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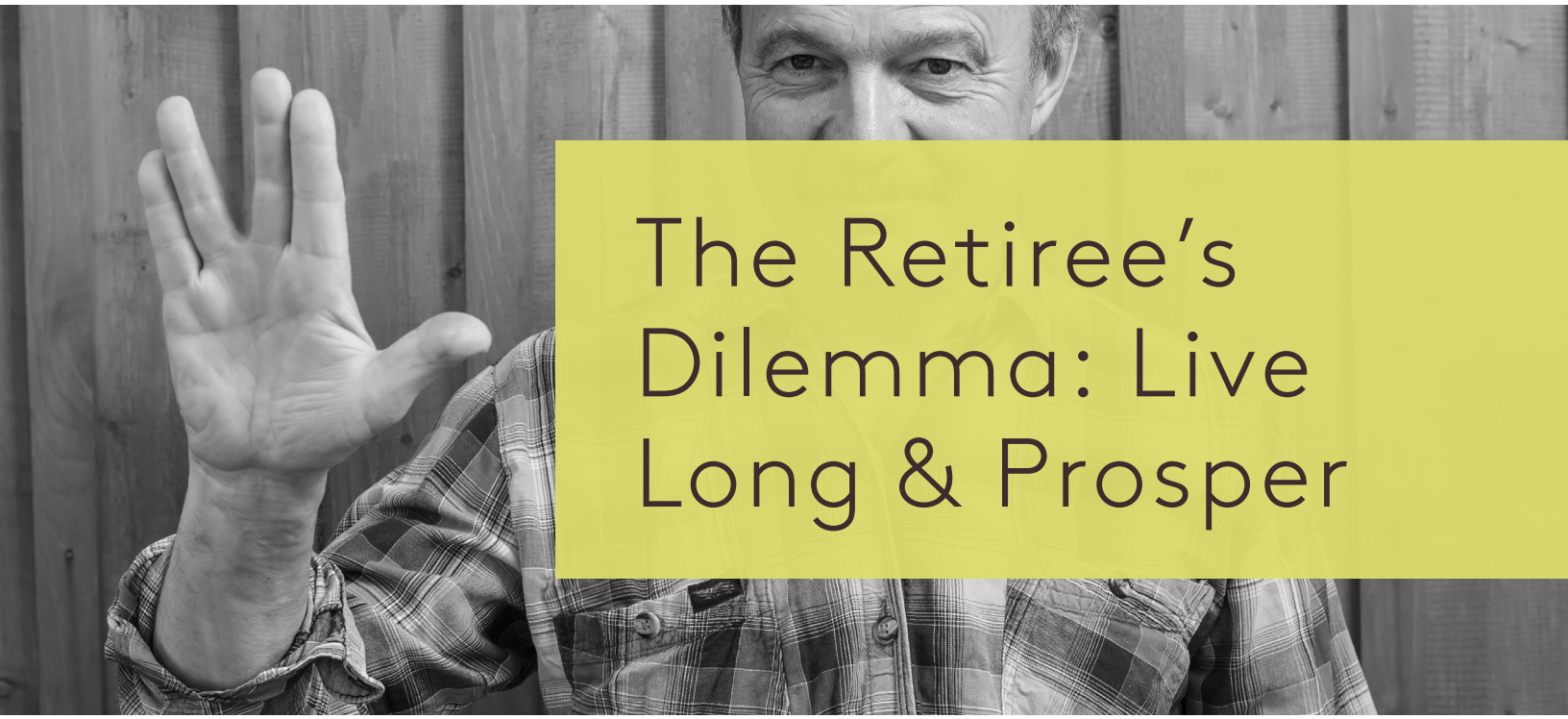
LONG LIVE YOUR MONEY



The Retiree's Dilemma: Live Long & Prosper

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ABSTRACT

The key challenge for most retirees is to create a stable income for their lifetime from investment capital that fluctuates in value. We identify the shortcomings of constant spending rules and introduce a dynamic spending rule that can boost total retirement income by 25-40%. Coupling the dynamic spending rule with asset liability management assures the retiree of less income volatility and reduces the risk income falls below a specified level. This approach allows a dialogue with retirees and near retirees that is more meaningful, because it is based on required and desired income rather than a probability of running out of money that most people find hard to comprehend.

