Achieving Sustainable Retirement Withdrawals: A Combined Equity and Annuity Approach

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Executive Summary

- This article contrasts sustainable retirement withdrawals from strategies with annuity components and strategies without annuity components.
- The authors discuss today's market environment as it affects retirement planning strategies with and without annuity components.
- This study evaluates common retirement planning strategies by analyzing the withdrawal stability for portfolios consisting of equity, fixed income, variable annuity, and fixed annuity assets.
- This article uses replacement Monte Carlo methodology to determine retirement success over investor accumulation and withdrawal phases. The goal of each trial was to secure calculated retirement funding rather than to maximize wealth.
- Five retirement portfolio strategies are evaluated: (1) 50 percent in equities and 50 percent in bonds, (2) 100 percent in equities, (3) a combination of equities and bonds in which the equities percentage is calculated as 128-minus-attained-age, (4) a variable annuity with a 5 percent withdrawal rate, and (5) 100 percent equities with a fixed annuity lock.
- Different rebalancing strategies were modeled to capture any variances between frequency. Portfolios composed of a higher portion of equities outperformed those with a higher portion of bonds. The trials using 50 percent equities and 50 percent bonds yielded the lowest chance of success. Attempting to reduce portfolio risk by reallocating to fixed-income assets annually is less likely to provide long-term success than an allocation that remains fully invested in equities.
- The results indicate that using an equity portfolio with a fixed annuity component provides a higher chance of maintaining retirement distributions than other alternatives.

Domestic and international equities markets have experienced dramatic volatility over the past two years. Fixed income positions have offered some relief, but typical equities portfolios have lost more than 30 percent of their value, even after rebounding from the market bottom. Consumer sentiment is low, and investors may be looking for alternative asset allocations.

Traditional retirement portfolio management holds that the percentage allocated to equities should be high when an investor is young and should decline over time. In theory, the higher percentage in the early years provides needed growth while the long time horizon ameliorates the accompanying risk. In contrast, an older investor with a shorter time horizon is less able to absorb the risk of an extended bear market.

Of course, rules of thumb do not always stand up to scrutiny, and with a generation of baby boomers reaching retirement, the need for identifying successful strategies is becoming increasingly critical. Those who retired in 2007 or 2008 may find that equity and bond markets alone are not able to sustain their anticipated retirement needs.

This research tests five retirement portfolio asset allocation strategies through both the retirement accumulation and distribution phases. Three of the strategies tested involve stocks and/or bonds, and two incorporate annuity contracts. Three of the portfolio strategies tested are often used as baseline cases in literature: (1) a portfolio that consists of 50 percent equities and 50 percent bonds, (2) a portfolio that consists of 100 percent equities, (3) a portfolio that adjusts asset allocation during the life cycle, reducing the equities percentage as

the client ages, (4) a variable annuity strategy that includes a 5 percent living benefit guarantee, and (5) a 100 percent equities model that annuitizes upon achieving a predetermined value.

Review of Literature

Asset allocation tools and techniques have been studied over many time horizons. (Anderson and Faff, 2004; Hau and Rey, 2004; Donohue and Yip, 2003; Ibbotson and Kaplan, 2000; Athanassakos, 1992). Literature suggests that investors experience higher overall returns in portfolios composed primarily of equity investments over 5-, 10-, and 20-year periods (Ciccotello, Grant, and Field, 2002). Investment data (Ibbotson and Kaplan, 2000) support the generally accepted belief that equity portfolios (particularly U.S. value-based portfolios) historically outperform their fixed and domestic bond counterparts. However, historical returns vary greatly depending on the date an investor begins investing and accessing his/her portfolio, and returns also vary based on any portfolio rebalancing tools that are implemented.

Studies of portfolio rebalancing strategies tend to look at initial asset allocation, trading frequency, trading styles, rebalancing triggers, and other aspects of investment decision making (Hlawitschka and Tucker, 2005; Jensen and Mercer, 2003; Judd, Kubler, and Schmedders, 2003). Of course, portfolio rebalancing strategies are typically aimed at creating a portfolio with a risk-return profile that is consistent with the investor's risk tolerance.

