

COVER PAGE

Retirement Planning -- Generating Lifetime Income, Leaving a Legacy, and the Components of Net Worth Throughout Retirement

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Retirement Planning -- Generating Lifetime Income, Leaving a Legacy, and the Components of Net Worth Throughout Retirement

Executive Summary

- A number of articles have appeared, in the *Journal of Financial Planning* and elsewhere, on the sustainability of inflation-adjusted (constant purchasing power) cash flow during retirement. Various strategies using home equity in conjunction with retirees' securities portfolios have been analyzed and compared, using Monte Carlo simulation.
- These articles demonstrated that, in general, cash flow sustainability is greatly enhanced by using home equity, as compared with not using home equity.
- These articles demonstrated that some strategies for using home equity, in some circumstances, provide greater enhancement of sustainability than other strategies.
- More specifically, when home equity, accessed by a reverse mortgage credit line, is used in the "Coordinated Strategy," and the home value is at least as great as the portfolio value, the probability of sustained cash flow throughout a 30-year retirement is greater than when the "Last Resort Strategy" is used. By contrast, when the portfolio value is greater than the home value, the two strategies provide approximately equal probabilities of cash flow sustainability.
- The previous articles have not considered, in any detail, the legacies left by the retirees, nor compared them using the two strategies. This article fills that gap and provides that analysis and comparison. The results show the medians and 10th percentiles of the legacies for each of three representative retirees using the two strategies
- The previous articles have not considered the composition of the retirees' net worth during retirement, using each of the two strategies. This article fills that gap and quantifies the extent to which the Coordinated Strategy results in greater proportions of securities in the retirees' net worth than the Last Resort Strategy. Greater proportions of securities, in turn, provide greater flexibility for the retiree and his/her financial planner to adjust to future changes in economic conditions.

INTRODUCTION

A number of articles have appeared in the *Journal of Financial Planning* focusing on the sustainability of retirees' cash flow throughout retirement. (see, e.g., Sacks and Sacks 2012; Salter, Evensky, and Pfeiffer 2012; Wagner 2016; Pfau 2016; Neuwirth, Sacks, and Sacks 2017; Walker, Sacks, and Sacks 2021). These articles have focused on retirees whose primary source

of income is a securities portfolio (typically, but not necessarily, held in a 401(k) account or a rollover IRA). They have demonstrated that it is possible to enhance the sustainability of cash flow in amounts greater than allowed by the classic “4 percent rule.” This is accomplished by the use of a “buffer asset” (specifically, home equity accessed by means of a reverse mortgage credit line), in a strategy coordinated with the portfolio in a way that offsets the portfolio’s volatility.

Those articles are based on Monte Carlo simulation of the investment performance of securities portfolios and of inflation and on the assumption of annual distributions that are inflation-adjusted to have constant purchasing power. Although, in several of those articles, there has been some mention of the retirees’ residual net worth or their legacy, none has focused specifically on, and explored in depth, the measure of residual net worth or legacy of the retirees considered. Moreover, those articles did not examine the individual components that constitute the retirees’ legacy or net worth and the relative proportions of those components.

This article is in three sections: The first section provides a background, summarizing the results of the earlier work on which the second and third sections are based. The earlier work posited three representative retirees, all having the same *initial* net worth, but with differing initial values of the components of that initial net worth. The results of the earlier work focused on the retirees’ cash flow survival throughout a 30-year retirement. The second section of this article sets out the results of computations of the values of the representative retirees’ legacies, (which would be their net worth amounts), at a range of time points throughout a 30-year retirement. The third section of this article examines the values of the components of the representative retirees’ net worth at the same time points during the 30-year retirement. (The components are the securities portfolio and the home equity.) In this article, as in the previous work, the total value of these assets is expressed by the terms “legacy” and “net worth.” The reason for using two different terms is explained below.

BACKGROUND

This article continues and draws on the previous work (Sacks and Sacks 2012; Neuwirth, Sacks and Sacks 2017; Walker, Sacks, and Sacks 2021) in the following ways:

- As in the previous work, the retirees are assumed to have, as their primary assets available to provide retirement income, a portfolio of securities (typically, but not necessarily, in a 401(k) account or a rollover IRA) and home equity (accessed by a reverse mortgage credit line). In this article, as in the previous work, the total value of these assets is used synonymously with the term “net worth.”

- As in the previous work, two strategies for taking distributions from the assets are compared: One strategy, called the “Coordinated Strategy,” involves the retiree’s establishing the reverse mortgage credit line immediately upon retirement, and taking distributions from the credit line in each year immediately following a year in which the portfolio’s investment performance is negative or weak. The other strategy, called the “Last Resort Strategy,” involves the retiree taking distributions only from the securities portfolio until the portfolio is exhausted, and then (if the portfolio is exhausted) establishing the reverse mortgage credit line and taking all subsequent distributions from that credit line.
- As in some of the previous work, three representative retirees are described, all of whom have the same total net worth at the onset of retirement. The total initial net worth of each retiree is \$1.2 million, consisting of the securities portfolio and home value, as follows:

	Initial Securities	Initial Home
	<u>Portfolio Value</u>	<u>Value</u>
Retiree No. 1	\$400,000	\$800,000
Retiree No. 2	\$600,000	\$600,000
Retiree No. 3	\$800,000	\$400,000

Cash Flow Survival

Using the same analysis as in the previous work, the probability of inflation-adjusted cash flow survival for each of these retirees is shown in figures 1, 2, and 3, respectively. And as in the previous work, the analysis is performed based on the choice of initial distribution amounts that yield a 90% probability of 30-year inflation-adjusted cash flow survival, with constant purchasing power.^{1,2}

It was shown in Neuwirth, Sacks & Sacks (2017) that, when the Coordinated Strategy is used, the dollar amount of cash flow that has a 90 percent probability of surviving throughout a 30-year retirement is roughly the same for a given initial total net worth, irrespective of the

composition of that initial total net worth. This result holds over the entire range of compositions considered.