This report was written by Graham Westmacott, PWL Capital Inc. The ideas, opinions, and recommendations contained in this document are those of the author and do not necessarily represent the views of PWL Capital Inc.

Graham Westmacott, *Portfolio Manager*, PWL Capital Inc. *"The Retiree's Dilemma: Live Long & Prosper".*

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1 Introduction

Nobel laureate William Sharpe recently described generating a reliable stream of retirement income as "the nastiest, hardest problem in finance"[1], because of the interplay of uncertainties relating to investment performance, longevity, inflation, interest rates and the retiree's changing priorities during retirement. As practitioners, our goal is not to address this problem in all its generality but to suggest that retirees can significantly improve their sustainable income by integrating a dynamic spending rule with an investment approach that takes into account their minimum spending requirements.

When compared to the accumulation phase, retirees must deal with the specific risks associated with generating retirement income. These are:

Income risk: the possibility that, even over a fixed period, the retiree's income will fall below a minimum consumption need due to lower than expected investment returns.

Longevity risk: the possibility that the retiree runs out of money because they live longer than anticipated.

In the sections that follow we discuss how to manage these risks as part of a dynamic income strategy for retirees.

2 Guiding Principles

To offer a better retirement planning experience we consider it important to offer suggestions that are flexible and relatable:

- **Flexibility.** Retirement circumstances and attitudes change, so we wished to avoid advocating rigid or irreversible commitments. An example of the latter would be the purchase of an annuity to cover some or all of a retiree's income needs. Annuity purchases are irreversible, which is one reason why interest in annuities remains low.
- **Relatability.** Clear options make for better choices. For example, asking the client to choose between:
  - an income of $30,000 with a 70% probability of running out of money or
  - an income of $40,000 with a 80% probability of running out of money

  is unhelpful if the client is fearful of any strategy that has a material risk of running out of money.

  In this case, we think it more meaningful to focus on a required level of income, irrespective of market conditions.

[1] https://www.bloomberg.com/view/articles/2017-06-05/tackling-the-nastiest-hardest-problem-in-finance

3 The Retirement Income Problem

Investors receive a bewildering range of advice about how best to turn investment capital into reliable income. In broad terms recommendations fall into three categories:

Total Return Strategies. Total return strategies focus on a portfolio that has an expected total return, from the yield and capital gains, in excess of the withdrawal rate. Living off dividends and interest is a sub-set of the total return approach, with the additional constraint that the portfolio yield generates sufficient income without the depletion of capital. If retiree's are wealthy enough to be not worried about income or longevity risk, then the total return approach is a natural extension of a pre-retirement accumulation strategy.

Bucket (or Time Segmentation) Strategies. Bucket strategies focus on different investment horizons and invest differently for retirement spending goals at different points in retirement. Typically the portfolio is divided into a bond ladder and an equity portfolio. The bond ladder provides short term income and the equity portfolio provides long term growth. The bond ladder can be fixed and extended throughout retirement or a rolling fixed period horizon. This approach promises greater income stability and has intuitive appeal because the size of the bond portfolio is dictated by income needs.

Annuity Strategies. The risk free asset for a retiree who seeks income security is the lifetime annuity. The lifetime annuity directly addresses longevity risk by guaranteeing an income for a long as the retiree lives. As noted already, interest in annuities remains low, but as we discuss below, the annuity calculation provides a useful way of calculating a safe spending limit.

All these approaches partially address retirement risks. A successful tool for a wide range of clients requires blending these different approaches to address the specific needs of individual clients.

