The True Impact Of Immediate Annuities On Retirement Sustainability: A Total Wealth Perspective

by

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Abstract

Past research on systematic withdrawals and annuitization tends to find that partial annuitization reduces the probability of financial asset depletion and may even provide an opportunity to build a larger portfolio legacy value for sufficiently long retirement periods. We agree with these findings, but determine that partial annuitization itself is only the reason for these outcomes in a subset of cases. When retiree wealth is investigated from a total balance sheet perspective, by including the present value of remaining single-premium immediate annuity (SPIA) payments as a way to show the implied stock/bond asset allocation glidepath, a significant portion of the benefits provided by a stocks/SPIA strategy can be explained by the implied rising equity glidepath underlying the approach. Accordingly, we examine the relative success of static portfolios, stock/SPIA portfolios, and dynamic stock/bond portfolios that match the glidepath of a stock/SPIA strategy, in order to separate the impact of the glidepath and the impact of mortality credits into their component parts. The conclusion shows that prior studies which indicated a benefit of partially annuitizing a retiree's portfolio were often actually showing the benefits of a rising equity glidepath using a bucketed liquidation strategy that spends down fixed assets first and allows the household equity allocation to rise. Although this research finds that SPIAs can enhance retirement success, retirees must live well past life expectancy before the unique mortality credit contribution from SPIAs provides material benefits, as the remainder of the SPIA "benefit" can be replicated simply by using bonds and stocks with a rising equity glidepath. In fact, for those who do not live to life expectancy, the impact of SPIAs is positive only because the value of the rising equity glidepath (which can be replicated without the SPIA) outweighs the negative contribution from mortality credits. Because the primary value of SPIAs accrues for those who live beyond life expectancy, the results also show that inflation-adjusted SPIAs are more effective than fixed SPIAs, due to the larger payments in later years. Given this current research, the primary scenarios where SPIAs should be used are specifically those where the intent is to hedge *significant* longevity risk beyond life expectancy; in the remaining scenarios for most retirees, though, the more effective way to improve retirement outcomes is simply to implement the rising equity glidepath that bucketed SPIA strategies indirectly create.

Introduction

Since Ameriks, Warshawsky, and Veres (2001) published their seminal work, numerous studies [examples include Huang, Grove, and Taylor (2012) and Pfau (2013)] have demonstrated that including a single premium immediate annuity (SPIA) into a retirement income portfolio can extend portfolio sustainability and even support a larger bequest for those with extended longevity. To provide one example from their study, we can compare systematic withdrawals from an 85% stocks and 15% bonds annually rebalanced retirement portfolio to a scenario in which half of the assets are used to purchase a fixed SPIA at retirement and the remaining assets are annually rebalanced to 85/15 for stocks and bonds. With a 4.5% inflation-adjusted withdrawal rate objective, their no-SPIA portfolio experienced a failure rate of 26.8% after 40 years and the median real remaining wealth was 95% of the retirement date value. When half of the assets are used to purchase a SPIA at retirement, the failure rate after 40 years was only 14.1% (with income still arriving from the SPIA even with depletion of the financial portfolio), and the median remaining real wealth was 102% of the retirement date value. This happens despite the portfolio initially being reduced by half when the SPIA is purchased. Essentially, the SPIA reduces the probability of portfolio depletion, provides some income even when the portfolio is depleted, and eventually may allow for a larger pool of financial assets to be left as a bequest.

There is, however, an aspect of this methodology which merits critical consideration. The typical approach is to divide retirement date assets between stocks, bonds, and SPIAs, and to then maintain a fixed asset allocation for stocks and bonds within the financial portfolio over the entire retirement period. This was the idea behind the example provided above. Any assets in the financial portfolio were always rebalanced to 85% stocks and 15% bonds. Doing this loses sight of retiree wealth from a total balance sheet perspective. Retirement wealth consists not only of financial assets, it also includes human and social capital. In this context, the SPIA maintains a present value which should be included on the retiree's balance sheet. Asset allocation in this context should be considered in terms of the entire household balance sheet, and a SPIA purchase has implications for the actual stock allocation of retirement assets from the total wealth perspective.

We will delve into these implications through a deeper investigation of retiree wealth from a total balance sheet perspective by including the present value of the remaining SPIA payments as a way to develop a stock/bond asset allocation glidepath which can more properly be compared to the decision of partial annuitization. We find that a significant portion of the benefits provided by a stocks/SPIA strategy can be explained by the implied rising equity glidepath of the strategy, rather than by mortality credits or any other inherent advantages of the SPIA, and that this benefit can be replicated with a portfolio of just stocks and bonds and no SPIAs. Retirees must live well past life expectancy before SPIAs provide benefits which cannot otherwise be replicated with bonds and a rising equity glidepath; in extreme longevity scenarios, though, the benefit of SPIAs is still highly and uniquely beneficial.

Methodology

Our hypothetical retirees are attempting to finance a particular spending goal, which is an inflation-adjusted amount equal to either 4% or 6% of initial retirement date assets, and to sustain that income stream for as long as possible in retirement.

There are three basic scenarios for how the retiree will attempt to finance their retirement goal. In Scenario 1, the retiree uses a systematic withdrawal strategy from a portfolio of stocks and bonds which is rebalanced annually to a fixed 50/50 asset allocation. In Scenario 2, the retiree uses 50% of their portfolio to purchase a SPIA and maintains a 100% stock allocation (which is 50% of their retirement date assets) for their financial portfolio through the remainder of their retirement. With this approach, the percentage of total assets remaining in stocks in Scenario 2 matches the allocation to stocks in Scenario 1 for the first year of retirement, but the percentage of assets in stocks from the total portfolio perspective including the present value of the SPIA will vary over time (as there is no rebalancing mechanism between stocks and SPIAs). In Scenario 3, the initial stock/bond allocation for the first year retirement is the same 50/50 as in Scenario 1. No SPIA is purchased. However, in subsequent years, the stock/bond allocation is rebalanced so that the portion of assets in stocks matches the evolving implied portion of total wealth in stocks for the stocks/SPIA combination in Scenario 2. In essence, the bond portion of the portfolio is allocated to be equivalent to the present value of the remaining SPIA payments, with the remainder allocated to stocks. This allows us to isolate the glidepath effect from the mortality credit effect of the stock/SPIA combination.

Table 1 shows the real return capital market expectations used to guide 100,000 Monte Carlo simulations. For the baseline, we use the real return assumptions prepared by Harold Evensky for the popular financial planning software MoneyGuidePro as of July 2013. In order to understand more about the implications for different capital market assumptions, we also consider a second scenario more closely calibrated to the low interest rate environment affecting today's retirees, and a third scenario based on the more optimistic historical real return averages found in Ibbotson's *Stocks, Bonds, Bills, and Inflation* yearbook.

