



CANNEX RESEARCH

How To Spend More in Retirement Safely: The CANNEX Adaptive Withdrawal Strategy

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How To Spend More in Retirement Safely: The CANNEX Adaptive Withdrawal Strategy

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Contents

- Executive Summary 1**
- Objective 2**
- Background 2**
 - Fixed Percentage Strategy..... 2
 - Approaches for Withdrawal Calculations 3*
 - Required Minimum Distribution Strategy 3
 - CANNEX Adaptive Withdrawal Strategy 4
- Research Methodology 4**
 - Cash Flow from Specific Sequences..... 5
 - Relative Value of Withdrawal Strategies..... 5
 - The Utility Model 5*
- Results 6**
 - Average Total Income..... 6
 - Fixed Percentage Strategy..... 6
 - RMD Strategy..... 7
 - CANNEX Adaptive Withdrawal Strategy 7
 - Effect of Guaranteed Income Amount on CANNEX Adaptive Withdrawal Strategy..... 8*
 - Portfolio Depletion Times 9
 - Cash Flow Samples 10
 - Relative Value of Withdrawal Strategies 11
- Discussion 11**
 - What Happens in Qualified Accounts? 12
- Conclusions 13**
- Appendix 15**
- Bibliography 18**

Exhibits

- Exhibit 1 Average Total Income 6
- Exhibit 2 Withdrawals Based on Different Guaranteed Income Amounts 8
- Exhibit 3 Portfolio Depletion Times 9
- Exhibit 4 Total Income Using Three Market Sequences 10
- Exhibit 5 Relative Value of Withdrawal Strategies 11
- Exhibit 6 Average Total Income for Varying Income Levels with CANNEX Adaptive Withdrawal Strategy..... 15
- Exhibit 7 Performance Illustrations Based on Three Market Sequences..... 15

EXECUTIVE SUMMARY

Systematic withdrawals serve as one means to take retirement income from savings. CANNEX has patented a process for withdrawals that is designed to allow retirees to get greater use of savings earlier in retirement, while taking into account multiple variables, including risk tolerance; retirement savings; and sources of guaranteed income, such as social security, pensions, and annuities. Accounting for guaranteed income is especially important because it greatly affects withdrawal policy in retirement but is often absent in other withdrawal strategies.

This study compares the performance of the CANNEX Adaptive Withdrawal Strategy against two methods: a fixed withdrawal strategy based on a starting withdrawal of 4% introduced by William Bengen that has become a common rule of thumb; and the recommendation to use the required minimum distribution (RMD) amounts dictated by the IRS to determine annual withdrawals.

We analyze the withdrawal strategies using stochastic modeling to simulate realistic market conditions. We assume that there is also guaranteed income from social security or other sources, which affects the withdrawal amounts using the CANNEX Adaptive Withdrawal Strategy.

In this CANNEX study, we found that:

- With the CANNEX Adaptive Withdrawal Strategy, the average income is highest at the beginning of retirement and declines gradually in later years. The strategy rewards the client with higher income in rising markets and adjusts spending in declining markets.
- The trajectory of withdrawals from the RMD method provides lower income early in retirement and higher income later in retirement, with withdrawal amounts on average reaching their peak very late in retirement, after age 90.
- Bengen did not intend for the fixed withdrawal strategy to constitute ongoing guidance for clients, so it should not replace professional advice or customized methods.
- All else being equal, money will run out later for a risk-averse individual. The earliest the fixed withdrawal strategy runs out of money is 21 years into retirement (age 86). The earliest the CANNEX Adaptive Withdrawal Strategy runs out of money is 33 years (age 98). The earliest the RMD method effectively runs out of money is 46 years (age 111).
- The RMD calculation uses actuarial tables to establish withdrawal amounts from the current portfolio value, so it is adjusted more than a fixed percentage but does not take into account other income sources or an individual's risk tolerance.
- The use of advanced mathematical techniques to design customized withdrawals for retirees gives them permission to spend their savings during retirement.

OBJECTIVE

The objective of this research is to determine the difference in receiving retirement income when using an adaptive withdrawal strategy over a more traditional static withdrawal strategy or an approach that uses the required minimum distribution rates. An adaptive strategy can be designed to make best use of retirement savings while maintaining sustainability by using the mathematical representation of consumer satisfaction (the technical term is the utility of consumption).

Governed by understandable concern about the possibility of running out of money during retirement, retirees may choose a conservative withdrawal strategy. This also means that they do not derive the most satisfaction from their savings and underutilize those assets, particularly early in retirement; lower withdrawal rates reduce the risk of running out of money but simultaneously reduce the total income taken during retirement.

Rules of thumb are convenient and they make good topics for personal finance articles for consumers anxious for security and comfort in a simple form. However, static rules fail to provide an adaptive and customized withdrawal strategy and are likely to result in less satisfaction during retirement.

A dynamic solution that takes into account guaranteed income—through pensions or annuities—and adapts a withdrawal rate based on age, health, risk preferences, and account value can potentially maximize a retiree's satisfaction (as measured by utility of consumption) while taking into account appropriate sustainability. Our aim is to not simply have enough to survive retirement but to have spendable income available when it is most desirable during retirement.

Lower spending rates early in retirement also lower retirement income at the point most retirees are most active and want to take advantage of the previous years of thrift that resulted in the accumulation of a nest egg. However, higher withdrawal rates make sense later in retirement because the remaining money does not have to last as long. No rule of thumb will navigate

these considerations effectively; an alternative solution gives investors a spending profile that will make better use of savings during retirement.

BACKGROUND

Systematic withdrawals are a common practice for decumulating assets built up for retirement. The process of building up assets is straightforward; savers have a defined window of time within which to decide the acceptable balance between immediate spending goals and the longer-term aim of setting aside money for the future by making short-term sacrifices. Most workers may not have a fixed retirement date but can reasonably estimate that target. For some, it is feasible to prolong working and continue saving in order to avoid drawing on assets or to increase the nest egg.

The process of planning the retirement spend-down is much more difficult for several reasons. First, people do not know how long they will live and therefore how to allocate spending during retirement. Unlike the start of retirement, the end date for needing retirement income is not easily altered. Second, sequence of returns risk, compounded by constant withdrawals from the account, poses a real risk to the sustainability of the portfolio.

Fixed Percentage Strategy

William Bengen, a fee-only financial planner, validated the use of a fixed percentage withdrawal strategy that effectively, though unintentionally, resulted in a rule of thumb. In 1994, Bengen published a paper in the *Journal of Financial Planning*, "[Determining Withdrawal Rates Using Historical Data](#)," that concluded that a 4.0% withdrawal rate (adjusted annually for inflation) based on initial total retirement assets, in an allocation between 50% equity-50% bond and 75% equity-25% bond, will provide sustained income while avoiding the risk of fully depleting savings for at least 30 years. He later revised that figure to 4.5% for a non-taxable portfolio. In the intervening years, some follow-up work has supported the 4.0% rule and, at times, a

Approaches for Withdrawal Calculations

The evolution of strategies used for systematic withdrawals reflects increasing sophistication in advisor and consumer expectations and the availability of methods that better help achieve planning goals. Adaptive withdrawal strategies reflect the most advanced contemporary approach. Like the CANNEX Adaptive Withdrawal Strategy, the J.P. Morgan Dynamic Retirement Income Withdrawal Strategy uses the concept of utility (satisfaction) to drive withdrawals, but bases this on a different utility equation.

| Withdrawal Calculation Style | Characteristics | Examples |
|------------------------------|--|---|
| Static | Fixed methodology at outset that does not take any client or market-related variables into account | Flat percentage (3.0%, 4.0%) based on starting wealth; Flat percentage based on starting wealth and adjusted every year for inflation |
| Adjusted | Linked to basic factors like market changes or mortality but not customized to client specifics | Flat percentage (3.0%, 4.0%) based on current account value; Required minimum distribution withdrawals |
| Adaptive | Customized and dynamic to specific client criteria and updated throughout retirement | CANNEX Adaptive Withdrawal Strategy; J.P. Morgan Dynamic Retirement Income Withdrawal Strategy |

3.0% withdrawal rate has emerged as a common recommendation.

The fixed percentage withdrawal strategy is a blunt tool to solve for retirement income needs. Whether the percentage is applied to the starting principal or is calculated against the current account value, it does not provide any adaptation to prevailing markets. Other researchers have examined the flaws of the fixed percentage withdrawal strategy (see the Bibliography). The subsequent reduction in the recommended withdrawal rate to 3.0% reflects the fact that this approach becomes an exercise in figuring out how much excess is necessary to self-insure against full depletion. At the same time, the risk of depletion persists in extreme market scenarios.