Before we rush to prescription, it is prudent to build a sound understanding of why William Sharpe, and others, consider generating retirement income a challenging problem. In the next section, we look at the impact of market volatility on portfolio withdrawals.

4 Market Volatility is Not Your Friend

It is still common to see "retirement projections" provided to retirees from financial planning software that takes no account of market volatility. As a consequence, retirees significantly overestimate the annual income that can be sustained from their investments.

Consider a simple example of two portfolios: Portfolio A yields a constant 3% return. Portfolio B has an equal chance of either a 9% return or a -3% return. Thus, the average return of Portfolio B is 3% = (-3+9)/2, the same as Portfolio A.

We start with $100,000 and withdraw $3,000 at the end of every year for 10 years, as shown in Table 1.

Table 1

Years	PORTFOLIO A		PORTFOLIO B			
			Sequence 1		Sequence 2	
	Annual Returns	Portfolio Value	Annual Returns	Portfolio Value	Annual Returns	Portfolio Value
0		$100,000		$100,000		$100,000
1	3%	$100,000	-3%	$94,000	9%	$106,000
2	3%	$100,000	9%	$99,460	-3%	$99,820
3	3%	$100,000	-3%	$93,476	9%	$105,804
4	3%	$100,000	9%	$98,889	-3%	$99,630
5	3%	$100,000	-3%	$92,922	9%	$105,596
6	3%	$100,000	9%	$98,285	-3%	$99,428
7	3%	$100,000	-3%	$92,337	9%	$105,377
8	3%	$100,000	9%	$97,647	-3%	$99,216
9	3%	$100,000	-3%	$91,718	9%	$105,145
10	3%	**$100,000**	9%	**$96,972**	-3%	**$98,991**

Source: PWL Capital

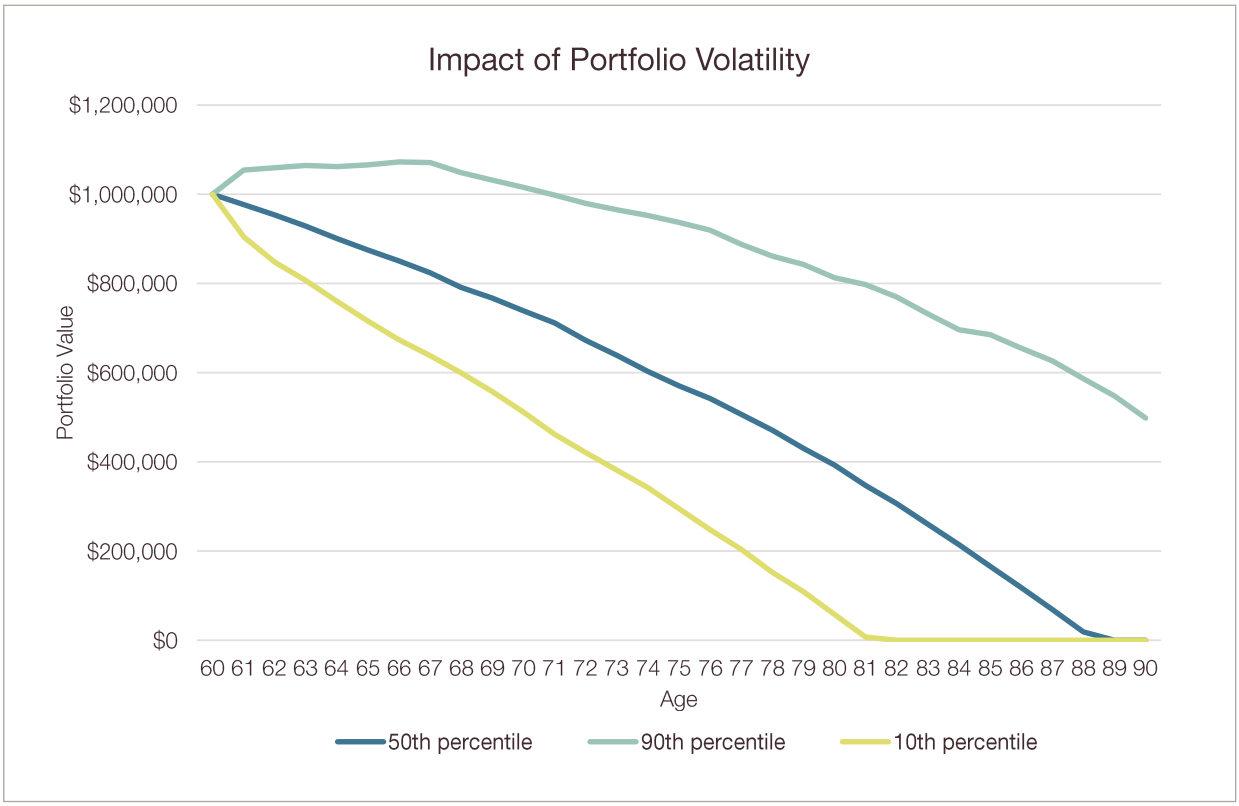
In the case of Portfolio A, the portfolio gains 3% every year ($3,000) which exactly funds the withdrawal of $3,000 leaving the principal intact. We show two options for Portfolio B that both have an average return of 3%, but the first is an alternating sequence beginning with -3% and the second begins with 9%. In each case, the principal value is less than $100,000 after 10 years due to the impact of the variability of returns. In addition, the sequence of returns impacts the final portfolio value. Despite Portfolio B having the same average return as Portfolio A, the impact of the volatility of returns is a reduction in the portfolio value.