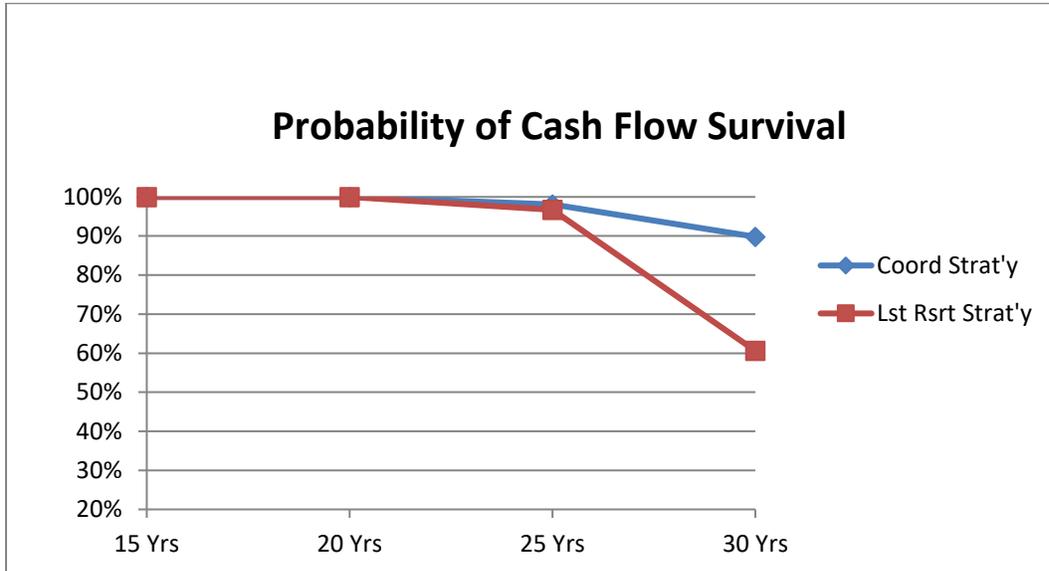


Figure 1 Retiree No. 1. Probability of cash flow survival with initial distribution equal to 8.25 percent of the initial portfolio value, i.e. \$33,000.³

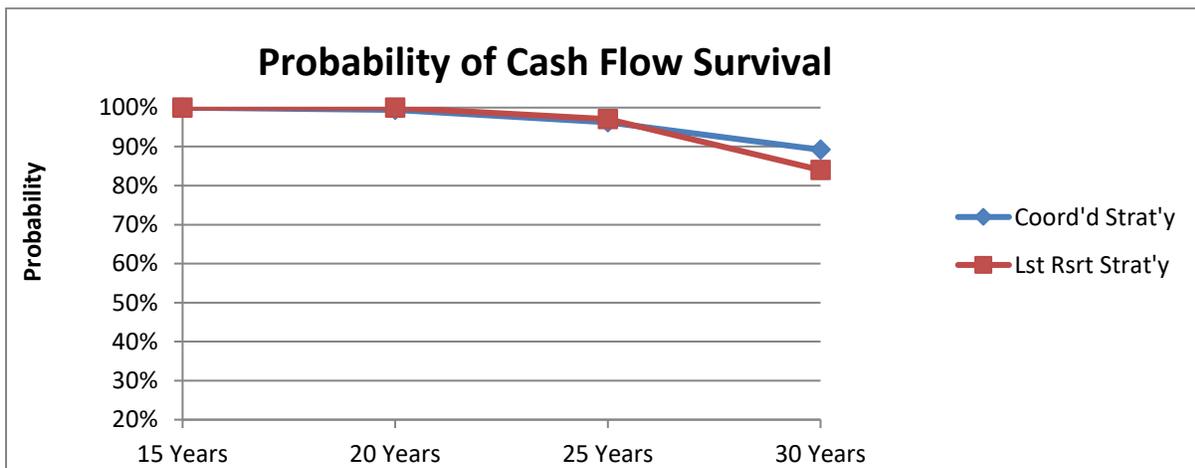


Figure 2 Retiree No. 2. Probability of cash flow survival with initial distribution equal to 5.60 percent of the initial portfolio value, i.e. \$33,600.

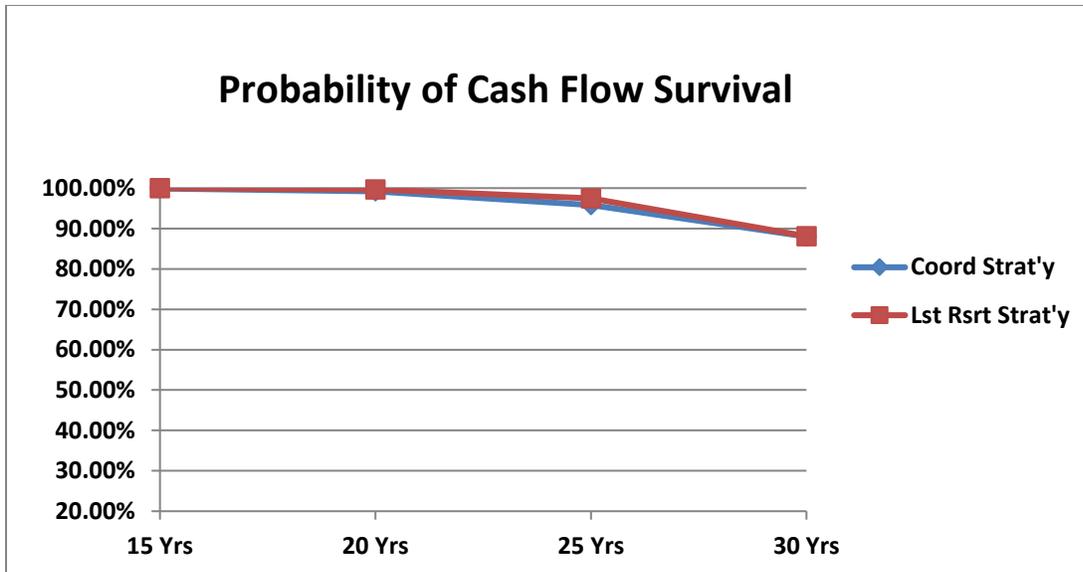


Figure 3 Retiree No. 3. Probability of cash flow survival with initial distribution equal to 4.20 percent of the initial portfolio value, i.e. \$33,600.

The conclusion from these results is that, where the retiree’s initial home value is substantially *greater* than his/her initial portfolio value (Retiree No. 1, shown in Figure 1), the Coordinated Strategy yields a much greater probability of a 30-year cash flow survival than the Last Resort Strategy. Where the retiree’s initial home value is *equal* to his/her initial portfolio value (Retiree No. 2, shown in Figure 2), the Coordinated Strategy yields only a slightly greater probability of a 30-year cash flow survival. Where the retiree’s initial home value is substantially *less* than his/her initial portfolio value (Retiree No. 3, as shown in Figure 3), the two strategies yield essentially the same 30-year cash flow survival probability.

LEGACIES

Histograms

It is quite obvious that over a 30-year period, or even over shorter periods, many different economic outcomes can unfold. Under consideration here are the many possible outcomes of the retiree’s legacy amount (which is equal to his/her total net worth). The term “legacy” is used in this section of the article because, in this section, it is the total value of the sum of the two constituent assets, and not the individual values of those assets, that is considered. (And it is most likely that the heirs or beneficiaries of the retiree would be concerned only with the total value, not with the amounts of the constituent assets.) A Monte Carlo simulation of the different possible outcomes at a single point in time (e.g., at 30 years into retirement) for any given set of initial conditions can be shown in a histogram.

Figures 4 and 5 illustrate such histograms. They represent the time point that is 30 years into retirement, for Retiree No. 3. The horizontal axis indicates the dollar amounts of the various possible outcomes of the retiree’s legacy at that time point. The vertical height of each column in the histogram indicates the percentage of the 2,000 Monte Carlo trials that the legacy amount came out within the range of dollar values shown at the base of the column.