One approach to setting the equity percentage in the retirement portfolio is the 100-minus-attained-age algorithm, which holds that subtracting the investor's age from 100 provides an appropriate percentage to allocate to equities (Bodie and Treussard, 2007). Of course, this approach fails to consider the investor's risk tolerance or the actual time horizon. Empirical studies have provided an improvement to this rule of thumb by evaluating the likelihood that the portfolio can be maintained throughout retirement. According to this approach, the optimal equities percentages should be 115-minus-attained-age for a conservative investor, 128-minus-attained-age for moderate investors, and 140-minus-attained-age for aggressive investors (Bengen, 1997). Another approach to asset allocation treats each projected retirement withdrawal as if it were a separate goal with its own time horizon. Asset allocation for each of these hypothetical portfolios is based on the investor's risk tolerance (Cordell, 2005). The asset allocations for all the hypothetical portfolios are amalgamated to generate an allocation for the actual portfolio. Relative to the 128-minus-attained-age approach, this technique tends to generate higher equities allocations in early years and lower allocations in the later years.

Variable annuity use has increased dramatically over the past five years. Variable annuity assets held in management by financial advisers and institutions grew 38.2 percent in 2006 to $1.36 trillion (Chen *et. al*, 2007), compared to mutual fund growth of under 20 percent by the same institutions. This growth, and the study of variable annuity products, has not been incorporated into investment literature with the same level of depth as traditional investment and mutual fund research. Indeed, variable and fixed annuity insurance tools are not often considered in the discussion of asset allocation and sustainable portfolio withdrawals.

The analytical approach in this study, Monte Carlo analysis,[1] is commonly used in academic research (Fink and Fink, 2005). Monte Carlo modeling allows users to test investment risk by simplifying more complex modeling methods and has been repeatedly used to test systematic and unsystematic risk in relation to returns (Minderhoud, 2006; Boscaljon, 2006). It has also been promoted as an effective tool for practitioners, most notably by the late Lynn Hopewell, a former editor of the *Journal of Financial Planning* (Kautt and Hopewell, 2000).

Methodology and Assumptions

This research evaluates five models for managing the retirement portfolio utilizing Ibbotson data for equities to evaluate each model's efficacy and compare it to other approaches. Monte Carlo analysis is performed to determine the chance of success out of 1,000 trials. Success is defined as a trial that successfully sustains an inflation-adjusted retirement need beginning at retirement age and continuing through age 100. Age 100 is used to reflect a conservative life expectancy and is often used by practitioners in retirement and survivor needs planning. Failure is defined as a trial that is unable to sustain continued withdrawals.

Two asset categories are evaluated: stocks and bonds. Stocks are represented by the Russell 1000 Index, which is composed of the 1,000 largest publicly traded U.S. companies. This index accounts for 90 percent of equity on U.S. stock exchanges. From its 1986 inception through 2008, the Russell 1000 has had a historical return of 12.86 percent and a standard deviation of 18.32 percent, which are the equity return and risk factors used in this analysis.

Bond data are modeled in the same manner as stock data. Bond data are derived from a blend of 50 percent corporate and 50 percent government bonds over broad bond markets. This combination has a historical return of 5.3 percent and standard deviation of 8.87 percent, with an average duration of 10 years (CRSP 20 Year Bond Data from 1998–2008).

Five retirement planning approaches are evaluated:

1. 50 percent equities and 50 percent bonds
2. 100 percent equities
3. An equities percentage equal to 128-minus-attained-age
4. A variable annuity with a "living benefit"
5. 100 percent equities with a fixed annuity lock

Each model assumes a 20-year accumulation phase and 35-year distribution phase, creating a case study with a beginning age of 45, retirement age of 65, and

Table 1: 128-Minus-Attained-Age: Asset Allocation

Age	Equities	Bonds
45	83%	17%
55	73%	27%
65	63%	37%
75	53%	47%
85	43%	57%
95	33%	67%

life expectancy of 100. Inflation is assumed to be 3 percent during both the accumulation and distribution phases. Different rebalancing strategies were modeled to capture any variances between frequency. We found that portfolios composed of a higher portion of equities outperformed those that had a higher portion of bonds. Portfolios that rebalanced more often to bonds had less of a chance of sustaining success than those that allowed equities to accumulate more frequently. In other words, the pile of money available at retirement to sustain withdrawals was larger in portfolios that allowed equities to experience style drift.