Of course, market returns can take on more than the two values in our example and the cumulative wealth from Portfolio B could show a large variation depending on the specific sequence of returns; at one extreme, a sequence of ten positive returns and at the other, a sequence of ten negative returns.

We consider a more realistic example of a 60% equity, 40% bond portfolio of $1 million for a retiree aged 60 who expects to be retired for 30 years. We use current PWL return projections which suggest an average expected return of 4.84% every year with inflation of 1.6%. This return estimate is low compared with historic values, but reflects the current low interest, low inflation environment.

Assuming no market volatility, the retiree could expect to withdraw $51,000 annually, indexed to inflation and deplete the portfolio to zero at age 90. Once we include a realistic measure of portfolio volatility (6.30%), the picture changes drastically, as illustrated in Figure 1. All data for portfolio values and income in the charts that follow are expressed in real dollars (i.e. net of inflation), as retirees as retirement savings should be trying to achieve real wealth goals. What was previously a certain income until age 90, is now achieved in less than 50% of cases. The 10th percentile is the line below which 10% of all outcomes fall – so 10% will run out of money before age 82.

Figure 1



Source: PWL Capital

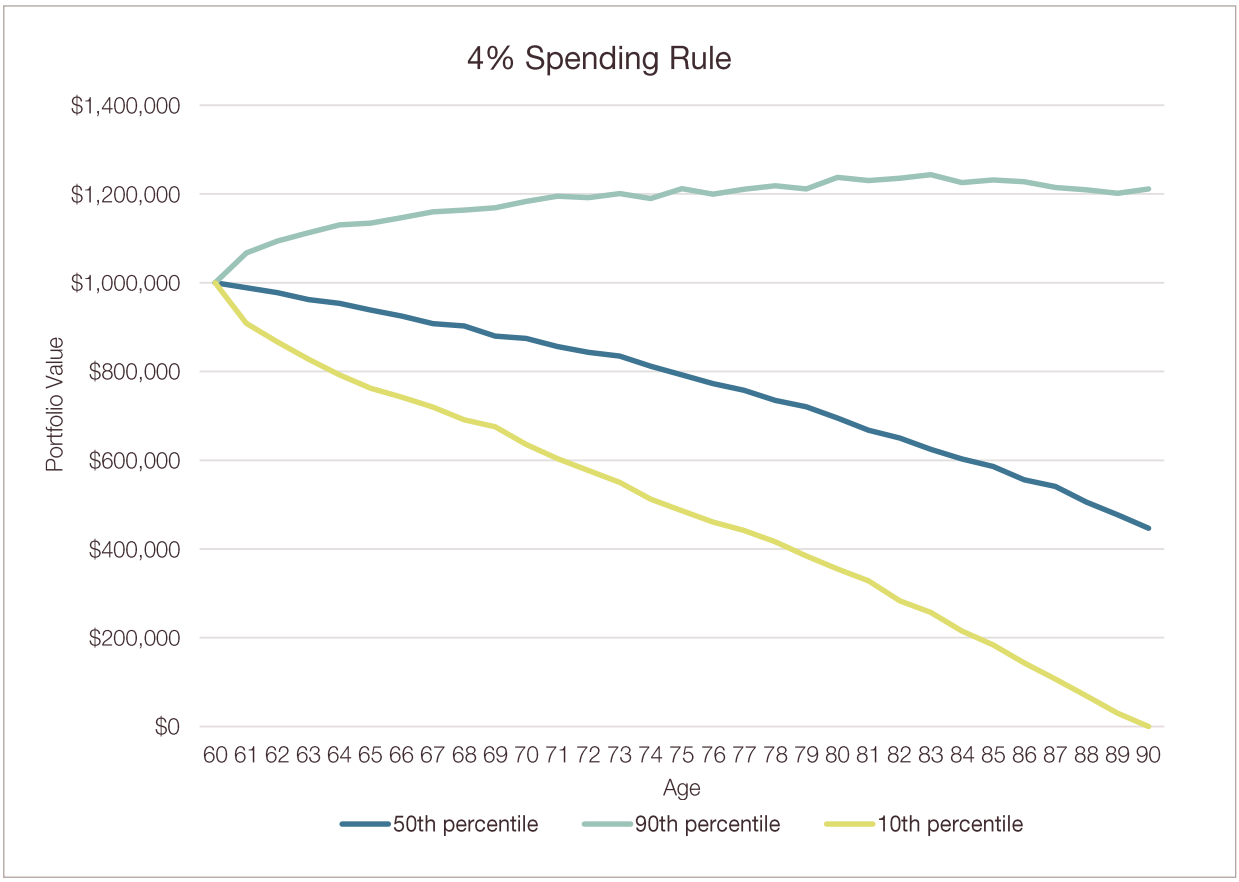
Financial planners who ignore market volatility in their projections are betting that their clients get lucky and experience above average returns.

5 A Safe Withdrawal Rate?