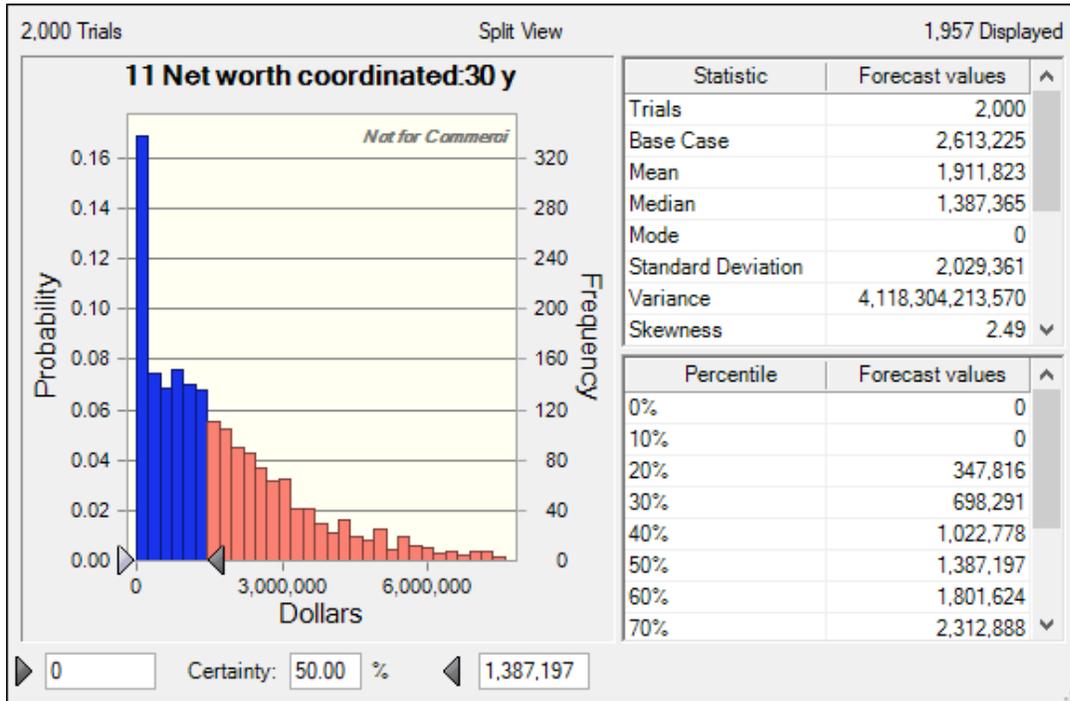


Figure 4: Retiree No. 3. Histogram of Net Worth at 30 years into retirement, where the Coordinated Strategy was used. (The same initial distribution, \$33,600, as used to generate Figure 3.)

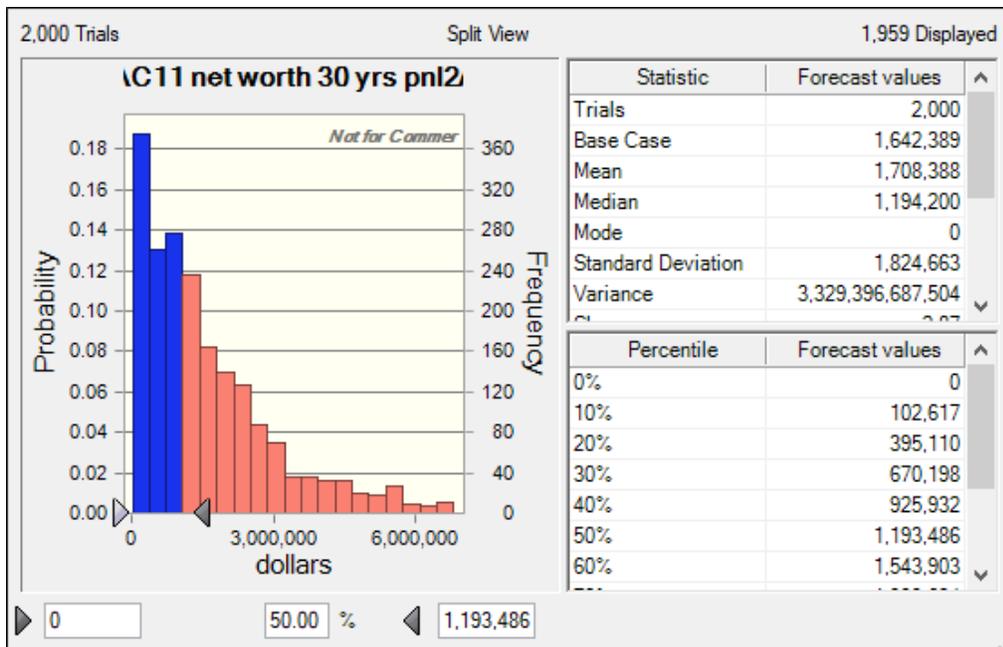


Figure 5: Retiree No. 3. Histogram of Net Worth at 30 years into retirement, where the Last Resort Strategy was used. (The same initial distribution, \$33,600, as used to generate Figure 3.)

This section begins by focusing on Retiree No. 3 because the analysis of cash flow survival shows that this retiree, who has the lowest ratio of home equity to total assets, gets virtually no cash flow sustainability advantage from using the Coordinated Strategy vs. the Last Resort Strategy. However, when legacy and the components of residual net worth are considered, the results show that the Coordinated Strategy is preferable to the Last Resort Strategy.

After consideration of the legacy implications of the two strategies for Retiree No. 3, the legacy implications for Retirees No. 1 and No. 2 will be considered.

Although there is more information in these histograms than can be readily grasped, there are a few important facts to notice:

1. In both of the histograms (Figures 4 and 5), there is a significant number of trials in which, even after distributing money for decades, more value is left as a legacy than the retiree started with.⁴ (The median net worth in Figure 4, showing the results of the Coordinated Strategy, is approximately \$1,387,000, which is more than the \$1,200,000 that the retiree started with, 30 years earlier. And the median net worth in Figure 5, showing the results of the Last Resort Strategy, is approximately \$1,194,000, which is a bit less than the \$1,200,000 that the retiree started with, 30 years earlier.)

2. In both of the histograms, there is also a number of trials in which the retiree has “run out of money,” i.e., has a zero net worth at or before the end of the 30-year period.

3. At the low end of the net worth figures, the Last Resort Strategy histogram (Figure 5) shows a somewhat tighter grouping toward the zero end than the Coordinated Strategy histogram (Figure 4). For example, in Figure 5, at net worths of approximately \$1,544,000 or less, 60 percent of the trials are included, while in Figure 4, it is necessary to increase to net worths of approximately \$1,802,000 or less to include 60% of the trials.

Thus, for Retiree No. 3, even though the cash flow survival probabilities are essentially the same, the likely legacies from the two strategies are somewhat different. But, as will become clear in the third section of this article, for this representative retiree and his/her financial planner, as well as for the other representative retirees and their financial planners, there are more significant differences between the results of the two strategies. And the conclusion will therefore become clearer that, even for Retiree No. 3, the Coordinated Strategy is preferable.