// Table 1 About Here //

To calculate annuity payout rates, we assume an inflation-adjusted SPIA is priced using survival probabilities and a flat yield curve with the same assumed compounded real growth rate for bonds of 1.54%. For fixed SPIAs, the annual compounded nominal return is 4.49% when combining the real return with the projected impact of inflation. Our baseline analysis is for a 65-year old male, but we also consider 65-year old females and couples, and 75-year old males. Mortality and survival probabilities are estimated with a Gompertz distribution function based on gender-specific parameters for modal age of death and the dispersion coefficient provided as reasonable values in Milevsky (2006). These are shown in Table 2, as well as comparisons from the Social Security Administration's 2009 Period Life Table, which some contend underestimates longevity by not incorporating expected future mortality reductions (i.e. the mortality rate for 85-year olds today is likely larger than the mortality rate that 65-year olds today will experience in 20 years when they are 85).

For the 65-year-old males, these assumptions imply a payout rate of 5.8% for the inflation-adjusted SPIA and 7.96% for the fixed SPIA (implications of other payout rates are discussed briefly later). Table 2 also provides payout rates for other capital market assumptions and for females and couples. Also included in Table 2 are the initial withdrawal rates from remaining financial assets required to meet the two different spending goals of 4% and 6% when half of the client's retirement date assets are used to purchase a SPIA.

We assume that the SPIAs are priced in an actuarially fair manner without any overhead charges to reduce their payout rates. We also assume that stocks and bonds earn their underlying index returns without any additional fees. This is so we can isolate the impacts of glidepaths and mortality credits without otherwise confounding the results by applying different types of fee structures.

// Table 2 About Here //

Results

Figure 1 tracks the evolution of real income from the inflation-adjusted and fixed SPIAs over the retirement period for 65 year old males. The compounding inflation rate is 2.91%. At this compounded rate of inflation, it takes just over 11 years for the real income provided by the fixed SPIA to fall below that generated by the inflation-adjusted SPIA.

// Figure 1 About Here //

Next, Figure 2 identifies the path for the present value of remaining annuity payments as a male proceeds through retirement after having annuitized $100 at age 65. The discount rate is the average compounded return on bonds (i.e., 1.54% from the Evensky assumptions). Because the real value of income from the fixed SPIA declines over time due to inflation, the present value of remaining payments from the inflation-adjusted SPIA always exceeds those from the fixed SPIA in the years after the SPIA purchase.

// Figure 2 About Here //

// Figure 3 About Here //

As a counterpart to what is seen in Figure 1, Figure 3 shows how the pattern of income needs from financial assets will vary over time based on the type of SPIA purchased. This figure shows income needs from financial assets, which are 50% of the initial assets, so that the necessary withdrawal rates as a percentage of retirement date assets are double these amounts (i.e., a 1.1% withdrawal rate from 50% of the portfolio is the equivalent of a 2.2% withdrawal rate from financial assets). Since the fixed SPIA has a higher initial payout rate, but the real value of this income source declines with inflation over time, someone dividing assets between stocks and fixed SPIAs will be able to withdraw less from their financial portfolio to meet their overall spending goal in the early part of retirement, but these spending needs increase over the retirement period.

The varying spending patterns have implications for the implied stock allocation from a total wealth perspective over the retirement period. Lower income needs from the stock portfolio allow it to grow more quickly than otherwise, implying that the allocation to stocks from the total wealth perspective (the value of the stock portfolio plus the present value of the remaining SPIA payments) rises more quickly with the fixed SPIA than the inflation-adjusted SPIA. As well, as we saw in Figure 2, the present value of remaining payments from a fixed SPIA decreases more quickly over time. Figure 4 highlights the combined impact of these factors by showing the median stock allocation across the Monte Carlo simulations for a retiree investing their retirement date assets 50/50 between stocks and SPIAs. The glidepath allocation for stocks rises more quickly with a fixed SPIA than with an inflation-adjusted SPIA, but both strategies indeed imply a rising equity glidepath (increasing stock allocation) over retirement in the median case.

// Figure 4 About Here //

Figure 5 shows the distribution of stock allocations from a total wealth perspective across the Monte Carlo simulations. The 10^{th}, 25^{th}, 50^{th}, 75^{th}, and 90^{th} percentiles of the distribution are illustrated for fixed and inflation-adjusted SPIAs. More often than not, the stock allocation increases as the portfolio of financial assets either grows or at least declines more slowly than the present value of the remaining annuity payments. However, in some simulations, a sequence of poor stock market returns sends the financial assets on a trajectory toward zero, reducing the effective stock allocation. Whenever financial assets are depleted, the stock allocation becomes 0%, as the present value of remaining SPIA payments is all which remains. The stocks and fixed SPIA combination generally results in a higher stock allocation, but due to the declining purchasing power of the fixed SPIA and increasing reliance on the portfolio, the downside risk is also greater; accordingly, there is a 10% chance of portfolio depletion by age 92 and a 25% chance by age 103 with a fixed SPIA while the inflation-adjusted SPIA at the 10^{th} percentile doesn't fail until age 97 (and doesn't fail through age 105 at the 25^{th} percentile).

// Figure 5 About Here //

Figure 6 begins our move toward seeing the implications of these previous figures. It shows the remaining financial assets at the 10^{th} percentile of the distribution for each of the 3 scenarios for a 4% withdrawal rate and a 50/50 initial allocation. The financial portfolio is used to obtain the income needed up to the 4% goal after accounting for any SPIA income. Here we can see the impact of the rising equity glidepath in helping to extend portfolio sustainability. This is the difference in wealth paths for Scenarios 1 and 3 in this unlucky 10^{th} percentile scenario. Also, though the stock/SPIA strategy leads to less wealth in the early part of retirement, should the retiree live long enough, the financial portfolio of stocks can grow to be larger even in this unlucky case. Even without including the present value of SPIAs, the stock/SPIA strategy provides more liquid assets by age 88 for both types of SPIAs, showing how SPIA strategies begin to provide more income for those who live several years past life expectancy.

// Figure 6 About Here //

Table 3 shows the initial results of the three scenarios – the probability of failure at a 4% withdrawal rate for a fixed 50/50 stock/bond allocation, the 50/50 stock/SPIA allocation, and the stock/bond portfolio that follows a glidepath mimicking the stock/SPIA allocation, tested using both a real SPIA and a fixed SPIA.