One justification of this strategy is that it incorporates a legacy aim, as it often results in a significant residual account value. However, this mindset splits the difference between a focus on covering retirement needs and leaving assets to heirs. Without deploying assets with purpose and specific goals, there is a muddiness to the planning that is not necessary in an era rife with tools.

For historical perspective, Bengen presented his strategy

at a time when financial planning tools and software were not widely available and where many advisors were happy to have a simple and quantitatively tested guideline. Furthermore, his research was done from the perspective of an advisor who provides ongoing guidance and monitoring for clients. Bengen was not searching for a replacement for professional advice. Results for the higher withdrawal percentages served as a warning for clients who were starry eyed with average investment returns and needed compelling evidence to curb unrealistic spending.

Required Minimum Distribution Strategy

Research from the Stanford Center on Longevity promotes the use of the Internal Revenue Service's required minimum distribution (RMD) schedule as a blueprint for systematic withdrawals, though the idea predated that work. Conceptually, the RMD schedule is intended to assure that the money saved in retirement accounts is used for retirement and not simply accumulated indefinitely with taxes deferred. As such, it spreads out distributions across a retiree's anticipated lifetime without depleting assets. Because of the design of the RMD schedule, this

approach incorporates longevity expectations into the calculations and is based on the current account value, therefore adjusting to market performance. That said, it does not incorporate any investor preference.

The Stanford Center on Longevity study, "[Optimizing Retirement Income by Integrating Retirement Plans, IRAs, and Home Equity](#)," provides a comprehensive analysis on optimizing multiple sources to maximize retirement income. The study points out that the contribution of home equity and the timing of social security payments are important factors for success, especially for lower-income and middle-income Americans. The implementation of the RMD schedule, which is more sophisticated than a flat percentage, improves the sustainability of the portfolio and the rates are readily available from the IRS.

Despite its strengths, the RMD-based strategy does not optimize for the particular circumstances of the individual retiree, such as an individual's risk preferences. The Stanford Center on Longevity study does acknowledge that strategies that do so would be more efficient but does not include quantitative validation of a particular method.

CANNEX Adaptive Withdrawal Strategy

CANNEX has patented ([US 8,781,937 B2](#)) an adaptive withdrawal strategy (the "CANNEX Adaptive Withdrawal Strategy") that increases the utilization of retirement savings. The patent was developed by Dr. Moshe Milevsky and Dr. Huaxiong Huang, of the QWEMA Group, since purchased by CANNEX. The patent relies heavily on their work published in "Spending Retirement on Planet Vulcan: The Impact of Longevity Risk Aversion on Optimal Withdrawal Rates," which is included in the bibliography among other noteworthy works in this area. The strategy boosts spending in earlier years when retirees are most likely to be alive and declines gradually over time, smoothly merging into guaranteed income. Incidentally, this also coincides with the time when they are more active; some retirement income approaches now focus on weighting spending to these earlier years on that basis alone.

This model takes into account the effect of guaranteed lifetime income and adjusts consumption accordingly, also calibrating for risk tolerance. With more guaranteed lifetime income, the spend-down of assets is also higher; if there is no lifetime income, the strategy adapts to be more conservative so as to sustain income from the portfolio longer. A key differentiator with this method is that it introduces high spending early on. It also accounts for individual risk preferences, a factor that is absent from both fixed percentage and RMD withdrawal strategies.

In addition, the CANNEX Adaptive Withdrawal Strategy does not assume or integrate a bequest intent. If a retiree is interested in leaving money for heirs, that goal must be dealt with separately and is not considered as part of the withdrawal recommendation.

RESEARCH METHODOLOGY

Our study analyzes the withdrawal strategies for the following three SWPs:

- Fixed percentage (4%) of the starting principal, adjusted annually for inflation;
- RMD rate applied to the account value;
- CANNEX Adaptive Withdrawal Strategy.

The scenario assumes a 65-year-old with a \$1,000,000 investment portfolio, allocated 60% equity-40% bond. An assumption of 2% constant inflation results in underlying performance assumptions for the portfolio of 4.4% real returns and 8.4% volatility.

Withdrawals are taken every month for all strategies. We calculate the withdrawal rate for the CANNEX Adaptive Withdrawal Strategy each month. The RMD and fixed withdrawal amounts are calculated once at the beginning of the year and we base the monthly withdrawals on this amount.

We define portfolio depletion as the point when the monthly withdrawal becomes minimal. Using a benchmark of 5% of the original portfolio, this amounts to the month in which the account balance falls below \$4,167. The choice is somewhat arbitrary,

but we expect a retiree to withdraw all remaining money from a portfolio once it is no longer contributing meaningfully to income.

The returns sequences are randomly generated with the above portfolio returns and volatility parameters.

We assume annual guaranteed income starting at \$25,200 (in today's dollars), which could be either social security alone or a combination of social security and a pension or an inflation-adjusted annuity. The \$25,200 total is above average for social security alone but less than the maximum rate. The figures are adjusted to today's dollars.

The total income for all strategies reflects the guaranteed income plus withdrawals. An advantage of using real (today's) dollars is that one can compare the purchasing power of the individual over the course of retirement.

The guaranteed income amount plays an important role in determining the withdrawal for the CANNEX Adaptive Withdrawal Strategy. To test the changes in average withdrawals based on different guaranteed

income, we also ran analyses based on no guaranteed income and double of the scenario (\$50,400) while keeping the portfolio amount the same.

Cash Flow from Specific Sequences

In addition to the stochastic modeling, we also examine 30 years of cash flow in current dollar values for three standard sequences that CANNEX uses to illustrate bear, bull, and moderate markets. Bear in mind that these sequences are intended to show how these strategies behave in different types of markets but do not predict any particular outcome. There is no expectation that an extreme market scenario would extend over a 30-year period, but these sequences highlight performance differences under these conditions.

Relative Value of Withdrawal Strategies

In our analysis, the simulations produce various cash flow streams for each of the three strategies. On their own, it is difficult to compare cash flows themselves. To do so, we rely on a mathematical utility model that also drives the spending calculations of the CANNEX

The Utility Model

To determine the spending that would give the retiree the most satisfaction, the CANNEX Adaptive Withdrawal Strategy uses a mathematical utility model. In this case, it is the constant relative risk aversion (CRRA) utility model using a risk aversion parameter assumed to be 2; this is commonly used in this type of work and is used in many of the studies that appear in the Bibliography.

In addition to being a central component to the CANNEX Adaptive Withdrawal Strategy, we can use the utility function, which is the measure of client satisfaction, as a basis for comparison of different strategies. Similar comparisons appear elsewhere (see Sheikh, et al., 2014), and we apply a version of this approach using the certainty equivalent of consumption that simplifies comparison of the relative value of a strategy to the retiree (for a good explanation of this aimed at non-economists, see "[Risk Attitude & Economics](#)," by Laura Concina).

To do this, we calculate the certainty equivalent of consumption by first computing the average of the normalized aggregate utility for each of the strategies. We then invert the utility function to arrive at the certainty equivalent value (CEV). We then compute a relative measure defined as the ratio of the CEV of each strategy to the CEV of the CANNEX Adaptive Withdrawal Strategy. By definition, this relative measure is equal to 1 for the CANNEX strategy. If a strategy is superior to the CANNEX strategy, then it is greater than 1; conversely, if a strategy performs poorly compared to the CANNEX strategy, then the measure is less than 1. Thus, we can now compare how the three strategies stack up against one another.

Adaptive Withdrawal Strategy. A more detailed explanation of the model and how we can use this to calculate relative value appears in The Utility Model (page 5).

RESULTS

Average Total Income

The analysis provides the average total income for each method. This includes both the amount generated from the withdrawal strategy and the guaranteed income. The guaranteed income is identical across all methods. These results are adjusted to current dollars and represent averages, so results for individual market sequences vary from this figure, often significantly. Exhibit 1, below, shows the average total income for each of the strategies.