Because it is difficult to readily and quickly draw much useful information directly from the histograms, (especially from a series of histograms from different time points) it is useful to distill these results and consider the medians and the 10th percentiles. (The median is the amount at which the retiree has a 50 percent probability of leaving *at least* that amount as a legacy. The 10th percentile is the value at which the retiree has a 90 percent probability of leaving *at least* that amount as a legacy. So, obviously, the 10th percentile amount is quite a bit less than the median amount.)

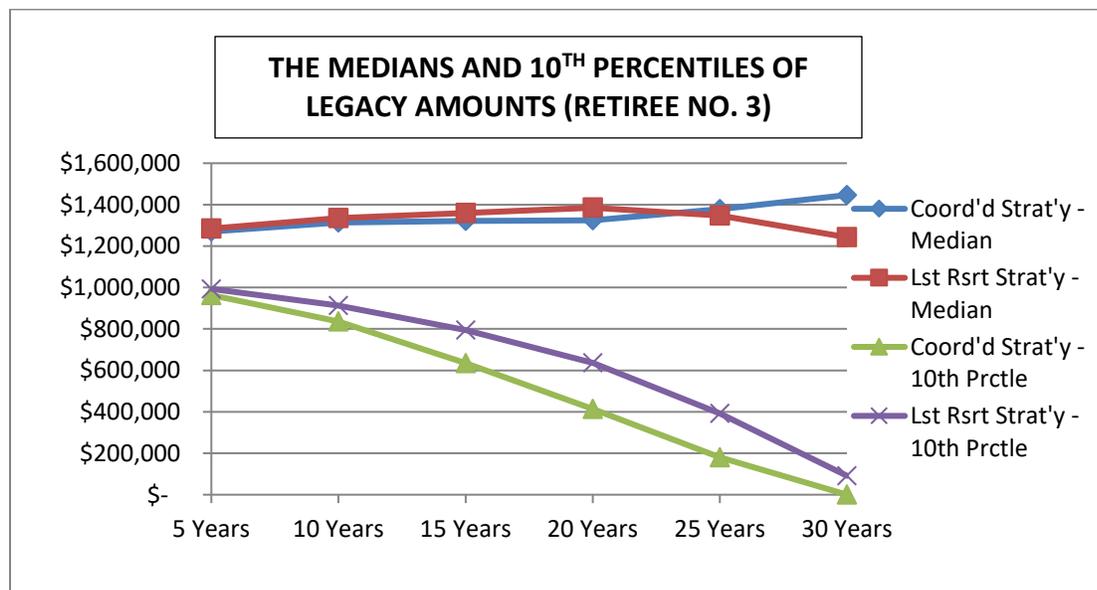


Figure 6: Medians and 10th percentiles of the legacy amounts of Retiree No. 3, at various time points during a 30-year retirement, reflecting the two different distribution strategies.

Discussion of the Legacy of Retiree No. 3:

Retiree No. 3, it is recalled, is the retiree whose initial home value is \$400,000 and whose initial portfolio value is \$800,000. This retiree is the one who has no cash flow survival advantage from using the Coordinated Strategy, as compared with using the Last Resort Strategy. In terms of the median legacy values, there is no significant difference between the results of the two strategies until 25 years into retirement. Indeed, the median results of the two strategies are both gradually increasing from the outset until 25 years into retirement. Beyond 25 years into retirement, though, the median results of the Last Resort Strategy decline as time goes on, but the median results of the Coordinated Strategy continue to increase the rest of the way to 30 years. Thus, there is an advantage, at the median, to the Coordinated Strategy over the Last Resort Strategy, and at 30 years into retirement, the median legacy value result of the Coordinated Strategy is more than \$200,000 greater than the median legacy value result of the Last Resort Strategy.

On the other hand, in the intermediate range of time periods, from about 10 years to about 25 years, the Last Resort Strategy provides some advantage over the Coordinated Strategy in the 10th percentile of legacy amounts.

Most noteworthy, however, for this retiree, is the fact that the median legacy amount (i.e., the median net worth) is *greater* than the initial net worth of \$1.2 million throughout the entire 30-year retirement, irrespective of which of the two distribution strategies is used.

Although all 3 representative retirees started off with same initial net worth, \$1.2 million, those with the greater initial amount in securities (Retirees No. 2 and No. 3) ended up with much greater legacy amounts than the retiree with the least initial amount in securities (Retiree No. 1). This result is reasonable in light of the fact that securities values generally increase over the long term at greater rates than home values.

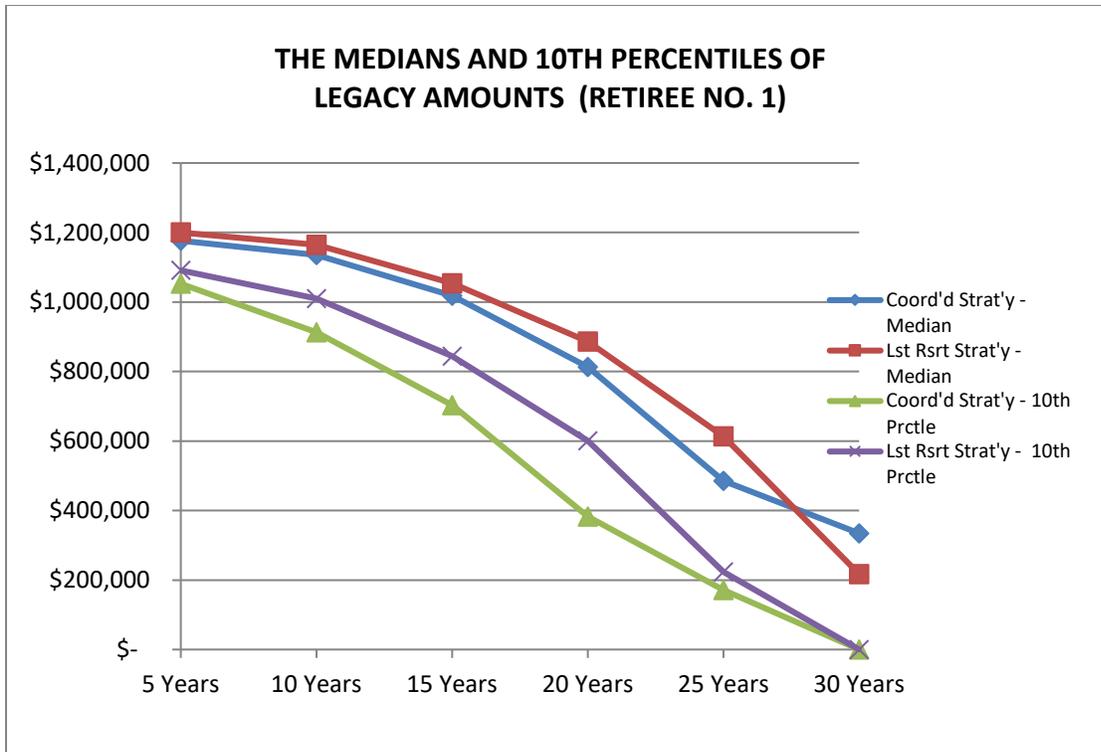


Figure 7. Medians and 10th percentiles of the legacy amounts of **Retiree No. 1**, at various time points during a 30-year retirement, reflecting the two different distribution strategies.