In virtually all scenarios, the stock/SPIA results are superior to the 50/50 stock/bond results, affirming the prior results of Warshawsky et. al. and other studies regarding the benefits of SPIAs. Failure rates were diminished, often quite substantially, with the use of stock/SPIA portfolios. One exception was a slightly higher failure rate for stock/SPIA results in the low returns environment over a 15- and 20-year time horizon, which we attribute primarily to the fact that the individual didn't even survive to life expectancy, and given the low returns, simply didn't live long enough to accrue substantial mortality credits. On the other hand, the longer the time horizon, the more significant the benefit of stock/SPIA portfolios over stock/bond portfolios, and furthermore the greater that the use of real SPIAs outperformed fixed/nominal SPIAs (as for those who significantly live past life expectancy, the inflation-adjusted payments in the later years provide more substantial internal rates of return).

// Tables 3 - 6 About Here //

In the case of the implied glidepath scenarios, a more interesting trend emerges. In general, the implied glidepath scenario results are better than the fixed stock/bond scenarios, but not as good as the stock/SPIA scenarios. This accentuates the fact that at least some of the improvement of going from the static stock/bond to the stock/SPIA is not actually a result of the SPIA at all, but instead simply a bucketing approach that leads to a liquidation strategy, where the fixed portion of the portfolio is disproportionately liquidated in the early years, such that the stock allocation from a total wealth perspective rises (as shown earlier in Figure 4). Accordingly, the difference between the implied glidepath and the static 50/50 portfolio essentially represents the benefit of the glidepath, while the difference between the glidepath scenario and the stock/SPIA scenario reveals the true benefit of the SPIA itself.

Accordingly, the results in Table 3 actually separate these improvements into their component parts. For instance, with the Evensky assumptions and a 30-year time horizon, the fixed 50/50 portfolio has a 26.5% probability of depletion, while the stock/SPIA scenario only has a 7.6% chance of depletion, an improvement of 18.9%. However, the implied glidepath scenario has 20.8% probability of depletion, which means the benefit of the glidepath is 26.5% - 20.8% = 5.7%. Since 5.7% of the total 18.9% improvement is attributable to the glidepath, this is characterized as a 30% contribution of the glidepath (as shown in the Table). The remaining improvement – from the 20.8% probability of depletion for the implied glidepath scenario to 7.6% for the stock/SPIA approach – is attributable to the benefit of the SPIA and its mortality credits.

When observed in the context of their separate contributions, several additional trends emerge. The first is that not only do nominal/fixed SPIAs have higher risks of failure than real SPIAs, but furthermore that a larger portion of the benefit of fixed SPIAs is simply attributable to the glidepath effect. In other words, for those who genuinely are seeking to use SPIAs to improve portfolio longevity, the real SPIA is substantially more effective in providing a unique and meaningful contribution of mortality credits.

The second notable effect is that for shorter time horizons, the contribution of mortality credits is actually *negative* (for both fixed and real SPIAs, though more so for fixed SPIAs) as the implied glidepath approach without a SPIA is actually *superior* to the stock/SPIA approach. Intuitively, this makes sense, as the greatest mortality credit leverage of SPIAs is for those who live substantially past their life expectancy, while the internal rate of return can be outright negative for a SPIA when the annuitant dies well before life expectancy. Nonetheless, the results truly emphasize that individuals must live significantly beyond life expectancy for a stock/SPIA approach to add unique and meaningful value beyond just its glidepath effect that can be replicated without the SPIA; even for the 65-year-old male, the mortality credit contribution does not begin to become significantly under after 25 years (and not until a 30-year time horizon for the low return environment), which is already beyond the 65-year-old male life expectancy of only 20.4 years under our mortality assumptions (and even further beyond the 17.5 year life expectancy of today's Social Security Administration Period Life tables).

Table 5 provides the results for females, which show a similar trend. Given that females have a slightly longer life expectancy, the contribution from the glidepath is greater and the time horizon is longer until mortality credits begin to contribute materially to the outcome.

In the case of married couples (also in Table 5), the trend is even more pronounced; even after 30 years, the benefits of the glidepath alone trump the benefits of the use of SPIAs, and it is not until a 35-year time horizon – when the married couple has reached the joint age of 100! – that the mortality credit benefit of the stock/SPIA scenario even becomes positive, and even then its benefit is limited. This represents a significant differentiation from the prior research on the use of SPIAs, which indicated that couples would see a material improvement in sustainable withdrawals and/or the probability of success by using a SPIA, and reveals that in fact for all but those with the longest life expectancies, the benefit was actually attributable to the glidepath unwittingly created by the stock/SPIA liquidation strategy, not by SPIAs themselves.

Tables 4 and 6 present the results of the analysis using a higher 6% withdrawal rate, which naturally increases the probability of portfolio depletion. At higher spending levels, the SPIA contributes less to the longevity of the portfolio, in large part because the risk is already elevated at a higher withdrawal rate, and the glidepath effect is even more dominant. Accordingly, the glidepath effect also persists for longer time horizons as well. Single males must live into their 90s before the mortality credits leave any positive contribution for a real SPIA at a 6% withdrawal rate, and married couples still don't see any improvement in using a stock/SPIA portfolio over the rising equity glidepath even as far out as age 105!

The last sections of Tables 5 and 6 also shows the results as applied to 75-year-old males at 4% and 6% withdrawal rates (rather than a 65-year-old males as discussed earlier), to briefly examine the effects of this framework with later initial annuitization ages. The results reveal that at higher annuitization rates (due to the later age), overall failure rates are reduced (especially at 4% withdrawal rates), though for significant longevity scenarios where the annuitant lives materially past life expectancy, the higher payouts do result in a greater contribution of mortality credits.

Implications And Further Research

The implications of this research are significant; the results suggest that most prior studies which indicated a benefit of partially annuitizing a retiree's portfolio were actually showing the benefits of a bucketed liquidation strategy that spends down fixed assets first and allows the household equity allocation to rise, not a benefit of the SPIA itself, especially in scenarios that do not extend materially beyond life expectancy. For instance, the results of Ameriks et. al. showed that over a 25-year time horizon, no annuitization resulted in a 5.8% risk of depletion, while 50% annuitization reduced that failure rate to only 0.6%, yet as our research shows, when liquidation strategies with comparable glidepaths are modeled, most or all of the implied benefits of SPIAs vanishes at these time horizons.

For those who materially outlive life expectancy, SPIAs do continue to show a valuable benefit to improving retirement income sustainability, and real SPIAs fare better in such a "longevity hedge" role than nominal SPIAs. However, the required time horizon for real SPIAs to make a meaningful contribution is significant – long enough that only a small percentage of retirees are likely to reach the benefit point, and the crossover takes even longer to achieve given today's low return environment. In addition, the reality is that the results of this research are still slightly weighted in *favor* of the SPIA, as our assumptions do not include distribution costs or a profit spread in the pricing of the SPIA that would be embedded in the pricing of actual products available for sale; to the extent that real world SPIAs have payout rates slightly lower than the results shown here, the required time horizon for a meaningful contribution from mortality credits would be even further past life expectancy. In addition, an examination of today's currently available payout rates in the marketplace suggest that even the Evensky assumptions in our baseline case are optimistic (i.e., market quotes of currently available annuities at the time of this article's publication have lower payout rates); reduced payouts would reduce the mortality credit of SPIAs even further, and yet again extend the time horizon even further beyond life expectancy for a meaningful contribution from mortality credits to emerge.