The case assumes initial pre-retirement income of $1,000, initial savings of five times income ($5,000), and an annual retirement need of 70 percent of initial income, or $700. (Note: $700 adjusted for 3 percent inflation for the 20-year accumulation period generates a beginning retirement withdrawal of $1,265.) Models assume no rebalancing costs. Annual costs of 0.53 percent were used to proxy indexed investing costs and annuity charges were 1 percent in addition to investment costs. A 0.53 percent proxy for investment costs was derived from taking the average of indexed and actively managed equity fund expense ratios in 2008 (Investment Company Institute, 2009).

50 Percent Equities and 50 Percent Bonds. In this approach, portfolios were invested in 50 percent equities and 50 percent bonds throughout the accumulation and distribution periods, and the portfolios were rebalanced annually.

100 Percent Equities. This approach invested 100 percent of the portfolio in equities throughout the accumulation and distribution periods. Fixed income instruments were not considered.

Equities Allocation Percentage Equals 128-Minus-Attained-Age. For this trial, the asset allocation was based on the following algorithm: equities percentage equals 128-minus-attained-age. As noted earlier, this is the allocation Bengen found to be most appropriate for moderate-risk-tolerance investors (Bengen, 1997). Thus, the initial asset allocation was 83 percent stocks (that is, 128-minus-45) and 17 percent bonds. The portfolio was rebalanced to its target allocation every January 1, and the target allocation was rebalanced toward bonds every 10 years as illustrated in Table 1, which gradually reduced the equities percentage.

Variable Annuity with a Living Benefit. Another technique is a living benefit, commonly offered by variable annuity contracts. A living benefit allows an investor to receive a guarantee of a percentage of the annuity value or a fixed dollar amount at a given point (generally the contract inception date) for life regardless of the outcome of the contract value. Living benefits can be added to annuity contracts, and their specific costs and features vary significantly by contract. One constant of living benefits is that they provide a non-inflating cash flow through the lifetime of the annuitant. (Note that specific limitations of living benefits vary by contract, and it is especially important for financial advisers and the public to evaluate the annuity prospectus before making any investment decisions.)

The cost of variable annuity contracts with living benefits varies dramatically among different insurers. To reflect a typical contract, this model assumes variable annuity portfolios invest in sub-accounts equal to the allocation of the Russell 1000 and deducts 1.53 percent from the account balance at year-end. This model reflects a cost 1 percent higher than other equity portfolios, for a total cost of 1.53 percent. This cost appears reasonable because an informal review of 10 contracts offered by 5 major insurers[2] revealed that they offer living benefits on contracts with total costs ranging between 1 percent and 1.85 percent.

In this retirement planning approach, the living benefit would be executed at any time during retirement when B (benefit) was equal to or greater than the retirement withdrawal need. The living benefit guarantees a non-inflating cash flow paid over the life expectancy of the client. A 100 percent equities allocation was used, and, as noted previously, this model factored additional costs of using an annuity product with a lifetime benefit. Given the above set of assumptions, an annuity must have achieved a value of $25,285 at age 65 to produce a living benefit that would guarantee 5 percent withdrawals at retirement. That is, $25,285 × .05 = $1,265, which, as noted earlier, is the $700 retirement withdrawal increasing at the 3 percent assumed inflation rate over the 20-year accumulation period.

100 Percent Equities with an Annuity Lock. The 100 percent equities with an annuity lock model maintains a 100 percent equities allocation until a "trigger date" occurs. A trigger date for this strategy is any point at which the portfolio is large enough that it can be reallocated to a fixed annuity that will provide all the funds necessary to cover the projected series of retirement withdrawals from age 65 to age 100. A scenario in which a trigger date is reached is deemed to be a successful funding of retirement. (All contributions to the portfolio subsequent to the trigger date can be invested in any way deemed appropriate, but the accumulations are not evaluated because the accumulation goal has already been achieved.) This process also implies a degree of conservatism.