Discussion of the Legacy of Retiree No. 1:

Retiree No. 1, it is recalled, is the retiree whose initial home value is \$800,000 and whose initial portfolio value is \$400,000. This retiree is the one who, in the later years of retirement, has the greatest cash flow survival advantage, by using the Coordinated Strategy, as compared with using the Last Resort Strategy. In terms of the median legacy values, there is no significant difference between the results of the two strategies.

On the other hand, in the intermediate range of time periods, from about 10 years to about 25 years, the Last Resort Strategy provides some advantage in the 10th percentile of legacy amounts over the Coordinated Strategy.

On balance, however, because of the importance of cash flow survival, for Retiree No. 1, the Coordinated Strategy is preferable.

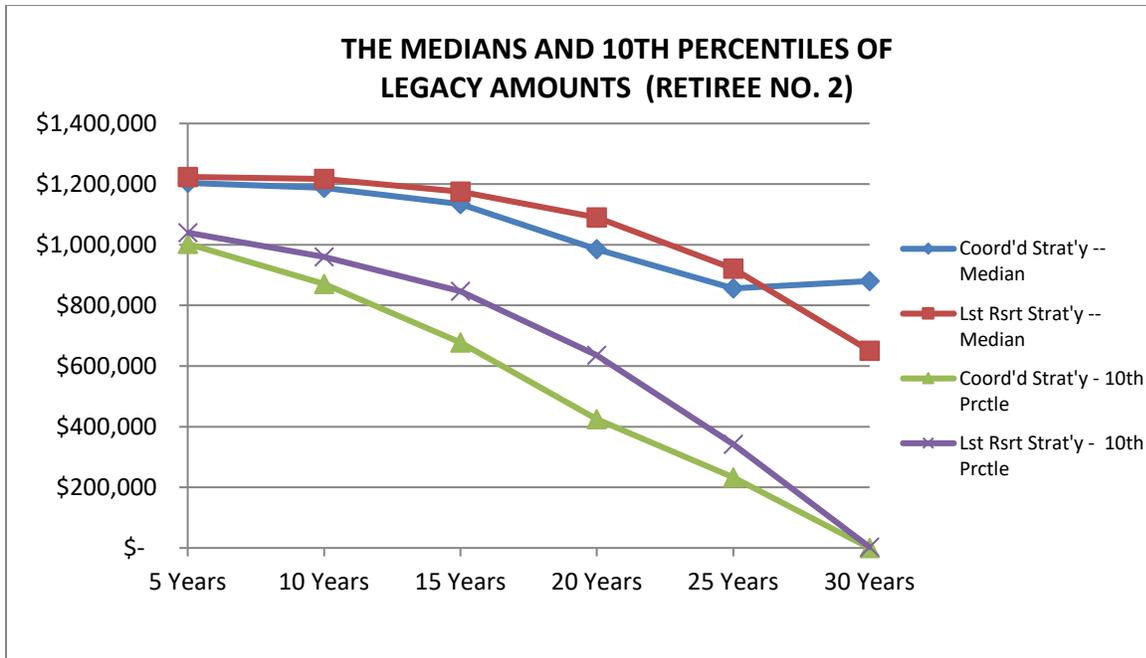


Figure 8. Medians and 10th percentiles of the legacy amounts of Retiree No. 2, at various time points during a 30-year retirement, reflecting the two different distribution strategies.

Discussion of the Legacy of Retiree No. 2:

Retiree No. 2, it is recalled, has equal initial values of the portfolio and the home, both at \$600,000. For this retiree, there is still a slight advantage, in terms of cash flow survival probability, but only in the time period of 25 to 30 years into retirement.

In terms of the legacy amounts, for this retiree the median legacy resulting from the two strategies are essentially the same, except for the time periods beyond 25 years into retirement. At and beyond 25 years into retirement, the Coordinated Strategy provides a substantially greater median legacy than the Last Resort Strategy.

For a brief portion of the intermediate time period, from about 15 years to 20 years into retirement, the 10th percentile legacy is quite a bit greater when the Last Resort Strategy is used than when the Coordinated Strategy is used; but for most of the time periods, both before 15 years into retirement and after 20 years into retirement, the 10th percentile legacy resulting from the Last Resort Strategy is only slightly greater than the 10th percentile legacy resulting from the Coordinated Strategy.

It is also worth noting that, for Retiree No. 2, the median legacy amount resulting from either of the two strategies is greater than \$1 million at 20 years into retirement. By contrast, at 20 years into retirement, for Retiree No. 1, the median legacy amount is closer to \$800,000.

On the other hand, in the intermediate range of time periods, from about 10 years to about 25 years, the Last Resort Strategy provides some advantage in the 10th percentile of legacy over the Coordinated Strategy.

Although all 3 representative retirees started off with same initial net worth, \$1.2 million, those with the greater initial amount in securities (Retirees No. 2 and No. 3) ended up with much greater legacy amounts than the retiree with the least initial amount in securities (Retiree No. 1). This result is reasonable in light of the fact that securities values generally increase over the long term at greater rates than home values.

COMPONENTS OF THE NET WORTH AMOUNTS

In this section of the article, the terminology pivots from “legacy” to “net worth” for the same quantity, which is the sum of the retiree’s portfolio value plus his/her home equity. The reason for this pivot is that the focus of this section is on the *components* of the retiree’s net worth and their significance both for the retiree *and* for his/her financial planner, rather than on the sum of the values of the two components, which is significant for the retiree’s heirs.