This doesn't necessarily mean that retirees should not use SPIAs at all, but to recognize that the benefits shown in prior studies were primarily due to a glidepath effect that can be achieved without the use of a SPIA contract. Given this current research, the primary scenarios where SPIAs should be used are specifically those were the intent is to hedge *significant* longevity beyond life expectancy, where SPIAs and their mortality credits simply provide an unparalleled fixed-income-equivalent return. In the remaining scenarios for most retirees, though, the more effective way to improve retirement outcomes is simply to implement a rising equity glidepath.

Notably, the benefits of rising equity glidepaths revealed in this study have also received little attention in prior research, and deserve further study. Research by Bengen (1996) and more recently by Blanchett

(2007) examined the benefits of declining glidepaths, based on the conventional wisdom that retirees should reduce their exposure to risk as they age, and found that declining equity exposures did not materially contribute to retirement success (and in many cases actually impaired it). Our research indirectly supports those prior studies, in revealing that not only are declining equity glidepaths potentially harmful, but that surprisingly rising equity glidepaths are actually beneficial. Further studies may wish to delve further into studying these effects.

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Figure 1: Real Income Provided by Single Premium Immediate Annuities per $100 Annuitized For 65 Year Old Males

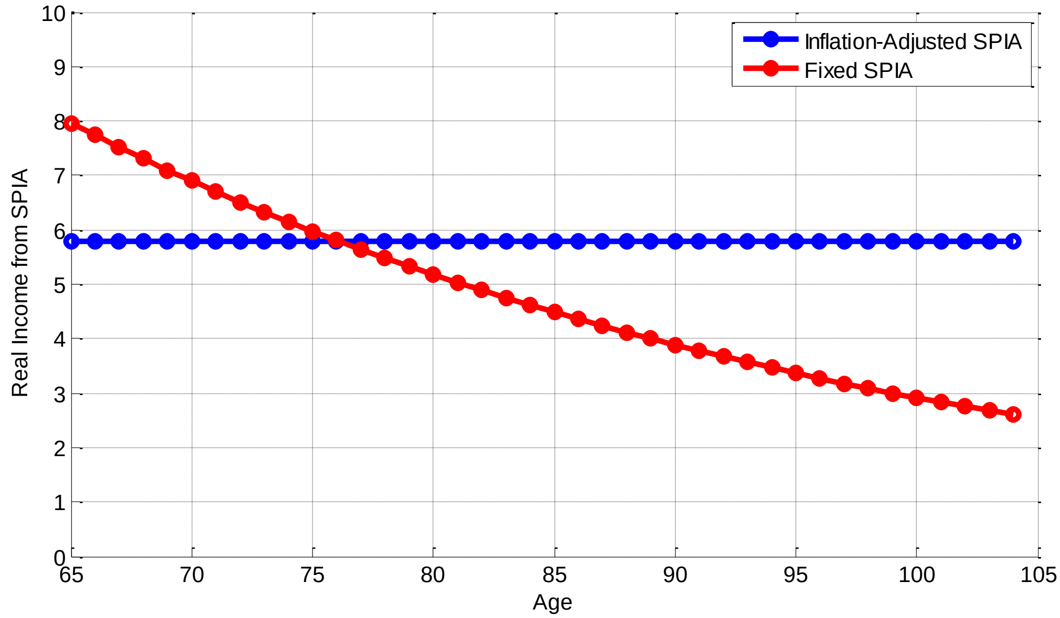


Figure 2: Present Value of Remaining SPIA Income by Age when $100 is Annuitized at Age 65 For 65 Year Old Males

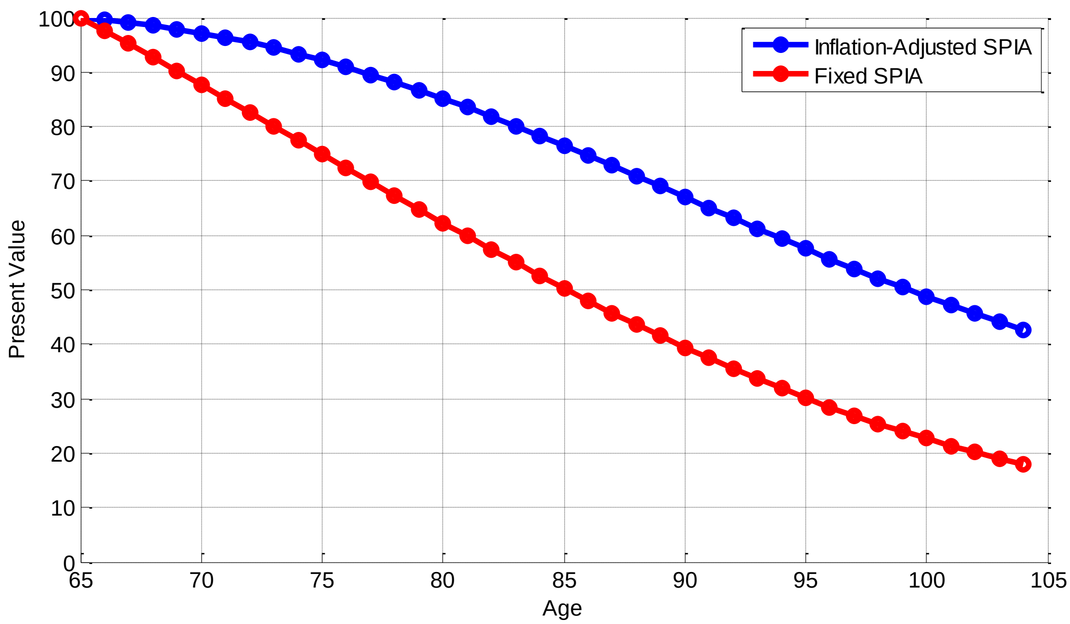


Figure 3: Real Income Needed from Financial Assets to Meet 4% Inflation-Adjusted Spending Goal With an Initial 50/50 Allocation to Stocks and SPIAs