If withdrawing $51,000 (5.1%) leads to a 50% failure rate, what withdrawal rate could be considered safe? A frequent suggestion in the financial planning literature is 4% of the initial portfolio (i.e. $40,000), indexed to inflation, as a safe withdrawal rate. This suggestion arose from a study[2] in 1994 when historical average returns were 10.3% for equities, 5.2% for bonds and inflation averaged 3.0%. Under those circumstances, there was not a single instance (going back to 1926) of a retiree running out of money in less than 30 years.

As already noted, today's investment environment is very different. If we revisit the earlier situation with the investor with $1 million, and use current expected returns, a 4% withdrawal rate results in a 10% chance of a retiree running out of money by age 90, as illustrated in Figure 2. We assume a 60% equity allocation and compute the real portfolio value[3].

Figure 2



Source: PWL Capital

[2] Bengen, William P. 1994. "Determining Withdrawal rates Using Historical Data", Journal of Financial Planning, vol7,no.4 (October):171-180.

[3] All subsequent results are displayed in real (i.e. net of inflation) values as retirees are primarily interested in preserving real

It is also clear from Figure 2 that 10% of retirees enjoy no decline in the real value of their portfolio and are left with more money than they started with. Clearly there is a trade-off: a retiree who wants to reduce the risk of running out of money by reducing the withdrawal rate, is more likely to leave a large proportion of their retirement assets unspent. This is the penalty for insisting on a constant withdrawal; requiring a constant spending from a volatile portfolio is fundamentally flawed.

