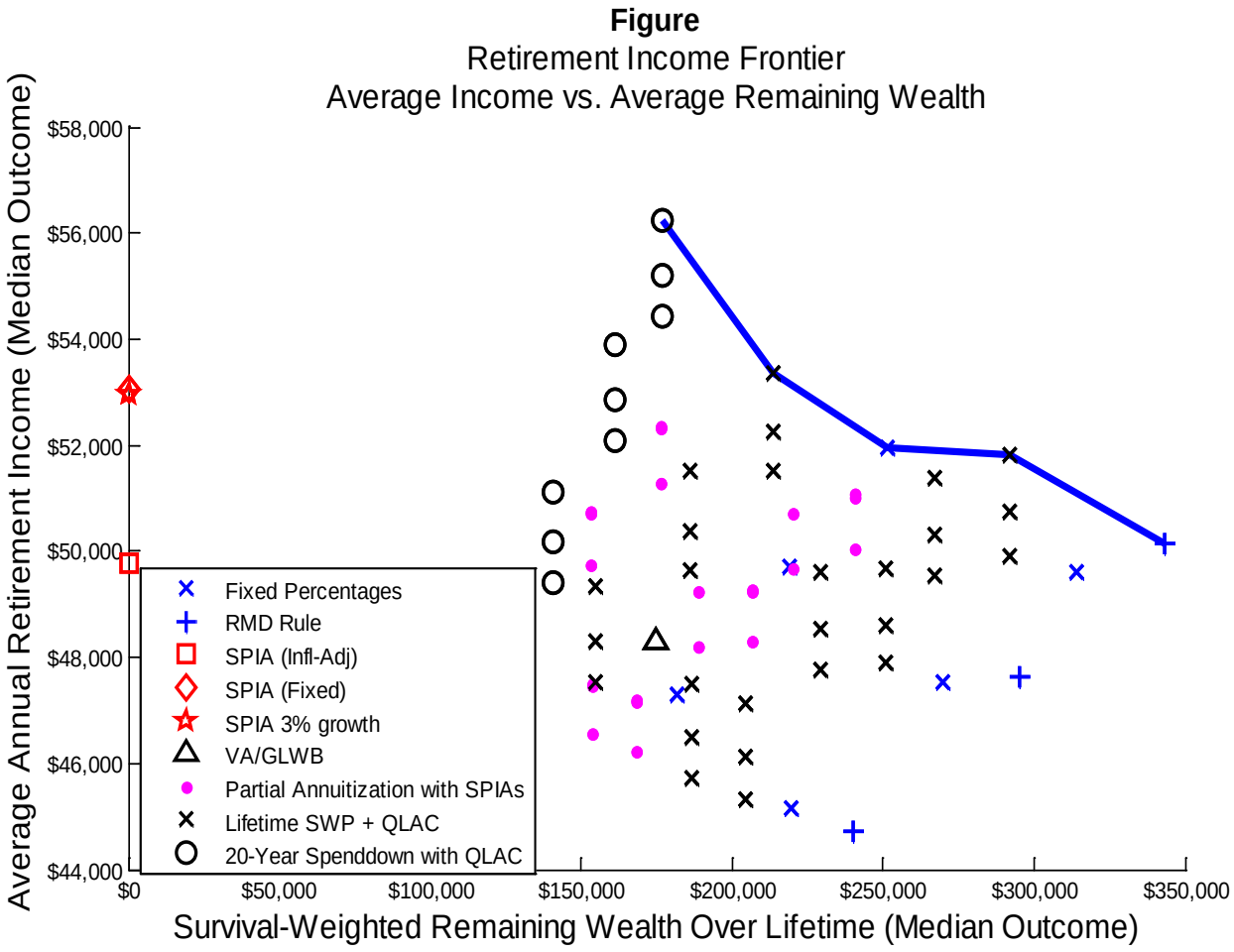
Risk decreases

Appendix E
Efficient Frontier #2 Results for Additional Hypothetical Retirees

- Married couple both age 65, retiring with $400,000 in assets
- Married couple both age 65, retiring with $1,000,000 in assets

- Note: For the graphs on the following pages, the axis scales change for different hypothetical retirees.