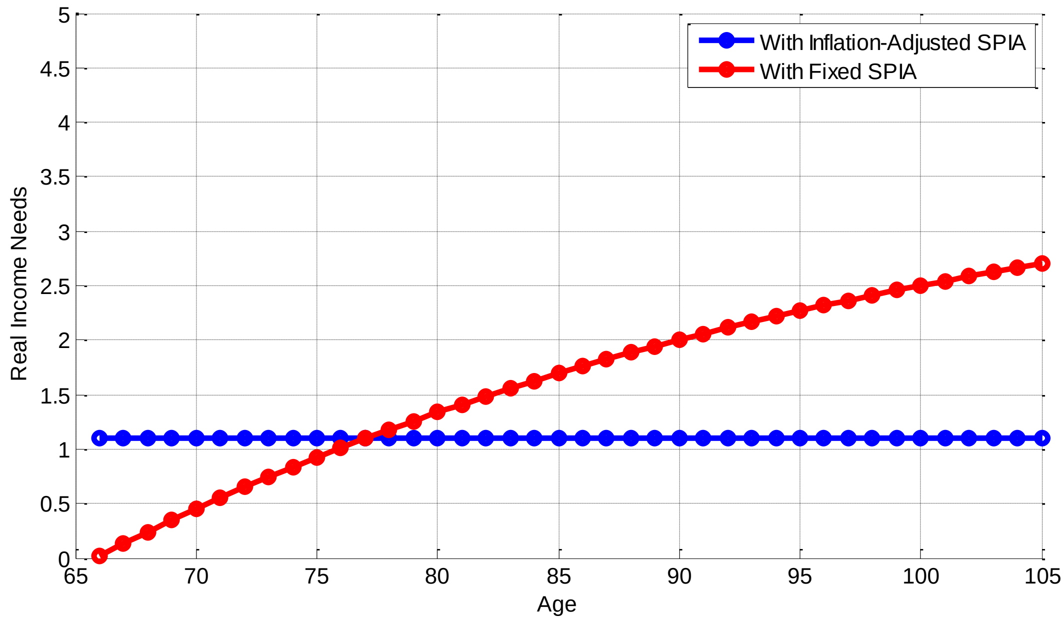


Figure 4: Median Allocation to Stocks over Time from a Total Wealth Perspective With an Initial 50/50 Allocation to Stocks and SPIAs

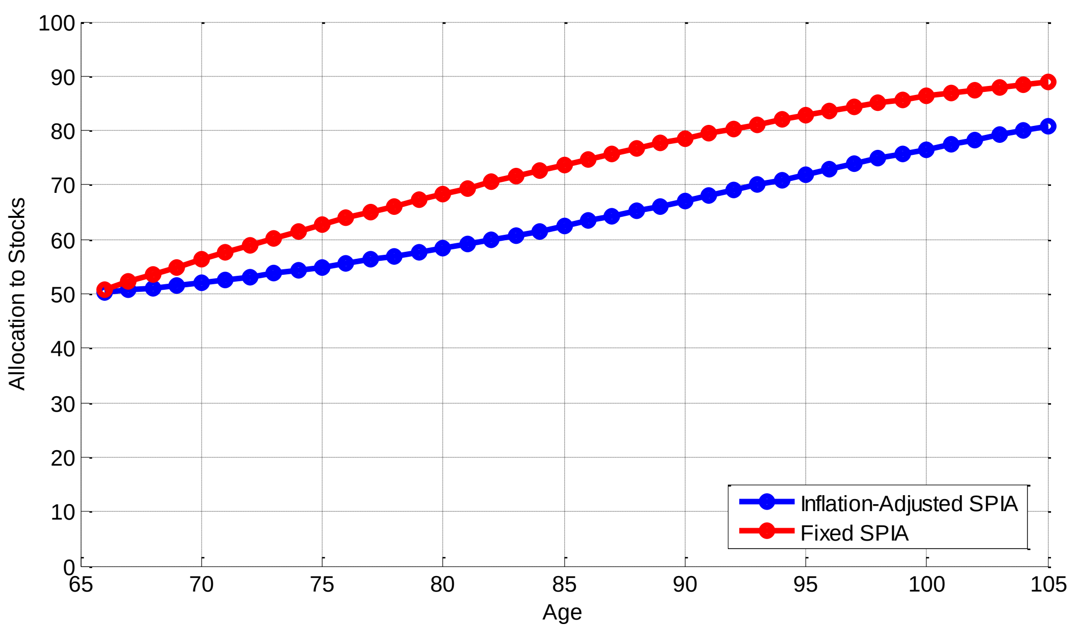


Figure 5: Distribution of Allocation to Stocks over Time from a Total Wealth Perspective With an Initial 50/50 Allocation to Stocks and SPIAs

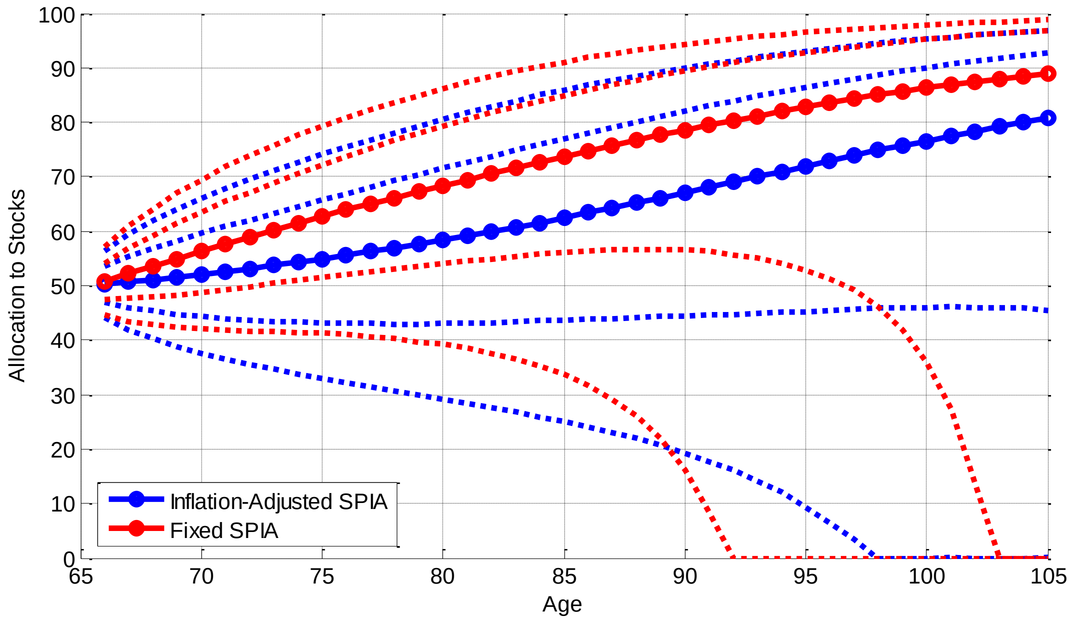
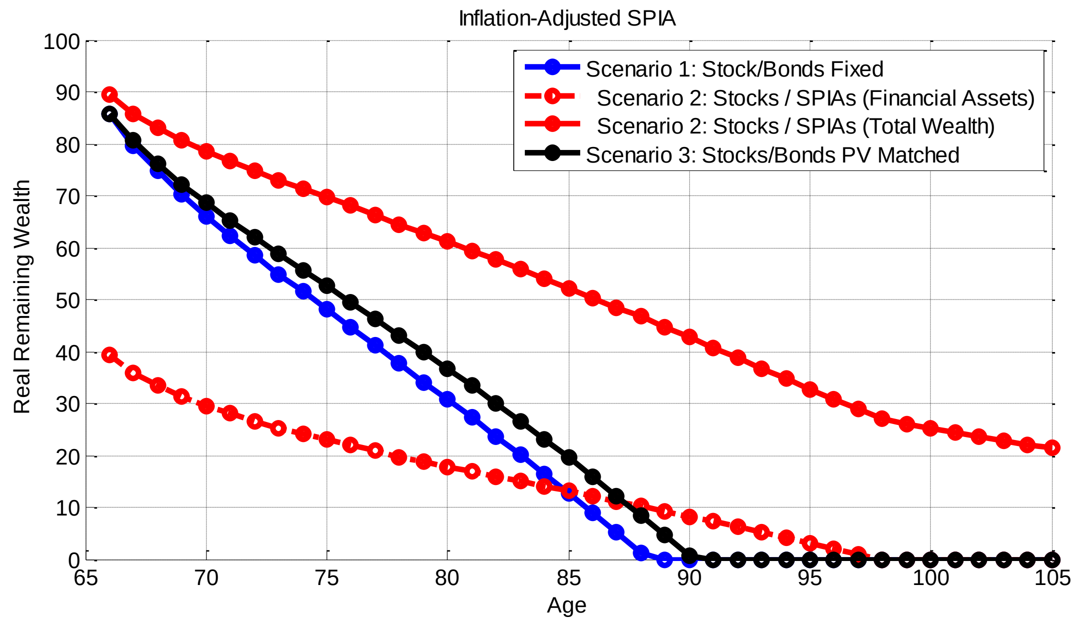