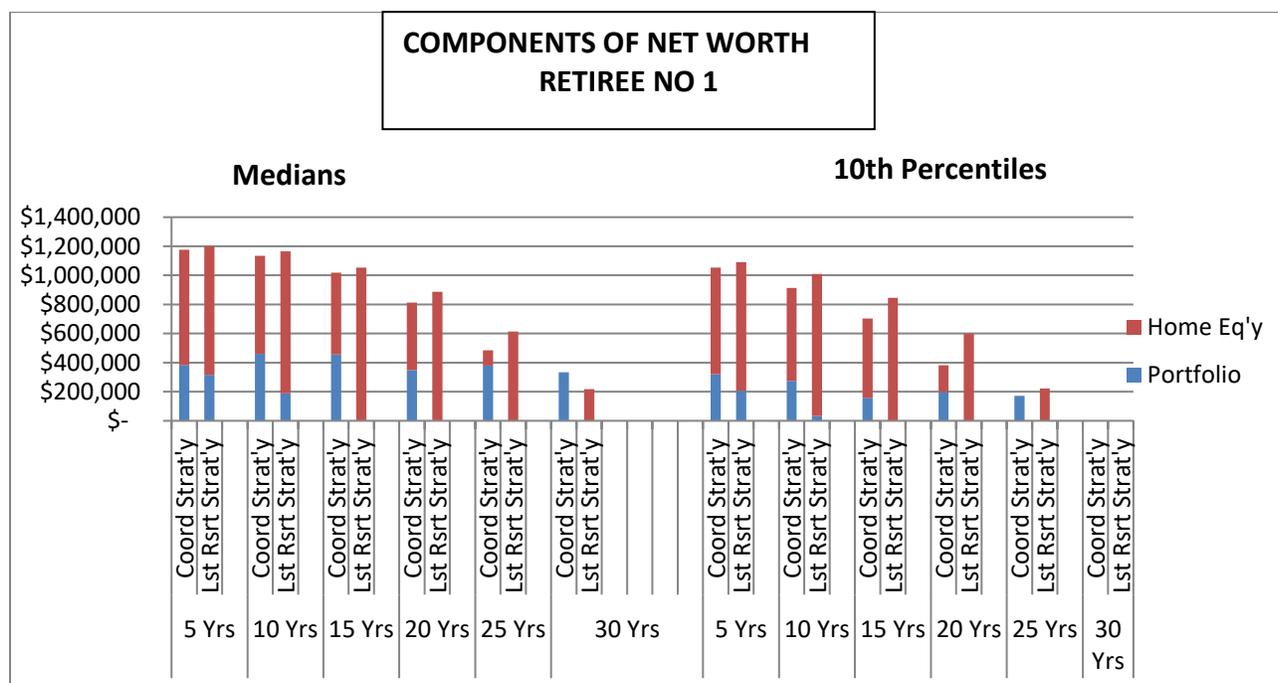


Figure 9: Components of the *Median* and *10th Percentile* net worth of Retiree No. 1, at 5-year intervals during a 30-year retirement, showing the results of the two different distribution strategies.

Discussion of the *Components* of the *Median* and *10th Percentile* Net Worth of Retiree No. 1:

10 Years into Retirement:

By 10 years into retirement, the median net worth of Retiree No. 1 using the Last Resort Strategy includes a substantially reduced amount of securities. Out of a total net worth of almost \$1.2 million, only about \$200,000 is in the securities portfolio. (Recall that this retiree started retirement with \$400,000 in the securities portfolio.) By contrast, this retiree's home equity has increased, from \$800,000 to approximately \$975,000, which is the result of the assumed 2 percent per year appreciation.

It should be noted that whenever the net worth of a retiree using the Last Resort Strategy includes any securities, the value of the home equity is equal to the initial home value, increased by the assumed 2 percent per year appreciation.

On the other hand, at 10 years into retirement, the median net worth of retiree No. 1 using the Coordinated Strategy, also close to \$1.2 million, includes slightly *more* than \$400,000 in securities, which is more than the amount held by this retiree at the outset of retirement.

By 10 years into retirement, the 10th percentile net worth of Retiree No. 1 using the Last Resort Strategy, at value of about \$1 million, has already almost completely depleted the securities portfolio and is almost entirely dependent on home equity for retirement income.

By contrast, at 10 years into retirement, the 10th percentile net worth of Retiree No. 1 using the Coordinated Strategy, at value of about \$900,000, includes about \$300,000 of securities.

15 and 20 Years into Retirement:

By 15 years into retirement, the median net worth of Retiree No. 1 using the Last Resort Strategy includes *no* securities. All of this retiree's net worth is in home equity.

On the other hand, at 15 years into retirement, the median net worth of Retiree No. 1 using the Coordinated Strategy still includes more than \$400,000 in the securities portfolio (i.e., still slightly more than the amount of securities held by this retiree at the outset of retirement).

At 15 years and 20 years into retirement, the 10th percentile net worth of Retiree No. 1 using the Last Resort Strategy, consisting entirely of home equity, noticeably exceeds the 10th percentile net worth of Retiree No. 1 using the Coordinated Strategy. The 10th percentile net worth of this retiree using the Coordinated Strategy consists of about 25 percent securities (at 15 years) and about 50 percent securities (at 20 years).

25 Years into Retirement:

At 25 years into retirement, the median net worth of Retiree No. 1 using the Coordinated Strategy still includes about \$100,000 of home equity, while the median net worth of this

retiree using the Last Resort Strategy consists entirely of home equity. At the 10th percentile, the net worth of this retiree using the Coordinated Strategy consists only of securities, and the net worth of this retiree using the Last Resort Strategy consists only of home equity.

30 Years into Retirement:

At 30 years into retirement, the median net worth of Retiree No. 1 using Last Resort Strategy and this retiree using the Coordinated Strategy have nearly equal values. However, the median net worth of this retiree using the Coordinated Strategy consists entirely of securities, while the median net worth of this retiree using the Last Resort Strategy consists entirely of home equity.

At 30 years into retirement, the 10th percentile net worth of Retiree No. 1 using either strategy is essentially exhausted.

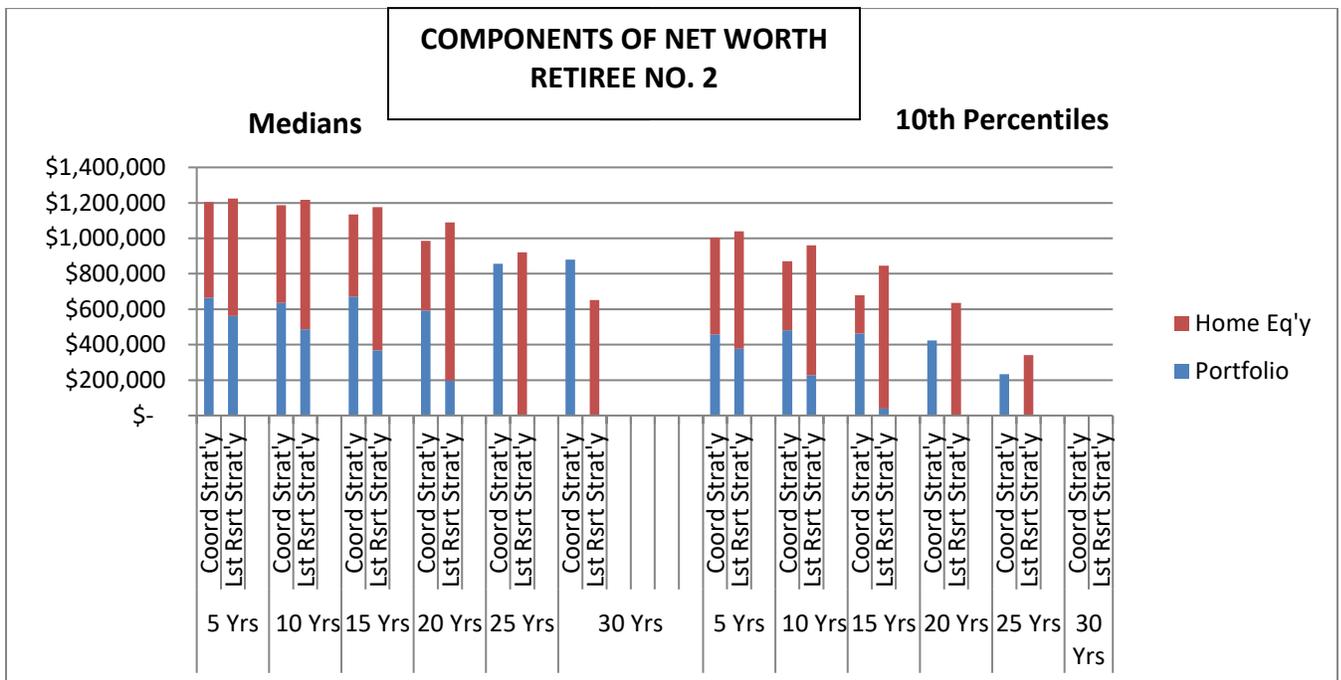


Figure 10: Components of the *Median* and the *10th percentile* net worth of Retiree No. 2, at 5-year intervals during a 30-year retirement, showing the results of the two different distribution strategies.