If a trigger date is not reached during the accumulation phase, which indicates that the retirement portfolio goal is not reached, the 100 percent equities portfolio is maintained and retirement withdrawals begin as scheduled. At first glance these withdrawals would seem to be ill-advised,

Figure 1: Retirement Withdrawal Success Rates for Five Strategies

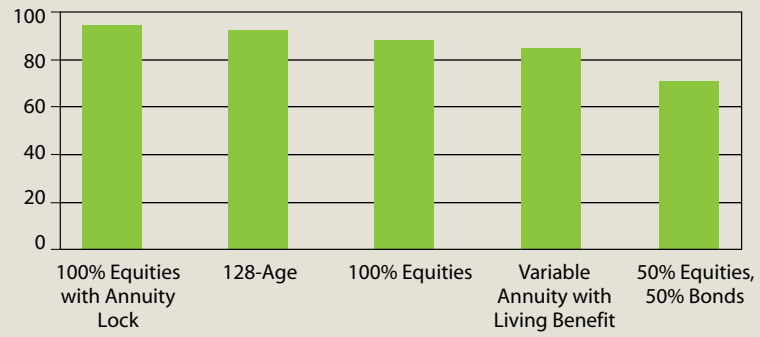

Table 2: 100% Equities with Annuity Lock: Discounted Annuity Values

Age	Discounted Annuity Values
60	$27,311
61	$28,702
62	$30,162
63	$31,692
64	$33,295

because the portfolio would be falling short of the calculated need and the withdrawal would represent a larger percentage of the balance than originally anticipated. However, the likelihood of a portfolio depleting assets during the first year of retirement is small, especially for portfolios that have existed for long periods. Further, because any shortfall is likely a result of an extended bear market in the final years of the accumulation period, it is highly probable that the resultant market recovery will cause the distribution-phase portfolio to recover the value needed to maintain scheduled withdrawals.

The specific methodology for the 100 percent equities with annuity lock approach is as follows. Monte Carlo analysis is run to year 16 (5 years before retirement) using 100 percent equities. At that point (age 60), if the balance for a trial is large enough to buy a fixed annuity that would cover aggregate projected retirement withdrawals from age 65–100, the trial is deemed to be a success. If the balance is insufficient, the funds for that trial remain fully invested in equities, and the same evaluation is made the next year. Again, if there are sufficient funds to buy the annuity, the trial becomes a success, and if not, the money remains invested. Retirement occurs at age 65 and, if there is still not enough money to buy the annuity, withdrawals are made directly from the equities portfolio. If during retirement there is eventually enough money to buy an annuity to fund the remaining withdrawals, the trial is a success. If a given trial never has enough money to buy an annuity it is deemed a failure.

This model assumes that a fixed annuity can be purchased at any time, yielding 1 percent over inflation. The annuity locks in lifetime payments equal to the specified retirement amounts and begins at age 65. At age 65, the required value to finance the annuity is $34,977. The annuity amount can be discounted back before retirement, although it will not begin making annual payments until age 65. Discounted annuity values are illustrated in Table 2.

Results

Figure 1 visually summarizes the success rates of the five approaches. Again, success is defined as successfully funding the entire retirement through age 100. Out of 1,000 trials for the 50 percent equities-50 percent bonds approach, 738 succeeded and 262 failed—a 73.8 percent success rate. The trials that passed maintained retirement distributions to at least age 100. For the 100 percent equities approach, out of 1,000 trials, 877 passed and 123 failed—an 87.7 percent success rate. It should be noted that the 100 percent equities model gave the client potential for the greatest wealth with the top quarter wealth of all trials being around $1.25 million.

In the 128-minus-attained-age approach, 946 of the 1,000 trials sustained retirement withdrawals throughout retirement, while 54 trials did not sustain withdrawals—a 94.6 percent success rate.

In the variable-annuity-with-living-benefit approach, 693 out of 1,000 trials passed, that is, reached the annuity purchase value, by age 65, while the other 307 did not reach the annuity purchase value by age 65. The 307 failing portfolios were aggregated in groups in $5,000 increments, as indicated in Table 3. Each of the groups was then modeled independently, again assuming withdrawals of $1,265, increased for inflation, and the results were as follows:

- 67 percent of the $20,000 portfolios could sustain retirement withdrawals of $1,265
- 40 percent of the $15,000 portfolios could sustain retirement withdrawals of $1,265
- 10 percent of the $10,000 portfolios could sustain retirement withdrawals of $1,265
- 1 percent of the $5,000 portfolios could sustain retirement withdrawals of $1,265

Of the 307 portfolios that did not achieve the targeted living benefit value of $25,285 at retirement, about 150 were able to maintain withdrawals through retirement. Thus, out of 1,000 portfolios using a living benefit, 843 succeeded and 157 reached terminal failure—an 84.3 percent success rate.