Figure 6: Remaining Real Wealth at 10th Percentile with a 4% Withdrawal Rate For a 65 Year Old Male



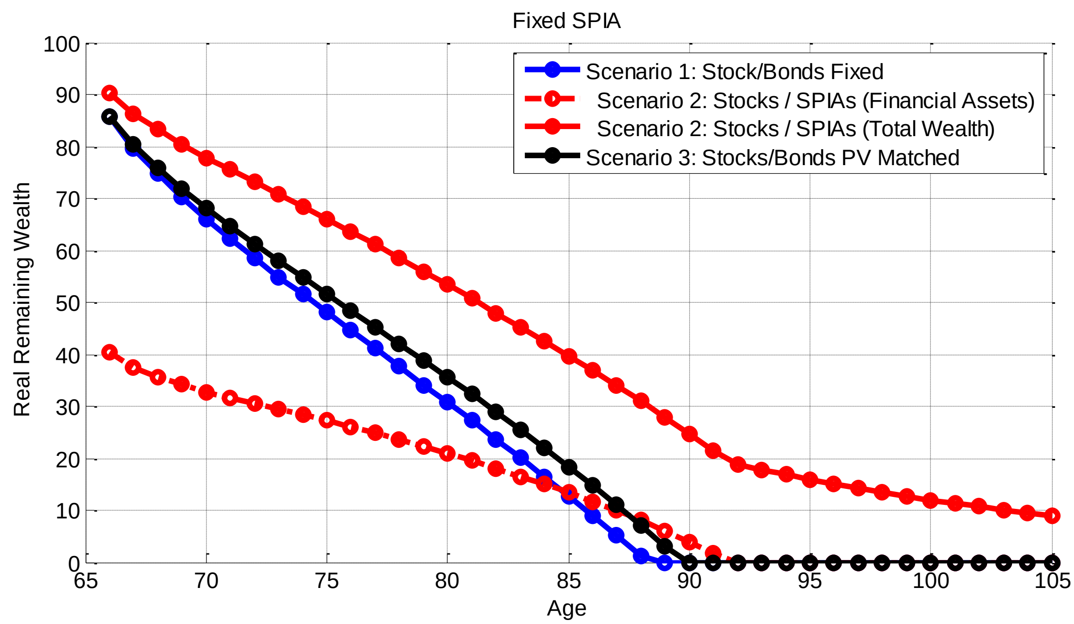


Table 1

Scenario A: Modelled on Evensky Assumptions for MoneyGuidePro

	Real Returns			Correlation Coefficients		
	Arithmetic Means	Geometric Means	Standard Deviations	Stocks	Bonds	Inflation
Stocks	5.50%	3.37%	20.7%	1	0.3	-0.2
Bonds	1.75%	1.54%	6.5%	0.3	1	-0.6
Inflation	3.00%	2.91%	4.2%	-0.2	-0.6	1
Equity Premium	3.75%					

Scenario B: Lower Future Returns

	Real Returns			Correlation Coefficients		
	Arithmetic Means	Geometric Means	Standard Deviations	Stocks	Bonds	Inflation
Stocks	5.10%	3.10%	20.0%	1	0.1	-0.2
Bonds	0.30%	0.06%	7.0%	0.1	1	-0.6
Inflation	2.10%	2.01%	4.2%	-0.2	-0.6	1
Equity Premium	4.80%					

Scenario C: Historical Data
Summary Statistics for U.S. Real Returns Data, 1926 – 2011

	Real Returns			Correlation Coefficients		
	Arithmetic Means	Geometric Means	Standard Deviations	Stocks	Bonds	Inflation
Stocks	8.59%	6.46%	20.7%	1	0.1	-0.2
Bonds	2.56%	2.35%	6.5%	0.1	1	-0.6
Inflation	3.07%	2.98%	4.2%	-0.2	-0.6	1
Equity Premium	6.03%					

Source: Own calculations from Stocks, Bonds, Bills, and Inflation data provided by Morningstar and Ibbotson Associates. The U.S. S&P 500 index represents the stock market, and intermediate-term U.S. government bonds represent the bond market.