Discussion of the *Components* of the Median and 10th Percentile Net Worth of Retiree No. 2:

5 Years into Retirement:

At 5 years into retirement, the median Net Worth of Retiree No. 2 is about the same whether using the Coordinated Strategy or using the Last Resort Strategy, and remains about equally allocated between the securities portfolio and home equity. The same is true of the 10th percentile net worth.

10 Years into Retirement:

Through 10 years into retirement, the median net worth of Retiree No. 2 using the Coordinated Strategy and using the Last Resort Strategy retain essentially equal net worth values *and* approximately equal values of the securities portfolio and of home equity.

On the other hand, by 10 years into retirement, the 10th percentile net worth of Retiree No. 2 using the Last Resort Strategy consists largely of home equity, while the 10th percentile net worth of this retiree using the Coordinated Strategy still consists of equal parts securities and home equity.

15 Years into Retirement:

By about 15 years into retirement, the median net worth of Retiree No. 2 using the Coordinated Strategy consists of substantially more securities than of home equity, while the median net worth of this retiree using the Last Resort Strategy consists primarily of home equity.

At the same time, i.e., at 15 years into retirement, the 10th percentile net worth of Retiree No. 2 using the Last Resort Strategy consists entirely of home equity, while the 10th percentile net worth of this retiree using the Coordinated Strategy consists of about 2/3 securities and 1/3 home equity.

25 Years into Retirement:

By 25 years into retirement, at the median of net worth, the entire net worth of Retiree No. 2 using the Coordinated Strategy is in the securities portfolio. On the other hand, at the median of net worth, the entire net worth of this retiree using the Last Resort Strategy is in home equity.

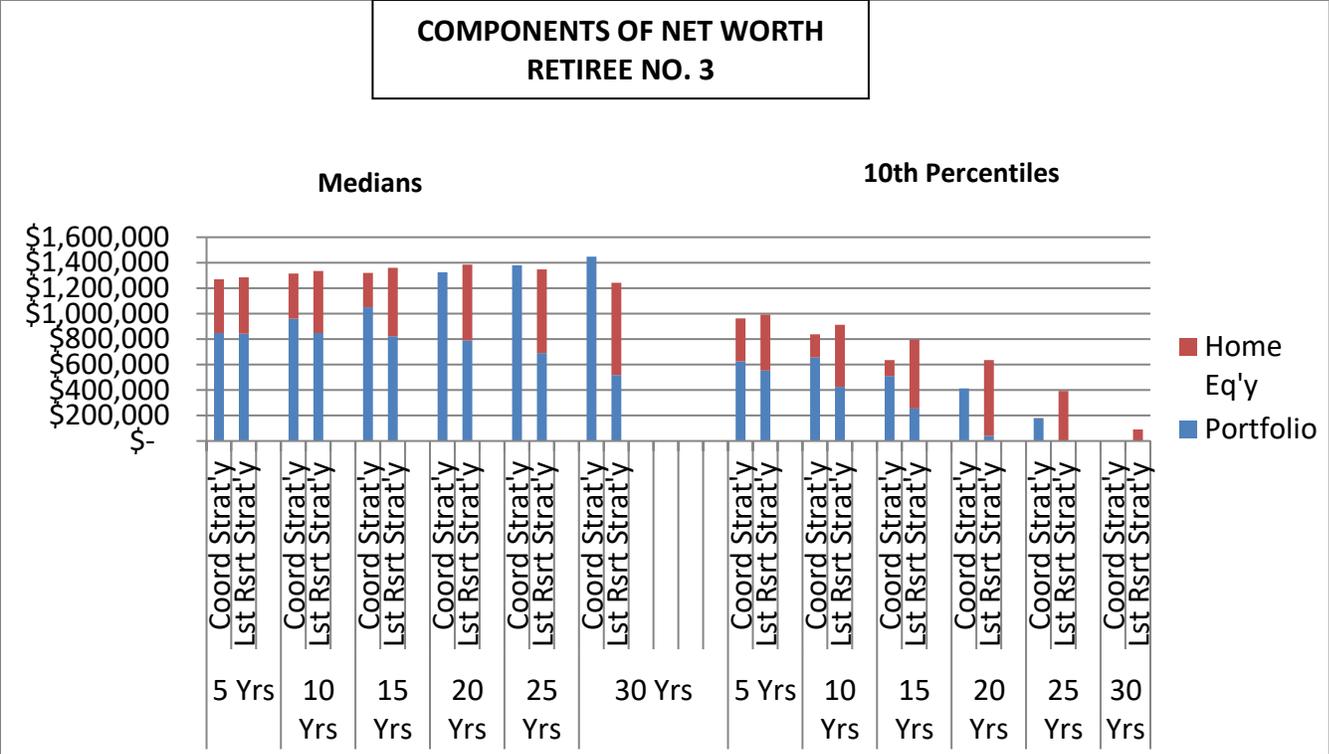


Figure 11: Components of the *Median* net worth and 10th Percentile net worth of Retiree No. 2, at 5-year intervals during a 30-year retirement, showing the results of the two different distribution strategies.

Discussion of the *Components* of the Median and 10th Percentile Net Worth of Retiree No. 3:

5 Years into Retirement:

At 5 years into retirement, the median Net Worth of Retiree No. 3 using the Coordinated Strategy and of this retiree using the Last Resort Strategy are about equal, and the initial allocation between securities portfolio and home equity continues approximately unchanged. The same is true of the 10th percentile net worth of this retiree using either of the two strategies.

10 Years into Retirement:

After 10 years of retirement, the median net worth of Retiree No. 3 is essentially the same whether using the Coordinated Strategy or the Last Resort Strategy, but the proportion of the net worth represented by the securities portfolio is somewhat greater for this retiree using the Coordinated Strategy for this retiree using the Last Resort Strategy.

By 10 years into retirement, the 10th percentile net worth of Retiree No. 3 using the Last Resort Strategy consists of about equal amounts of home equity and securities, but that of Retiree No. 3 using the Coordinated Strategy consists mostly of securities.