For the 100 percent equities with an annuity lock approach, the process is more complicated. Beginning at age 60 (year 16 of the analysis), 640 portfolios met or exceeded the balance needed to purchase

an annuity capable of sustaining retirement needs, while 360 failed to reach the necessary balance. The 360 trials that failed to meet the required balance are grouped according to the amount of the shortfall in $5,000 increments ranging from $5,000 to $25,000, and frequencies are noted for each group (Table 4).

One year of additional contributions and growth is applied to each $5,000 increment—and new pass and failure frequencies are calculated targeting the amount needed to purchase an annuity at age 61 (year 17 of the trial), $28,702. Table 5 reports pass frequencies for year 17.

By measuring the outcomes of failures in year 16, an additional 98 portfolios reached the target value of $28,702 by the end of year 17. A new case distribution of failed portfolios in year 17 can be found in Table 6 (on page 46).

This methodology was repeated through years 17–45 finding ending results in each year. Subsequent to retirement, portfolios that had end-of-year values less than the next year's distribution were considered to "terminally fail" and were removed from future calculations.

At the end of year 20 (client age 64), 889 trials had reached the annuity value and 111 had not. By the end of year 45 (client age 90), 968 portfolios had at some point achieved the annuity value. The remaining 32 portfolios had reached a terminal failure. See Table 7 for a summary of terminal failures by year.

Discussion

A summary of the success rates of different methodologies is provided in Table 8. The trials using 50 percent equities and 50 percent stocks yielded the lowest chance of success.

Purchasing an annuity contract with a living benefit rider did not provide a higher probability of success than using a standard 100 percent equities portfolio—84.3 percent vs. 87.7 percent. (Recall that the expense percentage for an equities portfolio was assumed to be 0.53 percent annually,

Table 3: Variable Annuity with Living Benefit: Failure Frequencies at Retirement

$5,000 Increment	Frequency
$20,000	160
$15,000	100
$10,000	30
$5,000	20

Table 4: 100% Equities with Annuity Lock: Failed Trials at Age 60, Year 16

Accumulation at Year 16	Frequency
$5,000	20
$10,000	40
$15,000	90
$20,000	100
$25,000	110

Table 5: 100% Equities with Annuity Lock: Trials that Failed in Year 16

Year 16 Accumulation (Frequency)	Year 17 Accumulation	Year 17 Distribution
$5,000 (20)		
	$15,000	1%
	$10,000	22%
	$5,000	67%
	$0,000	0%
$10,000 (40)		
	Achieved annuity value	1%
	$20,000	8%
	$15,000	41%
	$10,000	48%
	$5,000	2%
$15,000 (90)		
	Achieved annuity value	4%
	$28,000	3%
	$25,000	12%
	$20,000	40%
	$15,000	34%
	$10,000	6%
$20,000 (100)		
	Achieved annuity value	26%
	$28,000	6%
	$25,000	35%
	$20,000	26%
	$15,000	6%
	$10,000	1%
	$5,000	0%
$25,000 (110)		
	Achieved annuity value	58%
	$28,000	10%
	$25,000	25%
	$20,000	5%
	$15,000	2%
	$10,000	0%
	$5,000	0%

Table 6: 100% Equities with Annuity Lock: Trials that Failed in Year 17

Increment	N
$5,000	3
$10,000	39
$15,000	60
$20,000	70
$25,000	69
$28,000	21
Achieved annuity value	99

and an additional 1 percent was deducted to represent annuity charges.) This result is dependent on assumptions and time frame. The variable annuity result may outperform a 100 percent equities approach over long-term bear market periods. Cost is critical to analyzing the merits of using a 100 percent equities (without annuitization) strategy or considering a variable annuity contract with a living benefit rider. Cheaper annuity products and rougher market periods could potentially change the results.

The 128-minus-attained-age approach provided strong results. This approach simulated a client taking an aggressive stance pre-retirement and less volatility risk as they approach portfolio distribution during retirement. This model reduces portfolio withdrawal risk by limiting equity exposure during retirement withdrawal.