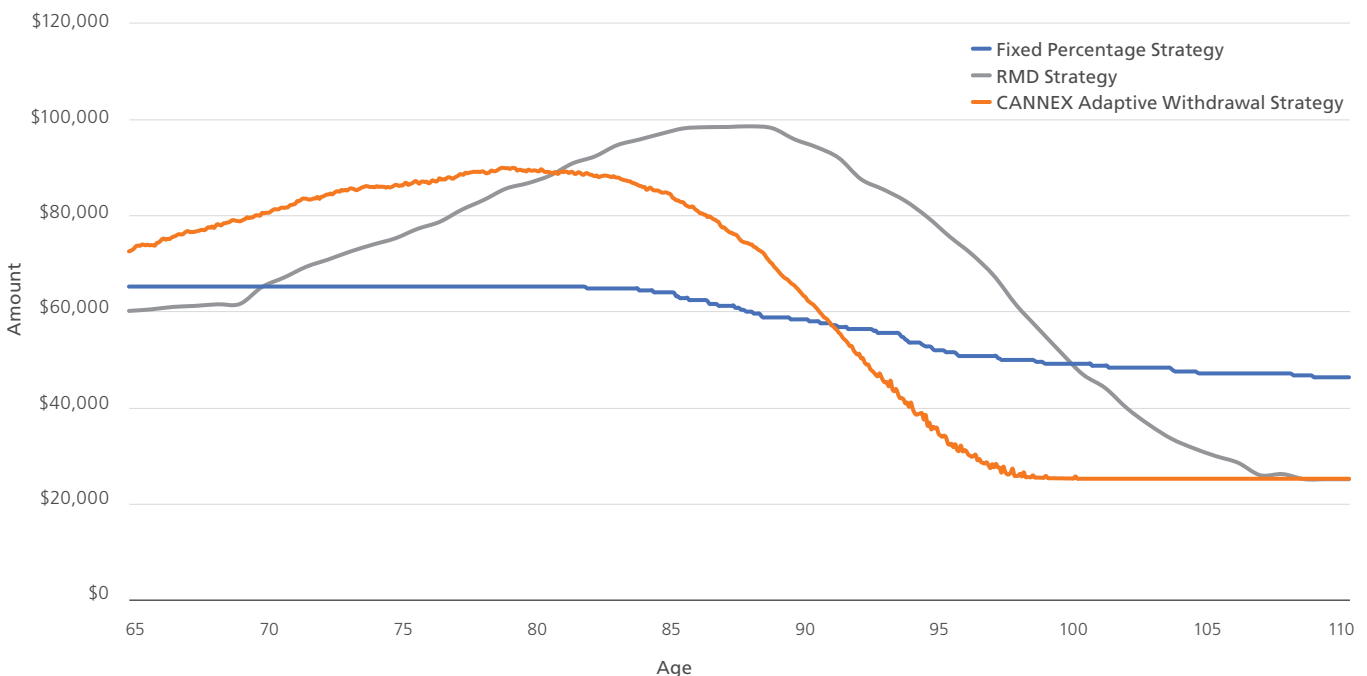
The differences in total income trajectories are pronounced. Overall, the CANNEX Adaptive Withdrawal Strategy provides the highest initial income and maintains at least this level into advanced old age. By contrast, the RMD method produces the lowest early

income and peaks during advanced old age. The fixed percentage strategy, by its nature, creates a monolithic total income stream until the portfolio ruins, if it does so during the retiree's lifetime. Detailed discussion of each strategy follows.

Fixed Percentage Strategy

The fixed percentage strategy we use here replicates Bengen's original 4% withdrawal recommendation. Exhibit 1 shows the average performance for this method, which is designed to provide increasing income to compensate for inflation; note that the figure adjusts income to current dollars, so the total income is flat as long as there are funds in the portfolio. Here, the average income remains flat until around age 79 because the portfolio withdrawals do not adjust to market performance or other factors. This figure shows the average, but because this strategy produces identical withdrawal amounts irrespective of the market sequence, it also represents the actual total income for each sequence until age 79. At that age, the average line starts to drop as the portfolio in certain

Exhibit 1: Average Total Income



Source: CANNEX Financial Exchanges Limited

instances begins to completely deplete and income from withdrawals soon thereafter stops (for more on portfolio depletion, see Exhibit 2, page 8). At this point, the choppiness in the slope represents sequences where the portfolio ruins.

RMD Strategy

The RMD strategy, which starts out with the lowest average income in Exhibit 1, ends up with the highest relative income payments, but only in advanced old age.

One notable oddity in the average income trajectory is the point in the sixth year when the strategy shifts from a flat 3.5% withdrawal rate to the RMD calculation, creating a wiggle as the withdrawal percentage jumps up. It is possible to modify the RMD methodology to use mortality to establish the early age withdrawals, but these would result in initial income levels even lower than those here.

The relatively sharp increase in withdrawal rates for this strategy is remarkable. The increase in the average income payments on average reflected in this figure stems from a combination of the ever-increasing RMD rate and market performance, which is generally upward. It is important to remember that the smoothing also reflects averaging; there are certainly individual

market sequences where the withdrawal amount does not increase from one year to the next because the increase in the RMD rate does not overcome a year with a large market drop.

CANNEX Adaptive Withdrawal Strategy

As expected, the CANNEX Adaptive Withdrawal Strategy provides a profoundly different profile from the other two strategies. We see in Exhibit 1 that the withdrawals begin with income over \$60,000, significantly higher than both of the other strategies. The algorithm generates an optimal spending strategy designed to consume in proportion to survival probabilities. The cash flows get adjusted upward with higher pension income and higher market performance of the underlying portfolio but, at the same time, get adjusted downward for longevity risk aversion. This results in a glide path for withdrawals that gradually decreases as the client ages and the investment portfolio declines.

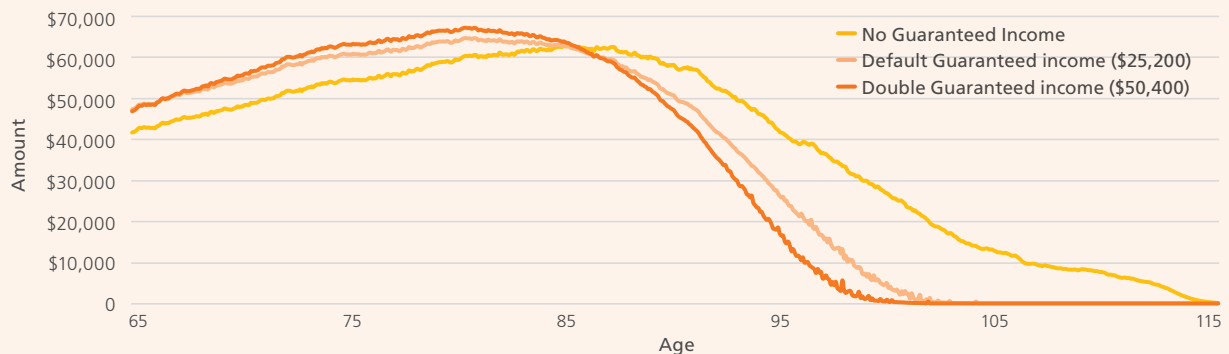
Assuming a base of guaranteed income, as is the case in this scenario, the CANNEX Adaptive Withdrawal Strategy allows the drawdown of the portfolio in advanced old age. The total income amounts are at or above the starting income on average for about 29 years, until age 94.

Effect of Guaranteed Income Amount on CANNEX Adaptive Withdrawal Strategy

The CANNEX Adaptive Withdrawal Strategy uses guaranteed income as an input to determine withdrawals. With less guaranteed income, the retiree needs to rely entirely on the portfolio withdrawals for income. With more, it is desirable to spend more in earlier years in order to get better use out of the savings.

Exhibit 2, below, shows the average withdrawals using the CANNEX Adaptive Withdrawal Strategy based upon different guaranteed income levels. The default guaranteed income is the same withdrawal rate that is included in the average total income in Exhibit 1 (average total income for these scenarios is available in Exhibit 6, page 15, in the Appendix). Changing the guaranteed income amount while leaving other variables alone shifts the point at which the portfolio fully depletes. In this figure, we add or subtract the same amount of guaranteed income compared to the default, but the effects on the withdrawal trajectory are very different.

Exhibit 2: Withdrawals Based on Different Guaranteed Income Amounts



Source: CANNEX Financial Exchanges Limited

The most dramatic change emerges under the assumption of no guaranteed income. In this case, the portfolio is the sole source of retirement income with withdrawals starting at \$41,757 and extending beyond age 115. By contrast, the year-one withdrawal under the default scenario is \$47,378 and it is only subtly higher at \$47,964 when the guaranteed income amount is twice as high. The need to provide income security significantly alters the overall trajectory, resulting in lower average withdrawals and a trajectory that more closely resembles the RMD strategy. We would generally expect this because both use mortality in the withdrawal calculations, though the additional factors in the CANNEX Adaptive Withdrawal Strategy integrate further tweaks.