15 Years into Retirement:

By 15 years into retirement, both the median and 10th percentile net worth of Retiree No. 3 using the Coordinated Strategy consists almost entirely of securities while the median and 10th percentile net worth of this retiree using the Last Resort Strategy consists of an approximately even mix of home equity and securities.

20 Years into Retirement:

By 20 years into retirement, at the median and 10th percentile, the entire net worth of Retiree No. 3 using the Coordinated Strategy is in the securities portfolio. Under the Last Resort Strategy, the median net worth of this retiree is evenly divided between the portfolio and home equity, while at the 10th percentile, the net worth of this retiree using the Last Resort Strategy is entirely in home equity.

25 Years into Retirement:

At 25 years into retirement, the median and the 10th percentile net worth of this retiree using the Coordinated Strategy is entirely in the securities portfolio. The median net worth of this retiree using the Last Resort Strategy is still partly in securities, meaning that the home equity is still unencumbered and equal to about \$656,000 (i.e., \$400,000 increased at the rate of 2 percent per year for 25 years). The 10th percentile net worth of this retiree using the Last Resort Strategy no longer has any securities.

30 Years into Retirement:

At 30 years into retirement, the median net worth of this retiree using either strategy is greater than the initial net worth, but the 10th percentile net worth is essentially exhausted. That is a result of the greater volatility of securities as compared to home equity.

THE SIGNIFICANCE OF THESE RESULTS

These results are significant both for the retirees *and* for their financial advisors. Most relevant is the fact that a portfolio of securities is much more flexible and manageable, financially, than a home. Therefore, if the financial climate changes, and/or if the retiree's personal circumstances change, the financial advisor can recommend, and implement, adjustments and changes in the retiree's securities portfolio to accommodate to such changes. On the other hand, if the retiree has no securities left, there is not much that the financial advisor can do. So, if, for any given net worth, the retiree has more value in the securities portfolio, there is more

that an advisor can do to assist the retiree to adjust to changing economic and financial conditions.

It is significant that the initial distribution percentages considered here are much higher than allowed by the classic 4 percent rule. At these higher percentages, 30-year inflation-adjusted cash flow survival probabilities, when the Coordinated Strategy is used (and in certain cases also when the Last Resort Strategy is used), are still approximately equal to 90 percent. However, when the Last Resort Strategy is used, the securities portfolio is generally exhausted years before (and even decades before) the end of the 30-year retirement. Leaving the retiree entirely dependent on home equity as the source of cash for living expenses is not a desirable result, making it difficult for the financial planner to provide useful assistance for the retiree.

These graphs showing the components of net worth, the compositions of the medians and the 10th percentiles, illustrate the benefit of the Coordinated Strategy across a broad range of ratios of home equity value to portfolio value.

This benefit improves the retirement prospects of the retiree and the flexibility of the retiree's financial planner and/or investment manager. Specifically, it enables the planner/manager to help the retiree to have sustainable income, and to adjust to economic and financial changes throughout a long retirement.

CONCLUDING THOUGHTS

It is clear from the foregoing that the legacy that all three representative retirees can expect to leave to their heirs is at least as good, and sometimes better, when the Coordinated Strategy is used than when the Last Resort Strategy is used, in terms of the nominal values of the legacies, and especially in terms of the components of the legacies. When net worth throughout retirement is considered, the advantages of the Coordinated Strategy, for both the retiree and for his/her financial planner, are even clearer.

Finally, while not addressed here, the results outlined above strongly suggest that the Coordinated Strategy is preferable to the Last Resort Strategy as a means of addressing the other two unique risks during the decumulation phase of life: unpredictable contingent expense ("UCE" is the possibility that retirees will experience at some point an unexpected temporary spike in living expenses) and longevity risk that will become apparent only in the middle period of retirement, if the retiree remains healthy after several years of drawing retirement income.

UCE risk can be seen as amplifying sequence of returns ("SOR") risk and, as was shown clearly in Walker, Sacks, and Sacks 2021, the use of the Coordinated Strategy directly addresses SOR risk by the use of a HECM as a "buffer asset."

With respect to longevity risk, more research is necessary. But, to the extent assets will need to be deployed in the middle of retirement to address longevity risk when it first becomes apparent i.e. when after several years of retirement the retiree is still healthy, then using the Coordinated Strategy may provide the means to purchase longevity insurance (e.g. a QLAC). Such purchase could more readily be made from the larger liquid securities portfolio component of net worth provided by the Coordinated Strategy than provided by the Last Resort Strategy. Meanwhile, the home equity could continue to be used as a buffer asset to protect against SOR and UCE risks.

Appendix:

THE MONTE CARLO SIMULATION is based on six asset classes in the securities portion of the portfolio. Each of these asset classes is individually simulated, and inflation, also, is simulated. All are assumed to have normal distributions, with the following means and standard deviations. The home equity notionally included in the portfolio is based on the initial value specified and is assumed to grow at a 2

percent annual rate. It is assumed to be accessed by a reverse mortgage credit line, the interest on which is equal to the one-year Treasury bill (simulated) plus a 2.5 percent margin. The securities portion of the portfolio is assumed to be rebalanced annually. (As a result of the rebalancing, bonds are sometimes sold at a loss, hence the standard deviation can spread the normal distribution into negative territory.)

The asset classes and their means and standard deviations used are the following:

Asset Class	Percent of Portfolio	Mean	Standard Deviation
U.S. Large-Cap Stock (S&P 500)	40%	7.00%	20.00%
U.S. Small-Cap Stock (Ibbotson)	10%	7.70%	22.00%
MSCI EAFE (International Stock)	10%	8.85%	22.50%
Long-Term Government Bonds	10%	3.30%	12.00%
Intermediate-Term Bonds	15%	3.50%	6.50%
One-year Treasury Bills	15%	3.30%	2.00%
Inflation		2.00%	1.50%

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¹ The choice of a 90 percent probability as an "acceptable" level is a somewhat arbitrary trade-off between extreme security with low cash flow, on the one hand, and greater risk with higher cash flow, on the other hand.

² It should be noted that, although these results are qualitatively very similar to the results shown in the past work, the results are quantitatively slightly different. The differences arise from two changes: One change is the increase in the "maximum claim amount" which is the maximum amount of home value that can be considered for a HECM reverse mortgage, which in 2022 increased from \$822,375 to \$970,800; The other change is a slight increase, at the time of this writing, of the "expected interest rate," which results in a slight decrease in the "principal limit factors." The principal limit factors, in turn, determine the percentage of the home value that is equal to the initial amount of the reverse mortgage credit line.

³ The initial distribution amount is determined by trial-and-error to find the amount that results in an approximately 90 percent probability of a 30-year cash flow survival. The slightly lower dollar figure for the initial distribution to Retiree No. 1 (who has the greatest initial home value) than for the other two representative retirees initial distribution probably is the result of the fact that the up-front costs for the reverse mortgage for this home is greater than for the other two representative retirees, and hence leaves a little less of the initial cash available for distribution.

⁴ It should be noted that these net worth and legacy values, which are set out at times after, and even long after, the onset of retirement, are nominal values, not adjusted for inflation.