The 100 percent equities with annuity lock approach had superior success in meeting the retirement withdrawal requirements when contrasted to the other tested methods. Relative to the 100 percent equities approach, the 100 percent equities with an annuity lock method was more successful for two reasons. First, the possibility of achieving the required annuitization balance prior to retirement in some cases avoids the situation in which an otherwise successful program could be undermined by a subsequent bear market. Second, it prevents portfolios from experiencing below annuity (1 percent + inflation) returns once the portfolio achieves an annuity value.

Table 7: 100% Equities with Annuity Lock: Terminal Failures by Year

Year #	Passes	Fail	Term Fail	Year #	Passes	Fail	Term Fail
16	640	360		32	1	29	2
17	98	262		33	1	27	1
18	68	194		34	1	25	1
19	48	148		35	1	23	1
20	36	112		36	1	21	1
21	18	94		37	1	18	2
22	11	83		38	1	15	2
23	9	74	1	39	1	13	1
24	6	67	1	40	1	11	1
25	5	61	1	41	1	9	1
26	4	55	2	42	2	6	1
27	3	49	2	43	1	5	0
28	3	44	2	44	0	0	5
29	2	40	2				
30	2	36	2	**Totals**	968		34
31	2	32	2				

Table 8: Comparison of Success Rates Among Methodologies

Method	Success	Failure
100% Equities with Annuity Lock	96.8%	3.2%
128 - Age[3]	94.6%	5.4%
100% Equities with No Annuity	87.7%	12.3%
Purchase a "Living Benefit" Using a Variable Annuity	84.3%	15.7%
50% Equities, 50% Bonds with No Annuity	73.8%	26.2%

The 100 percent equities with annuity lock approach does not attempt to maximize wealth, and indeed it generates less wealth on average than the standard 100 percent equities approach. The specified goal, however, is to secure the calculated retirement funding need rather than to maximize accumulations. It should also be emphasized that this method did not provide 100 percent success, as 32 trials experienced terminal failure (that is, they ran out of money). On the other hand, a 96.8 percent success rate isn't bad, especially considering the fact that age 100 is used for the life expectancy. If age 95 had been used, or if historical mortality experience were considered, an even larger success ratio would have been obtained. Further, the failure percentage for the next most successful approach was almost four times as high: 12.3 percent vs. 3.2 percent.

Note again that this study assumed a 55-year time period from the onset of accumulation through age 100, with 35 years during the withdrawal period. Of course, all portfolios would have higher success rates if a life expectancy shorter than age 100 were used.

Conclusion

Individuals have different goals. Some will be interested in maximizing potential bequests. Others will want to minimize variability of returns. For those clients who want to maximize the probability of achieving financial security, defined as maintaining projected retirement withdrawals to age 100, the 100 percent equities with

annuity lock is the preferred approach.

The results suggest that a 100 percent (or at least very high percentage) equities allocation is more defensible when the annuitization alternative is considered and when retirement fund investors recognize that success can be achievable before or after the retirement date. Another important point is that, even if the client reaches the annuitization trigger, there is, of course, no requirement to annuitize. Indeed, market conditions and imputed fixed income annuity rates at the "trigger date" may indicate that maintaining a high equities balance is a better alternative.

Given the uncertainties in investment markets, it is worth noting that investors who reached retirement between 2007 and early 2008 would have greatly benefited from employing annuitization strategies. Annuitization strategies are not used to maximize wealth, but to ensure that projected retirement withdrawals can be maintained.

By specifying the annuity purchase as a future alternative, the financial planner can encourage a higher-equities portfolio, which will likely lead to a larger accumulation in retirement.

Endnotes

1. Monte Carlo analysis provides an ideal method of measuring the likelihood an investment portfolio and savings plan will successfully reach a predetermined goal. Monte Carlo method determines aggregate portfolio performance based on a series of randomly generated returns tied to specific asset classes. Thousands of trials are run, each containing a unique series of random numbers. Each trial either succeeds or fails at meeting a predetermined goal.
The authors would like to give special thanks to Wealthcare Capital Management, creator of Financeware.com, for permitting educational use of their Monte Carlo Software Tool.
2. Policies from the following companies were evaluated: Allianz Life, Penn Mutual, Prudential, AXA, and Mass Mutual.
3. The authors studied both 128-age and 100-age allocations. Employing a 100-age approach achieved a success rate of 75 percent and failure rate of 25 percent. A lower equity portfolio allocation during the accumulation phase led to lower success rates of sustainable withdrawals for the 100-age model.

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