This example changes one variable, guaranteed income, while leaving others constant in the face of market forces. However, it is important to bear in mind that the withdrawal calculations are based on fully updated information and therefore adjust to changes in a variety of factors. For example, a windfall such as an inheritance might increase the portfolio amount or a health change might alter the risk aversion regarding longevity. This is not to mention market effects, which constantly buffet the portfolio and may spur subsequent withdrawal rate changes.

Portfolio Depletion Times

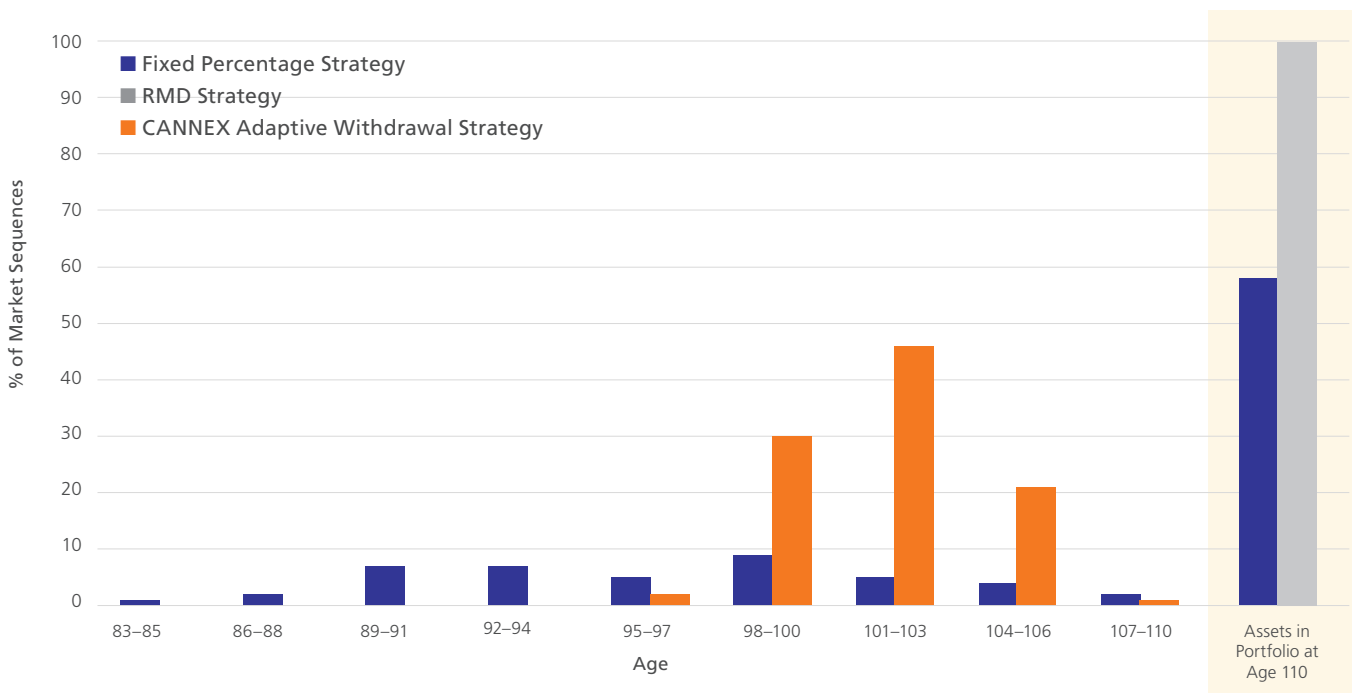
Recall that we define portfolio depletion as the point when the monthly withdrawal represents 5% of the original portfolio income. Exhibit 3, below, compares the distribution of portfolio depletion times for each of the three strategies. The figure on the left represents the percentage of market sequences in which the portfolio depleted and the figure on the right represents the percentage in which there are still assets remaining at age 110. The trade-off among them is evident. The fixed withdrawal strategy combines earlier potential portfolio depletion on one end of the spectrum with significant residual assets on the other, even assuming survival past 110. The RMD strategy does not experience portfolio depletion at all during this timeframe because it is based on mortality expectations. By contrast, under the CANNEX Adaptive Withdrawal Strategy, the portfolio depletion times are tightly clustered because it is designed to create a smooth transition into reliance on guaranteed income.

For the example in this study, the average time to depletion for the fixed withdrawal strategy is 45 years (age 110), compared with 37 years (age 102) for the CANNEX Adaptive Withdrawal Strategy. However, the range of ages when depletion can take place is extremely broad when using the fixed withdrawal strategy because it is so sensitive to volatility.

For our retiree, the portfolio depletes, at the earliest, after 21 years, or age 86. In more than half of scenarios, the wealth lasts past age 110. Bengen himself evaluated the success of the portfolio based upon a timeframe of 30 years (age 95), and we found that the portfolio depleted before age 95 nearly 20% of the time.

Because the RMD strategy hinges on life expectancy and adjusts for market effects, the withdrawals do not result in portfolio depletion until advanced old age. The maximum average withdrawal peaks in the early 90s and the earliest it could run out of funds is after 45 years, which is age 110.

Exhibit 3: Portfolio Depletion Times



Source: CANNEX Financial Exchanges Limited

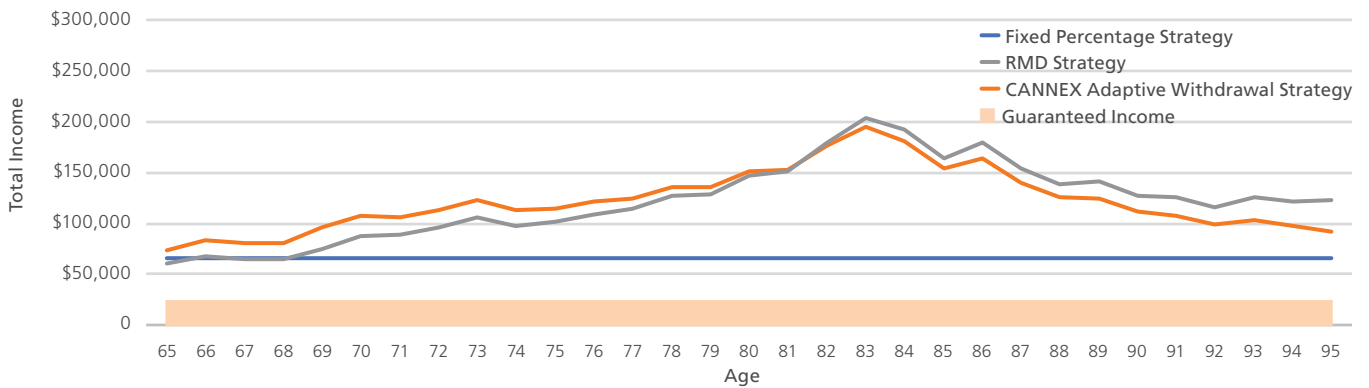
Cash Flow Samples

Average results from the simulations are useful in understanding the aggregate behavior of the strategies, but performance under specific return sequences sheds light on dynamics under different conditions. Total income trajectories based on three standard sequences appear in Exhibit 4 (below) and, like the average total

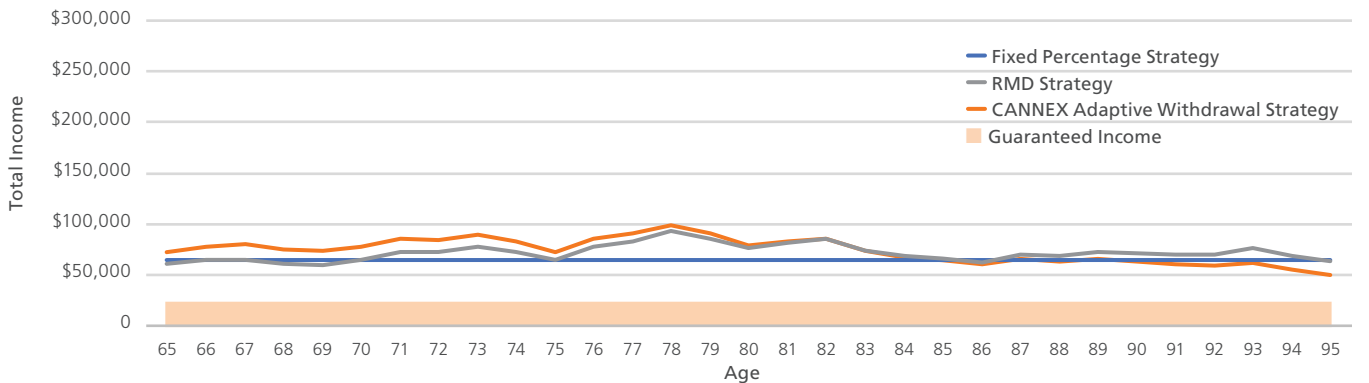
income, is presented in real dollars. Also, note that these sequences extend for 30 years, ending at age 95. The guaranteed income, which is the same for all scenarios, is the shaded area at the base of each figure. Illustration details with annual cash flows for withdrawals, guaranteed income, and the total amount for each year are included in Exhibit 7, page 15, in the Appendix.