Table 2

Gompertz Distribution Parameters for 65 Year Olds

	m	b
Males	88.18	10.5
Females	92.63	8.78

Number of Remaining Years in Life for 65 Year Olds

	Life Expectancy	10th Percentile	Median	90th Percentile	Probability to Live 30 More Years
Males	20.4	7.1	20.9	32.4	16.5%
Females	23.9	10.9	24.9	35.1	28.2%
Couple (last survivor)	27.6	18	28.2	36.4	40.0%

For Comparison Purposes: Number of Remaining Years in Life for 65 Year Olds

Using Social Security Administration 2009 Period Life Table (http://www.ssa.gov/OACT/STATS/table4c6.html)

	Life Expectancy	10th Percentile	Median	90th Percentile	Probability to Live 30 More Years
Males	17.5	5.3	17.9	28.5	6.7%
Females	20.2	7.4	21	31.2	13.4%
Couple (last survivor)	24	14.6	24.5	32.5	19.2%

Simulated SPIA Payout Rates for 65 Year Olds

Capital Market Assumptions	Male		Female		Couple (Joint and 100% Survivors)	
	Inflation-Adjusted	Fixed	Inflation-Adjusted	Fixed	Inflation-Adjusted	Fixed
Baseline Evensky	5.8	7.96	5.05	7.15	4.46	6.47
Low Returns	4.83	6.17	4.12	5.4	3.58	4.79
Historical	6.35	8.66	5.58	7.84	4.96	7.14

Required Withdrawal Rate from Financial Assets in First Year of Retirement

to Meet 4% Spending Goal When 50% of Financial Assets are Used for SPIA Purchase

Capital Market Assumptions	Male		Female		Couple (Joint and 100% Survivors)	
	Inflation-Adjusted	Fixed	Inflation-Adjusted	Fixed	Inflation-Adjusted	Fixed
Baseline Evensky	2.2	0.04	2.95	0.85	3.54	1.53
Low Returns	3.17	1.83	3.88	2.6	4.42	3.21
Historical	1.65	-0.66	2.42	0.16	3.04	0.86

Required Withdrawal Rate from Financial Assets in First Year of Retirement

to Meet 6% Spending Goal When 50% of Financial Assets are Used for SPIA Purchase

Capital Market Assumptions	Male		Female		Couple (Joint and 100% Survivors)	
	Inflation-Adjusted	Fixed	Inflation-Adjusted	Fixed	Inflation-Adjusted	Fixed
Baseline Evensky	6.2	4.04	6.95	4.85	7.54	5.53
Low Returns	7.17	5.83	7.88	6.6	8.42	7.21
Historical	5.65	3.34	6.42	4.16	7.04	4.86

Table 3

Probability of Financial Asset Depletion

For 65 Year Old Males With a 50/50 Asset Allocation at Retirement and a 4% Withdrawal Rate

Baseline Evensky Assumptions

		Real SPIA				Fixed SPIA			
		Failure Rates		Contributions		Failure Rates		Contributions	
Retirement Period	Fixed 50/50 Stocks/Bonds	50/50 Stocks/SPIA	Implied Glidepath	Glidepath	Mortality Credits	50/50 Stocks/SPIA	Implied Glidepath	Glidepath	Mortality Credits
15	0.1	0.1	0.0	108%	-8%	0.2	0.0	167%	-67%
20	3.6	1.3	1.4	96%	4%	2.3	1.7	151%	-51%
25	13.7	4.0	9.3	45%	55%	7.4	10.1	57%	43%
30	26.5	7.6	20.8	30%	70%	14.1	21.5	40%	60%
35	37.9	11.2	31.2	25%	75%	21.1	31.7	37%	63%
40	47.3	14.6	39.4	24%	76%	27.3	39.6	38%	62%

Low Returns Environment

		Real SPIA				Fixed SPIA			
		Failure Rates		Contributions		Failure Rates		Contributions	
Retirement Period	Fixed 50/50 Stocks/Bonds	50/50 Stocks/SPIA	Implied Glidepath	Glidepath	Mortality Credits	50/50 Stocks/SPIA	Implied Glidepath	Glidepath	Mortality Credits
15	0.2	1.3	0.0	689%	-589%	1.1	0.0	594%	-494%
20	5.8	6.5	3.6	134%	-34%	6.5	3.7	133%	-33%
25	20.9	14.0	17.3	53%	47%	15.0	17.0	66%	34%
30	38.3	21.6	32.5	34%	66%	23.9	31.6	46%	54%
35	52.5	28.1	44.4	33%	67%	31.8	43.1	45%	55%
40	63.2	33.5	52.9	35%	65%	38.6	51.4	48%	52%

Historical Averages

		Real SPIA				Fixed SPIA			
		Failure Rates		Contributions		Failure Rates		Contributions	
Retirement Period	Fixed 50/50 Stocks/Bonds	50/50 Stocks/SPIA	Implied Glidepath	Glidepath	Mortality Credits	50/50 Stocks/SPIA	Implied Glidepath	Glidepath	Mortality Credits
15	0.0	0.0	0.0	n/a	n/a	0.0	0.0	n/a	n/a
20	0.4	0.0	0.1	83%	17%	0.2	0.1	142%	-42%
25	2.3	0.1	1.2	52%	48%	0.9	1.3	69%	31%
30	5.9	0.3	3.8	38%	62%	2.1	4.1	48%	52%
35	10.5	0.5	7.0	35%	65%	3.6	7.4	45%	55%
40	14.6	0.8	10.0	33%	67%	5.2	10.3	46%	54%

Table 4

Probability of Financial Asset Depletion

For 65 Year Old Males With a 50/50 Asset Allocation at Retirement and a 6% Withdrawal Rate

Baseline Evensky Assumptions

		Real SPIA				Fixed SPIA			
		Failure Rates		Contributions		Failure Rates		Contributions	
Retirement Period	Fixed 50/50 Stocks/Bonds	50/50 Stocks/SPIA	Implied Glidepath	Glidepath	Mortality Credits	50/50 Stocks/SPIA	Implied Glidepath	Glidepath	Mortality Credits
15	9.6	24.1	6.4	548%	-448%	16.9	6.6	339%	-239%
20	39.1	44.4	36.5	306%	-206%	37.7	35.5	267%	-167%
25	62.8	57.9	59.6	65%	35%	53.3	57.5	56%	44%
30	76.4	66.4	72.0	44%	56%	63.6	69.7	52%	48%
35	83.9	71.9	78.8	42%	58%	70.3	76.7	53%	47%
40	88.2	75.6	82.8	43%	57%	74.9	80.9	55%	45%

Low Returns Environment

		Real SPIA				Fixed SPIA			
		Failure Rates		Contributions		Failure Rates		Contributions	
Retirement Period	Fixed 50/50 Stocks/Bonds	50/50 Stocks/SPIA	Implied Glidepath	Glidepath	Mortality Credits	50/50 Stocks/SPIA	Implied Glidepath	Glidepath	Mortality Credits
15	13.6	37.9	12.1	1754%	-1654%	30.6	11.7	1028%	-928%
20	50.3	60.1	50.0	2666%	-2566%	53.7	47.9	237%	-137%
25	74.9	72.3	71.9	116%	-16%	67.7	69.5	75%	25%
30	86.6	79.1	81.8	64%	36%	75.9	79.7	64%	36%
35	92.1	83.3	87.0	58%	42%	81.0	85.1	63%	37%
40	95.0	86.0	89.7	59%	41%	84.3	88.2	63%	37%