Efficient Frontier Analysis #2: Emphasize Retirement Income
Hypothetical Retiree #2: Married couple age 65 with $400,000
15% of assets devoted to QLAC

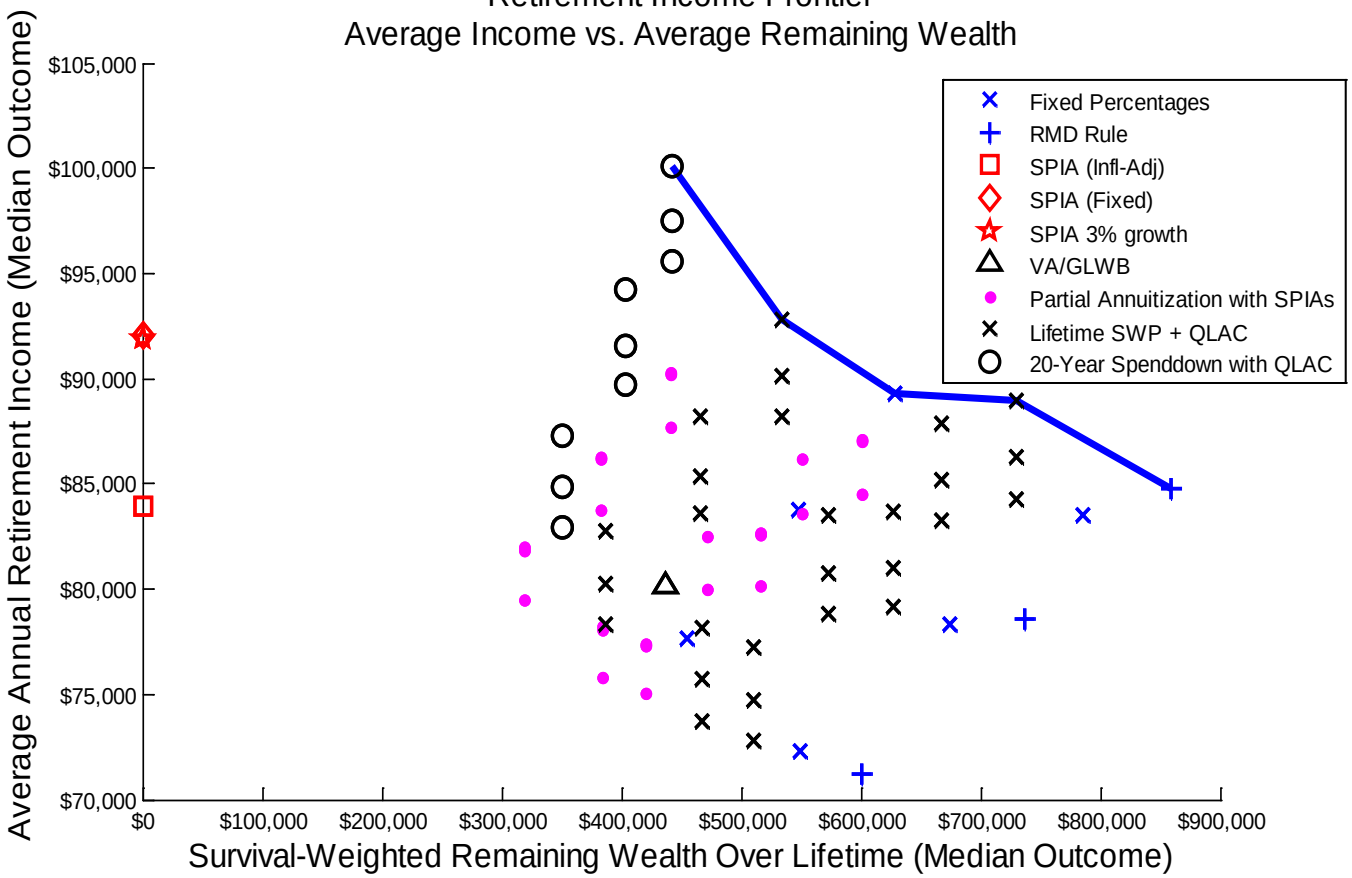


Average income increases

Risk decreases

Efficient Frontier Analysis #2: Emphasize Retirement Income
Hypothetical Retiree #3: Married couple age 65 with $1,000,000
15% of assets devoted to QLAC

Figure
Retirement Income Frontier
Average Income vs. Average Remaining Wealth



Average income increases

Risk decreases