Exhibit 4: Total Income Using Three Market Sequences

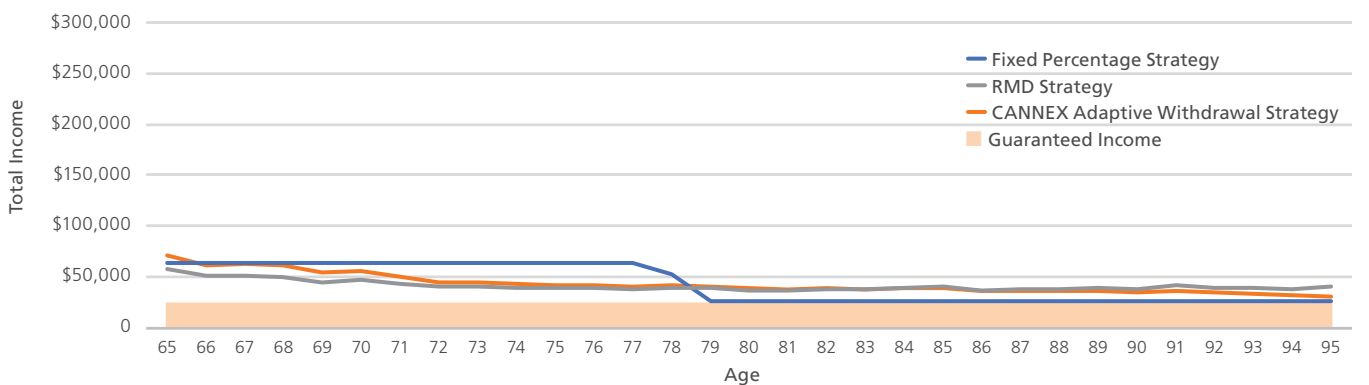
Bull Market Sequence



Moderate Market Sequence



Bear Market Sequence



Source: CANNEX Financial Exchanges Limited

As discussed earlier, the CANNEX Adaptive Withdrawal Strategy has the highest initial income of any of the methods. Since the RMD method has the opposite dynamic, the two converge at some point during retirement. Despite the wide variation in these sequences, the strategies cross paths after 13 to 18 years, at which point withdrawals from the RMD method increase and those from the CANNEX Adaptive Withdrawal Strategy decrease.

The fixed withdrawal strategy has a consistent withdrawal pattern in both bear and moderate market sequences, since it has no link to market performance. In the bull market sequence, withdrawals in both the CANNEX Adaptive Withdrawal Strategy and the RMD method increase with market gains; in the fixed withdrawal strategy, the gains are reserved and ultimately passed on to heirs. The bear market sequence highlights the risk of depletion that comes with the fixed withdrawal strategy, which abruptly runs out of money because the strategy does not adjust to prevailing market conditions.

Relative Value of Withdrawal Strategies

The CANNEX Adaptive Withdrawal Strategy is designed to maximize the utility (satisfaction) that the retiree gets during retirement from using the savings;

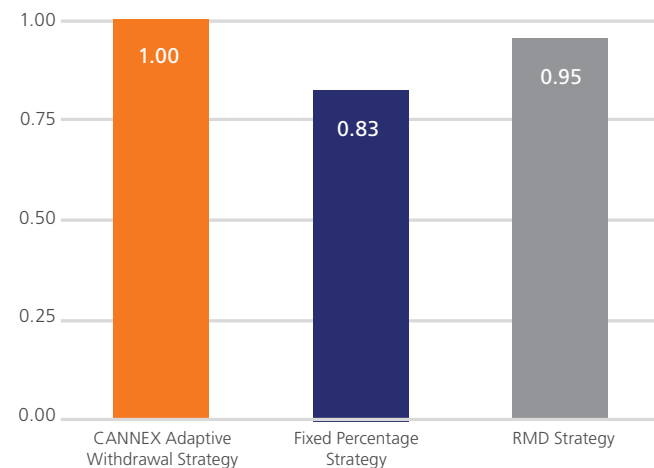
this relies on a mathematical expression of the utility of consumption. Because the strategy uses this equation to determine withdrawal amounts, we expect the resulting withdrawals to efficiently accomplish this.

The analysis in Exhibit 5, below, compares the relative performance of the three strategies based on this measure. We calculate the retiree satisfaction with withdrawal strategy for each individual market scenario and compare each of the strategies against the CANNEX Adaptive Withdrawal Strategy to determine a ratio.

As expected, each of the other strategies underperforms the CANNEX Adaptive Withdrawal Strategy. With no market adjustment or customization, the fixed withdrawal strategy provides the lowest relative satisfaction to the retiree. The RMD strategy, which does take into account market movement and mortality, is a much closer fit for this client situation.

However, bear in mind that the CANNEX Adaptive Withdrawal Strategy adjusts withdrawals based on the amount of guaranteed income and other factors. An individual with more income and the same size portfolio will have withdrawals skewed to draw more heavily in early years with the expectation of running out of money sooner than we see in this scenario. Under such circumstances, the relative satisfaction under the RMD strategy would be lower.

Exhibit 5: Relative Value of Withdrawal Strategies



Source: CANNEX Financial Exchanges Limited

DISCUSSION

The overarching question when considering any withdrawal strategy is this: what are retirees seeking to achieve with their accumulated savings? Each strategy serves a different purpose based on either intentional design or incidental properties. Nevertheless, the common framework for evaluating a withdrawal strategy is reliable lifetime income. This is certainly an important and valid goal, but focus on that alone can introduce blind spots that may keep retirees from meeting their lifestyle goals. One of the pervasive issues for those who have collected a nest egg is underspending early in retirement due to fears about outliving assets.

Bengen's original concerns revolved around the common overreliance on average returns that calculate success based on a monotonous return expectation as opposed to more realistic return scenarios. His point was that sequence of returns risk endangers withdrawal strategies that appear reasonable when considering only average returns. In this regard, his analysis, which relies on historical returns, does a good job of illustrating the effect of regular withdrawals in poor market scenarios. Furthermore, it is helpful in guiding clients and other advisors away from withdrawal rates that may end up being disastrously aggressive if slavishly maintained; to this end, Bengen's work has been a success, so much so that it has come to define a "safe" systematic withdrawal rate.

The Fixed Percentage Strategy does reliably provide income for at least 30 years, which was Bengen's timeframe for adequate longevity. Nevertheless, leaning on this methodology to dictate withdrawals throughout retirement comes at the cost of the client's freedom to spend earlier accompanied by potential insecurity for those who live into advanced old age or,

in certain market sequences, even earlier. Variability in potential outcomes (running out of money in contrast with extremely high legacy) plagues this method, as it produces volatile results where there is both a risk of underspending and overspending. Looking at our bull market sequence through age 95 (see Exhibit 7 in the Appendix for details), this method provides the highest account value after 30 years of all the strategies. This is a boon for heirs but also represents significant underutilization of retirement assets. By contrast, in our bear market sequence, we see that Bengen's strategy depletes the most quickly because it has no sensitivity to market performance.

Despite a high early spending goal, the CANNEX Adaptive Withdrawal Strategy provides greater sustainability because it adapts to market performance, client age, and changes in risk aversion. Even when the CANNEX Adaptive Withdrawal Strategy spends down assets, it does so gradually. Specific to the example in this study, the earliest that the account depletes is age 98; by contrast, Bengen's method depletes as early as age 86.

What Happens in Qualified Accounts?

We have been considering the RMD strategy solely as an alternative rule of thumb to guide sustainable withdrawals. One important consideration in evaluating and implementing withdrawal strategies is the tax status of the portfolio assets and the potential need to comply with RMD withdrawal rates as an account requirement, as the penalty for insufficient withdrawals is significant. Obviously, the RMD strategy exactly fits the requirements.