Historical Averages

		Real SPIA				Fixed SPIA			
		Failure Rates		Contributions		Failure Rates		Contributions	
Retirement Period	Fixed 50/50 Stocks/Bonds	50/50 Stocks/SPIA	Implied Glidepath	Glidepath	Mortality Credits	50/50 Stocks/SPIA	Implied Glidepath	Glidepath	Mortality Credits
15	2.1	6.6	1.2	629%	-529%	4.3	1.2	367%	-267%
20	15.5	16.4	14.0	161%	-61%	13.6	13.1	124%	-24%
25	33.1	25.1	30.4	34%	66%	23.1	28.2	49%	51%
30	47.2	31.4	42.0	33%	67%	30.6	39.0	49%	51%
35	57.0	35.9	49.4	36%	64%	36.4	46.2	52%	48%
40	63.6	39.1	54.2	38%	62%	40.6	50.9	55%	45%

Table 5

Probability of Financial Asset Depletion

With a 50/50 Asset Allocation at Retirement, a 4% Withdrawal Rate, and Baseline Evensky Capital Market Assumptions

65 Year Old Females

		Real SPIA				Fixed SPIA			
		Failure Rates		Contributions		Failure Rates		Contributions	
Retirement Period	Fixed 50/50 Stocks/Bonds	50/50 Stocks/SPIA	Implied Glidepath	Glidepath	Mortality Credits	50/50 Stocks/SPIA	Implied Glidepath	Glidepath	Mortality Credits
15	0.1	0.9	0.0	733%	-633%	0.6	0.0	475%	-375%
20	3.6	4.7	1.4	152%	-52%	4.4	1.6	144%	-44%
25	13.7	10.7	9.7	137%	-37%	11.7	10.1	180%	-80%
30	26.5	16.9	21.4	53%	47%	20.0	21.6	75%	25%
35	37.9	22.6	32.1	38%	62%	27.8	32.0	58%	42%
40	47.3	27.4	40.4	35%	65%	34.4	40.0	56%	44%

65 Year Old Couples

		Real SPIA				Fixed SPIA			
		Failure Rates		Contributions		Failure Rates		Contributions	
Retirement Period	Fixed 50/50 Stocks/Bonds	50/50 Stocks/SPIA	Implied Glidepath	Glidepath	Mortality Credits	50/50 Stocks/SPIA	Implied Glidepath	Glidepath	Mortality Credits
15	0.1	2.3	0.0	1925%	-1825%	1.3	0.0	1042%	-942%
20	3.6	9.4	1.4	372%	-272%	7.2	1.6	281%	-181%
25	13.7	18.2	10.0	219%	-119%	16.4	10.2	178%	-78%
30	26.5	26.1	22.2	1054%	-954%	25.8	21.9	622%	-522%
35	37.9	32.7	33.1	92%	8%	34.0	32.6	137%	-37%
40	47.3	38.0	41.6	61%	39%	40.6	40.7	98%	2%

75 Year Old Males

		Real SPIA				Fixed SPIA			
		Failure Rates		Contributions		Failure Rates		Contributions	
Retirement Period	Fixed 50/50 Stocks/Bonds	50/50 Stocks/SPIA	Implied Glidepath	Glidepath	Mortality Credits	50/50 Stocks/SPIA	Implied Glidepath	Glidepath	Mortality Credits
5	0.0	0.0	0.0	n/a	n/a	0.0	0.0	n/a	n/a
10	0.0	0.0	0.0	n/a	n/a	0.0	0.0	n/a	n/a
15	0.1	0.0	0.0	92%	8%	0.0	0.0	92%	8%
20	3.6	0.0	1.7	53%	47%	0.2	2.1	44%	56%
25	13.7	0.0	9.8	28%	72%	1.0	11.0	22%	78%
30	26.5	0.0	21.0	21%	79%	3.4	22.4	18%	82%

Table 6

Probability of Financial Asset Depletion

With a 50/50 Asset Allocation at Retirement, a 6% Withdrawal Rate, and Baseline Evensky Capital Market Assumptions

65 Year Old Females

		Real SPIA				Fixed SPIA			
		Failure Rates		Contributions		Failure Rates		Contributions	
Retirement Period	Fixed 50/50 Stocks/Bonds	50/50 Stocks/SPIA	Implied Glidepath	Glidepath	Mortality Credits	50/50 Stocks/SPIA	Implied Glidepath	Glidepath	Mortality Credits
15	9.6	33.7	6.5	868%	-768%	23.7	6.6	567%	-467%
20	39.1	54.7	37.5	1117%	-1017%	45.9	36.2	333%	-233%
25	62.8	67.4	61.1	362%	-262%	60.7	58.5	205%	-105%
30	76.4	74.6	73.4	168%	-68%	70.1	70.7	91%	9%
35	83.9	79.0	80.1	79%	21%	75.9	77.6	80%	20%
40	88.2	82.0	84.0	69%	31%	79.8	81.7	77%	23%

65 Year Old Couples

		Real SPIA				Fixed SPIA			
		Failure Rates		Contributions		Failure Rates		Contributions	
Retirement Period	Fixed 50/50 Stocks/Bonds	50/50 Stocks/SPIA	Implied Glidepath	Glidepath	Mortality Credits	50/50 Stocks/SPIA	Implied Glidepath	Glidepath	Mortality Credits
15	9.6	41.4	6.6	1128%	-1028%	30.0	6.7	780%	-680%
20	39.1	62.4	38.4	3633%	-3533%	52.7	36.8	700%	-600%
25	62.8	73.7	62.3	2322%	-2222%	66.7	59.6	220%	-120%
30	76.4	79.9	74.7	308%	-208%	74.9	71.7	322%	-222%
35	83.9	83.6	81.2	887%	-787%	80.0	78.5	138%	-38%
40	88.2	86.1	85.0	151%	-51%	83.3	82.5	115%	-15%

75 Year Old Males

		Real SPIA				Fixed SPIA			
		Failure Rates		Contributions		Failure Rates		Contributions	
Retirement Period	Fixed 50/50 Stocks/Bonds	50/50 Stocks/SPIA	Implied Glidepath	Glidepath	Mortality Credits	50/50 Stocks/SPIA	Implied Glidepath	Glidepath	Mortality Credits
5	0.0	0.0	0.0	n/a	n/a	0.0	0.0	n/a	n/a
10	0.0	0.1	0.0	150%	-50%	0.1	0.0	175%	-75%
15	9.6	2.6	6.3	47%	53%	3.6	6.7	48%	52%
20	39.1	10.0	34.2	17%	83%	14.8	34.2	20%	80%
25	62.8	19.1	56.3	15%	85%	28.2	55.6	21%	79%
30	76.4	27.2	68.7	16%	84%	39.9	67.7	24%	76%