For all of the points where either of the other strategies recommends a withdrawal rate higher than the RMD, there is no peril of under withdrawal. When the recommended withdrawal amount is too low, it is important to withdraw the full RMD amount and then reserve the rest in a taxable account. For the CANNEX Adaptive Withdrawal Strategy, this is critical, as the recommendations plot a specified glidepath for portfolio reduction and potential depletion. The high early withdrawals will cause the portfolio to deplete prematurely if a retiree switches from one method to the other.

This issue highlights the fact that the RMD calculations do not necessarily provide an optimal spending pattern in retirement. In fact, it may require some asset juggling in order to maintain the trajectory of a method that does optimize spending. The solution to this is simple and may be easier in situations where a retiree has a combination of qualified and non-qualified assets.

In this client scenario, the RMD method has the greatest sustainability of all methods, with the earliest depletion age at 110. However, it also provides the lowest withdrawals in the early years. The spending peak is the highest of any of the methods and occurs latest in life. Until the withdrawal peak, the rate of withdrawal increase is greater than the expected inflation rate at the cost of greatly reduced spending in early retirement.

Bear in mind that the RMD method is not a retirement income strategy at all; it is a means of easing retirees out of prolonged tax deferral by taking withdrawals over their expected lifespan. The percentage is derived from the anticipated remaining years of a participant's life and requires that the account holder withdraw one year's allotment of assets. This methodology incidentally is effective for assuring that payments will last for life, but it does not personalize it for a given retiree.

When considering the viability of a withdrawal strategy for the purpose of lifetime income, it makes sense to evaluate the performance based on the amount of time before the portfolio is likely to ruin. All three strategies achieve this reasonably well but with very different spending trajectories and with different degrees of variability in results.

The chance of ruin should not be the only metric for assessing a withdrawal strategy, as the aim is to provide retirees with income. Ultimately, we are not endeavoring to compare these strategies on an apples-to-apples basis. Instead, this analysis highlights the performance differences among them with an understanding of what each is intended to do. The guiding principle behind the CANNEX Adaptive Withdrawal Strategy is to maximize the use of savings while taking into account mortality. It also calculates the effect of guaranteed income and overall risk aversion, which are important factors guiding the spending trajectory and possibility of gliding into complete dependence on guaranteed income in advanced old age.

CONCLUSION

The entire point of using a rule of thumb for a systematic withdrawal program is to give investors the confidence to spend a certain amount of their savings without endangering their planning goals. The question many investors ask: "How much of my savings can I spend without eating cat food in the last years of my life?"

It is important to put the answer in its proper context. Any withdrawal strategy is not meant to be used blindly, without reviewing the status of the plan on a regular basis. In the event of significant portfolio changes, there is certainly cause to question whether it is time to consider shifting the spending strategy. Bengen, himself a financial planner, did not conduct his work to replace professional advice but to support it, and it's certain that he expected an advisor to manually adjust the plan based upon changes along the way.

The CANNEX approach quells fears around insufficient retirement income. More importantly, it addresses the problem of underuse of savings, which often arises when that fear looms ominously. We fully acknowledge that our solution is linked to the choice of the mathematical utility function that we use. The selection of the function does affect the output and the withdrawal trajectory would look different based on a different optimization philosophy. Therefore, the underlying principles of our strategy should match an investor's plans or desires. Because its design is explicit, it is easy to determine if that is the case.

The continued dominance of any withdrawal guideline that blindly addresses a single client concern is irrational in the modern era. Today, it is possible to leverage financial engineering that performs adjustments that quantitatively take into account various factors, such as capital market expectations, the retiree's aversion to risk, and probability of survival. The purpose of the CANNEX Adaptive Withdrawal Strategy is to give investors permission to take higher withdrawals in the years when they can get the most use out of that money while maintaining their overall retirement income goals. After the initial

recommendation, the strategy also provides the ability to update and reassess the plan to accommodate the latest portfolio information and investor preferences; any changes are seamlessly integrated into the next year's recommendation.

One advantage of the CANNEX Adaptive Withdrawal Strategy is that it clearly and intentionally segregates retirement income goals from legacy goals. Muddling these lays the groundwork for greater inefficiencies in retirement. Bengen himself asserted that some wiggle room in the straight 4% withdrawal strategy comes from the variable role of legacy. However, if that is truly an important goal to an investor, it is best managed separately. The same can be said for concerns over long-term care costs, which are not predictable and may be better addressed through other products or strategies.

Furthermore, the most important distinction of this strategy is the consideration of guaranteed income, which plays a critical role in shaping efficient and safe decumulation, greatly improving the sustainability of retirement plans. The CANNEX Adaptive Withdrawal Strategy can increase early income more when there is a solid floor of income. Bengen's original analysis effectively attempts to replicate an inflation-adjusted annuity but, in the effort to minimize the risk of running out of assets, it requires a significant pool of money that is likely to end up underutilized. The RMD method modulates to market changes but with an income trajectory that tilts heavily towards higher spending at older ages, which is likely to be undesirable to many retirees.

We can think of retirement savings as a tank of gas. That gas is used based on the position of the accelerator, which is equivalent to the rate of spending as a percentage. However, the speed of the car depends on environmental factors, which are analogous to market conditions. A flat amount based on the initial value is like tying a rock onto the accelerator. The position never changes and the same amount of gas goes into the engine no matter what is happening in the environment. The RMD-based strategy is a

step better because it adjusts to the market and the withdrawal profile is based on human mortality, yet it still falls short because it lacks personalization; it fails to modulate the gas pedal appropriately for the specific needs of the retiree and may make the car go either too fast or too slowly.

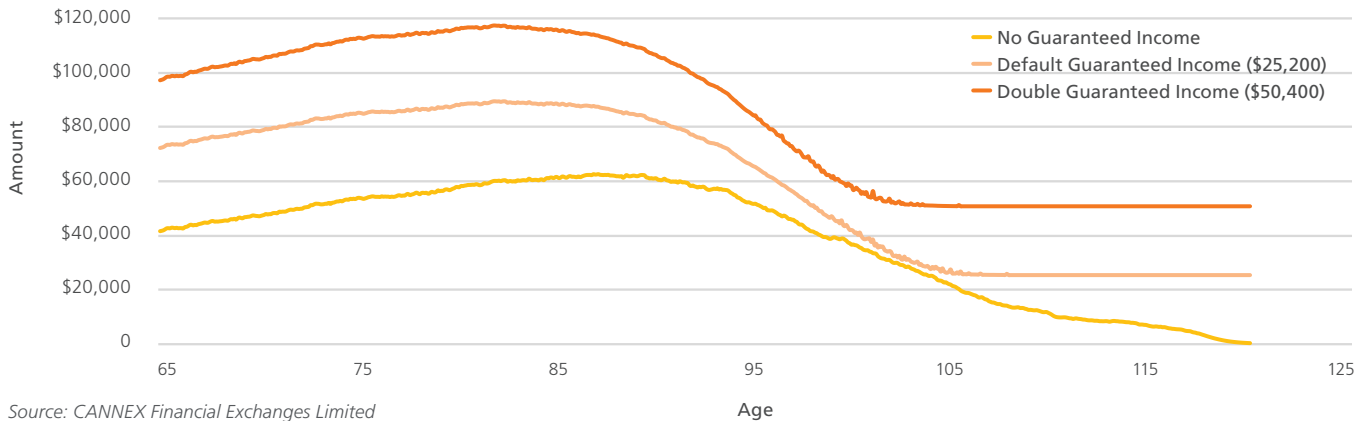
The process of deploying retirement savings is a challenge to the financial services industry that is far from solved. While we recognize the value and utility of rules of thumb, we propose that they still fall short and that we can better serve retirees today with more sophisticated methods. Retirees do not have uniform needs, expectations, and risks.

The CANNEX Adaptive Withdrawal Strategy can guide clients to take income early in retirement, when advisors believe that clients will have the greatest income needs, according to the [2019 Guaranteed Lifetime Income Study by Greenwald & Associates and CANNEX](#). The strategy could be used on brokerage assets or even within an investment-only variable annuity in a shift from accumulation to income generation.

The advantage of the CANNEX Adaptive Withdrawal Strategy is that it incorporates multiple variables into a retiree's drawdown recommendations, adjusting along the way. Most importantly, it includes the contribution of guaranteed income to establish appropriate withdrawals from other portfolio assets. This approach can simultaneously increase safety and increase spending in early retirement while keeping the plan on track. Many investors are so accustomed to save diligently during their working years that they have difficulty giving themselves permission to spend in retirement. Modern financial engineering can serve as a license to appropriately spend money when they are still able to enjoy it.

APPENDIX

Exhibit 6: Average Total Income for Varying Income Levels with CANNEX Adaptive Withdrawal Strategy



Source: CANNEX Financial Exchanges Limited

Exhibit 7: Performance Illustrations Based on Three Market Sequences

| | | BULL MARKET SEQUENCE | | | | | | |
|------|-----|----------------------|-------------------------------------|--------------|---------------------------|--------------|---------------|--------------|
| | | Guaranteed Income | CANNEX Adaptive Withdrawal Strategy | | Fixed Withdrawal Strategy | | RMD Strategy | |
| Year | Age | | Account Value | Total Income | Account Value | Total Income | Account Value | Total Income |
| 0 | 65 | \$25,200 | \$1,000,000 | \$73,441 | \$1,000,000 | \$65,200 | \$1,000,000 | \$60,200 |
| 1 | 66 | \$25,200 | \$1,167,759 | \$82,475 | \$1,176,000 | \$65,200 | \$1,181,000 | \$66,535 |
| 2 | 67 | \$25,200 | \$1,098,807 | \$80,675 | \$1,124,240 | \$65,200 | \$1,127,855 | \$64,675 |
| 3 | 68 | \$25,200 | \$1,057,617 | \$80,148 | \$1,098,855 | \$65,200 | \$1,103,042 | \$63,806 |
| 4 | 69 | \$25,200 | \$1,331,588 | \$95,288 | \$1,400,599 | \$65,200 | \$1,407,482 | \$74,462 |
| 5 | 70 | \$25,200 | \$1,526,485 | \$107,098 | \$1,639,318 | \$65,200 | \$1,638,309 | \$87,731 |
| 6 | 71 | \$25,200 | \$1,469,011 | \$106,480 | \$1,625,547 | \$65,200 | \$1,601,991 | \$88,520 |
| 7 | 72 | \$25,200 | \$1,556,668 | \$113,564 | \$1,772,485 | \$65,200 | \$1,722,900 | \$95,811 |
| 8 | 73 | \$25,200 | \$1,678,455 | \$122,925 | \$1,971,771 | \$65,200 | \$1,884,881 | \$105,408 |
| 9 | 74 | \$25,200 | \$1,443,096 | \$112,761 | \$1,770,086 | \$65,200 | \$1,650,113 | \$97,892 |
| 10 | 75 | \$25,200 | \$1,432,019 | \$114,998 | \$1,823,900 | \$65,200 | \$1,664,877 | \$101,570 |
| 11 | 76 | \$25,200 | \$1,479,696 | \$120,925 | \$1,958,995 | \$65,200 | \$1,748,334 | \$108,852 |
| 12 | 77 | \$25,200 | \$1,486,070 | \$124,686 | \$2,054,165 | \$65,200 | \$1,785,317 | \$114,022 |
| 13 | 78 | \$25,200 | \$1,609,495 | \$136,234 | \$2,322,290 | \$65,200 | \$1,964,293 | \$127,507 |
| 14 | 79 | \$25,200 | \$1,535,479 | \$135,469 | \$2,335,703 | \$65,200 | \$1,907,165 | \$128,850 |
| 15 | 80 | \$25,200 | \$1,701,597 | \$151,218 | \$2,716,129 | \$65,200 | \$2,146,804 | \$147,177 |
| 16 | 81 | \$25,200 | \$1,650,448 | \$152,600 | \$2,795,639 | \$65,200 | \$2,119,286 | \$151,348 |
| 17 | 82 | \$25,200 | \$1,910,904 | \$177,282 | \$3,412,614 | \$65,200 | \$2,491,170 | \$180,898 |
| 18 | 83 | \$25,200 | \$2,079,853 | \$196,875 | \$3,945,933 | \$65,200 | \$2,753,989 | \$205,199 |
| 19 | 84 | \$25,200 | \$1,802,106 | \$182,003 | \$3,704,690 | \$65,200 | \$2,433,536 | \$193,030 |
| 20 | 85 | \$25,200 | \$1,398,414 | \$154,828 | \$3,157,148 | \$65,200 | \$1,932,312 | \$165,223 |
| 21 | 86 | \$25,200 | \$1,437,994 | \$164,500 | \$3,499,163 | \$65,200 | \$2,026,099 | \$179,864 |
| 22 | 87 | \$25,200 | \$1,114,630 | \$140,852 | \$3,011,270 | \$65,200 | \$1,612,094 | \$155,208 |
| 23 | 88 | \$25,200 | \$899,777 | \$125,237 | \$2,703,267 | \$65,200 | \$1,338,610 | \$138,642 |
| 24 | 89 | \$25,200 | \$843,829 | \$124,522 | \$2,795,727 | \$65,200 | \$1,290,760 | \$141,485 |
| 25 | 90 | \$25,200 | \$682,064 | \$111,720 | \$2,548,843 | \$65,200 | \$1,078,959 | \$127,958 |
| 26 | 91 | \$25,200 | \$609,867 | \$107,874 | \$2,562,369 | \$65,200 | \$998,860 | \$126,095 |
| 27 | 92 | \$25,200 | \$497,919 | \$98,328 | \$2,399,375 | \$65,200 | \$850,019 | \$115,628 |
| 28 | 93 | \$25,200 | \$499,977 | \$102,828 | \$2,721,681 | \$65,200 | \$887,945 | \$126,103 |
| 29 | 94 | \$25,200 | \$430,348 | \$97,401 | \$2,725,228 | \$65,200 | \$801,249 | \$121,736 |
| 30 | 95 | \$25,200 | \$391,284 | \$92,058 | \$2,895,070 | \$65,200 | \$766,409 | \$123,458 |

Source: CANNEX Financial Exchanges Limited

HOW TO SPEND MORE IN RETIREMENT SAFELY: THE CANNEX ADAPTIVE WITHDRAWAL STRATEGY

Exhibit 7: Performance Illustrations Based on Three Market Sequences (continued)

| MODERATE SEQUENCE | | | | | | | | |
|-------------------|-----|-------------------|-------------------------------------|--------------|---------------------------|--------------|---------------|--------------|
| Year | Age | Guaranteed Income | CANNEX Adaptive Withdrawal Strategy | | Fixed Withdrawal Strategy | | RMD Strategy | |
| | | | Account Value | Total Income | Account Value | Total Income | Account Value | Total Income |
| 0 | 65 | \$25,200 | \$1,000,000 | \$73,441 | \$1,000,000 | \$65,200 | \$1,000,000 | \$60,200 |
| 1 | 66 | \$25,200 | \$1,093,759 | \$79,039 | \$1,102,000 | \$65,200 | \$1,107,000 | \$63,945 |
| 2 | 67 | \$25,200 | \$1,097,889 | \$80,631 | \$1,120,406 | \$65,200 | \$1,126,926 | \$64,642 |
| 3 | 68 | \$25,200 | \$965,606 | \$75,640 | \$1,001,978 | \$65,200 | \$1,008,599 | \$60,501 |
| 4 | 69 | \$25,200 | \$919,028 | \$74,700 | \$965,985 | \$65,200 | \$977,332 | \$59,407 |
| 5 | 70 | \$25,200 | \$953,160 | \$77,900 | \$1,013,890 | \$65,200 | \$1,032,063 | \$64,592 |
| 6 | 71 | \$25,200 | \$1,092,045 | \$86,808 | \$1,177,682 | \$65,200 | \$1,200,116 | \$72,635 |
| 7 | 72 | \$25,200 | \$1,040,265 | \$85,873 | \$1,148,281 | \$65,200 | \$1,163,481 | \$72,884 |
| 8 | 73 | \$25,200 | \$1,106,504 | \$91,472 | \$1,248,372 | \$65,200 | \$1,257,742 | \$78,721 |
| 9 | 74 | \$25,200 | \$945,073 | \$84,324 | \$1,101,012 | \$65,200 | \$1,096,056 | \$73,484 |
| 10 | 75 | \$25,200 | \$722,452 | \$72,941 | \$870,537 | \$65,200 | \$858,154 | \$64,565 |
| 11 | 76 | \$25,200 | \$922,512 | \$87,055 | \$1,129,131 | \$65,200 | \$1,113,135 | \$78,460 |
| 12 | 77 | \$25,200 | \$971,357 | \$92,385 | \$1,224,626 | \$65,200 | \$1,193,452 | \$84,576 |
| 13 | 78 | \$25,200 | \$1,065,418 | \$101,032 | \$1,387,914 | \$65,200 | \$1,332,189 | \$94,585 |
| 14 | 79 | \$25,200 | \$883,044 | \$91,501 | \$1,209,123 | \$65,200 | \$1,129,585 | \$86,591 |
| 15 | 80 | \$25,200 | \$687,818 | \$80,172 | \$992,591 | \$65,200 | \$903,275 | \$76,522 |
| 16 | 81 | \$25,200 | \$711,946 | \$84,247 | \$1,066,739 | \$65,200 | \$955,829 | \$82,095 |
| 17 | 82 | \$25,200 | \$710,567 | \$86,647 | \$1,113,145 | \$65,200 | \$976,357 | \$86,222 |
| 18 | 83 | \$25,200 | \$522,639 | \$74,002 | \$875,005 | \$65,200 | \$741,543 | \$73,667 |
| 19 | 84 | \$25,200 | \$427,322 | \$67,980 | \$757,130 | \$65,200 | \$627,079 | \$68,447 |
| 20 | 85 | \$25,200 | \$369,158 | \$64,685 | \$689,873 | \$65,200 | \$561,257 | \$65,871 |
| 21 | 86 | \$25,200 | \$307,893 | \$60,678 | \$609,170 | \$65,200 | \$487,472 | \$62,412 |
| 22 | 87 | \$25,200 | \$339,844 | \$65,738 | \$702,579 | \$65,200 | \$557,017 | \$70,121 |
| 23 | 88 | \$25,200 | \$302,025 | \$63,781 | \$668,199 | \$65,200 | \$516,552 | \$68,976 |
| 24 | 89 | \$25,200 | \$298,177 | \$65,389 | \$705,042 | \$65,200 | \$532,180 | \$73,144 |
| 25 | 90 | \$25,200 | \$259,479 | \$62,930 | \$668,567 | \$65,200 | \$486,897 | \$71,571 |
| 26 | 91 | \$25,200 | \$222,267 | \$60,260 | \$629,905 | \$65,200 | \$441,500 | \$69,796 |
| 27 | 92 | \$25,200 | \$198,099 | \$58,936 | \$620,770 | \$65,200 | \$418,537 | \$69,725 |
| 28 | 93 | \$25,200 | \$200,615 | \$61,246 | \$694,371 | \$65,200 | \$450,604 | \$76,405 |
| 29 | 94 | \$25,200 | \$145,912 | \$54,796 | \$589,794 | \$65,200 | \$357,493 | \$68,271 |
| 30 | 95 | \$25,200 | \$108,583 | \$48,843 | \$518,535 | \$65,200 | \$295,475 | \$63,081 |

Source: CANNEX Financial Exchanges Limited

HOW TO SPEND MORE IN RETIREMENT SAFELY: THE CANNEX ADAPTIVE WITHDRAWAL STRATEGY

Exhibit 7: Performance Illustrations Based on Three Market Sequences (continued)

| BEAR MARKET SEQUENCE | | | | | | | | |
|----------------------|-----|-------------------|-------------------------------------|--------------|---------------------------|--------------|---------------|--------------|
| Year | Age | Guaranteed Income | CANNEX Adaptive Withdrawal Strategy | | Fixed Withdrawal Strategy | | RMD Strategy | |
| | | | Account Value | Total Income | Account Value | Total Income | Account Value | Total Income |
| 0 | 65 | \$25,200 | \$1,000,000 | \$73,441 | \$1,000,000 | \$65,200 | \$1,000,000 | \$60,200 |
| 1 | 66 | \$25,200 | \$744,759 | \$62,599 | \$753,000 | \$65,200 | \$758,000 | \$51,730 |
| 2 | 67 | \$25,200 | \$743,853 | \$63,573 | \$749,897 | \$65,200 | \$768,612 | \$52,101 |
| 3 | 68 | \$25,200 | \$698,042 | \$62,349 | \$702,398 | \$65,200 | \$734,024 | \$50,891 |
| 4 | 69 | \$25,200 | \$531,754 | \$54,774 | \$532,454 | \$65,200 | \$572,539 | \$45,239 |
| 5 | 70 | \$25,200 | \$540,998 | \$56,201 | \$531,324 | \$65,200 | \$594,296 | \$47,883 |
| 6 | 71 | \$25,200 | \$419,650 | \$50,417 | \$402,593 | \$65,200 | \$472,365 | \$43,871 |
| 7 | 72 | \$25,200 | \$307,986 | \$44,724 | \$279,658 | \$65,200 | \$356,387 | \$39,806 |
| 8 | 73 | \$25,200 | \$301,704 | \$45,083 | \$251,684 | \$65,200 | \$357,106 | \$40,396 |
| 9 | 74 | \$25,200 | \$258,591 | \$43,115 | \$192,304 | \$65,200 | \$314,413 | \$39,051 |
| 10 | 75 | \$25,200 | \$227,488 | \$41,788 | \$142,497 | \$65,200 | \$284,527 | \$38,252 |
| 11 | 76 | \$25,200 | \$214,085 | \$41,582 | \$104,492 | \$65,200 | \$275,459 | \$38,380 |
| 12 | 77 | \$25,200 | \$186,571 | \$40,332 | \$59,058 | \$65,200 | \$247,955 | \$37,536 |
| 13 | 78 | \$25,200 | \$199,238 | \$41,990 | \$27,858 | \$53,058 | \$272,564 | \$39,396 |
| 14 | 79 | \$25,200 | \$175,076 | \$40,899 | – | \$25,200 | \$248,283 | \$38,694 |
| 15 | 80 | \$25,200 | \$133,641 | \$38,259 | – | \$25,200 | \$198,292 | \$36,467 |
| 16 | 81 | \$25,200 | \$120,716 | \$37,817 | – | \$25,200 | \$187,224 | \$36,344 |
| 17 | 82 | \$25,200 | \$119,325 | \$38,367 | – | \$25,200 | \$193,491 | \$37,293 |
| 18 | 83 | \$25,200 | \$103,891 | \$37,595 | – | \$25,200 | \$177,722 | \$36,816 |
| 19 | 84 | \$25,200 | \$105,626 | \$38,457 | – | \$25,200 | \$190,276 | \$38,322 |
| 20 | 85 | \$25,200 | \$104,305 | \$39,054 | – | \$25,200 | \$198,655 | \$39,595 |
| 21 | 86 | \$25,200 | \$63,853 | \$35,215 | – | \$25,200 | \$133,603 | \$35,399 |
| 22 | 87 | \$25,200 | \$63,033 | \$35,709 | – | \$25,200 | \$142,643 | \$36,703 |
| 23 | 88 | \$25,200 | \$56,683 | \$35,487 | – | \$25,200 | \$140,554 | \$37,111 |
| 24 | 89 | \$25,200 | \$56,486 | \$36,071 | – | \$25,200 | \$153,661 | \$39,043 |
| 25 | 90 | \$25,200 | \$42,565 | \$34,600 | – | \$25,200 | \$131,520 | \$37,726 |
| 26 | 91 | \$25,200 | \$48,532 | \$36,120 | – | \$25,200 | \$166,473 | \$42,015 |
| 27 | 92 | \$25,200 | \$32,322 | \$33,864 | – | \$25,200 | \$131,512 | \$39,191 |
| 28 | 93 | \$25,200 | \$25,533 | \$33,014 | – | \$25,200 | \$125,149 | \$39,421 |
| 29 | 94 | \$25,200 | \$16,519 | \$31,063 | – | \$25,200 | \$105,045 | \$37,856 |
| 30 | 95 | \$25,200 | \$13,960 | \$30,178 | – | \$25,200 | \$113,398 | \$39,738 |

Source: CANNEX Financial Exchanges Limited

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ABOUT CANNEX

CANNEX supports the exchange of **pricing information** for annuity and bank products across North America. We provide financial institutions with the ability to evaluate and compare various guarantees associated with retirement savings and retirement income products.

Our **quantitative research** team provides methodologies that help optimize the selection and allocation of annuity and insurance guarantees in support of retirement programs and practices.

Our pricing and analytic services can be deployed to support a variety of processes, including:

- Research & Market Intelligence
- Financial Planning & Education
- Sales & Compliance
- Transaction Processing
- Product Service & Administration

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