In Table 2 we calculate the percentage of the portfolio that is wasted (i.e. unspent) as a percentage of the initial portfolio value. An investor who has a 60% equity allocation and withdraws at 4.25% wastes, on average, 15.2% of the initial portfolio. If the withdrawal rate is reduced to 3.5% then 29.4% is wasted.

Table 2

% OF INITIAL PORTFOLIO UNSPENT	EQUITY ALLOCATION					
Withdrawal Rate	0%	15%	30%	45%	60%	75%
3.50%	5.9%	13.5%	20.3%	25.4%	29.4%	32.2%
3.75%	0.0%	7.4%	14.7%	20.4%	24.7%	28.1%
4.00%	0.0%	1.2%	9.2%	15.5%	20.1%	24.0%
4.25%	0.0%	0.0%	3.8%	10.2%	15.2%	19.7%
4.50%	0.0%	0.0%	0.0%	5.0%	10.7%	15.4%

Source: PWL Capital using DFA Returns 2 from Dimensional Fund Advisors Canada

Table 3

INCREASE IN RETIREMENT INCOME	EQUITY ALLOCATION					
Withdrawal Rate	0%	15%	30%	45%	60%	75%
3.50%	6.3%	15.6%	25.5%	34.1%	41.6%	47.5%
3.75%	0.0%	8.0%	17.3%	25.7%	32.8%	39.0%
4.00%	0.0%	1.2%	10.1%	18.3%	25.1%	31.5%
4.25%	0.0%	0.0%	3.9%	11.4%	18.0%	24.5%
4.50%	0.0%	0.0%	0.0%	5.3%	12.0%	18.2%

Source: PWL Capital using DFA Returns 2 from Dimensional Fund Advisors Canada

If these surpluses could be used, the retirement income would rise, as indicated in Table 3. For example, for a 4% withdrawal rate and 60% equity allocation, the unspent percentage (from Table 2) is 20.1%. If this was spent then the retirement income would rise by 0.201/(1-0.201) = 25.1%.

The countervailing pressure is that while higher withdrawal rates reduces surpluses, it also increases the risk of the portfolio running out of money, as calculated in Table 4.

Table 4

% OF INITIAL PORTFOLIO UNSPENT	EQUITY ALLOCATION					
Withdrawal Rate	0%	15%	30%	45%	60%	75%
3.50%	10.31%	1.16%	1.25%	1.73%	2.02%	2.80%
3.75%	56.26%	11.35%	5.58%	4.86%	4.80%	5.10%
4.00%	100.00%	42.18%	16.64%	11.00%	9.25%	8.61%
4.25%	100.00%	78.21%	34.95%	21.09%	16.31%	13.63%
4.50%	100.00%	95.59%	57.01%	34.83%	24.97%	19.88%

Source: PWL Capital using DFA Returns 2 from Dimensional Fund Advisors Canada

Thus, a withdrawal rate of 4.25% from a 60% equity portfolio has a probability of running out of money of 16.31%. This falls to 4.80% when the withdrawal rate is reduced to 3.75%.

The inefficiency of fixed spending rules would be striking under any circumstances. In the present environment, where future market returns are expected to be lower than historic rates, coupled with longer retirements, a more effective spending rule would be helpful for retirees.

The analysis assumes a constant asset allocation. Would a glide path, starting with a high equity allocation and trending to a lower equity allocation with age, improve the efficiency of a fixed withdrawal rate? A recent paper[4] looked at the performance of a glide path versus a fixed asset allocation with constant savings and concluded that the glide path offered little advantage. Switching from constant savings to constant spending wouldn't change this conclusion, a view supported by other studies[5].

Having a buffer of unspent funds may be considered a useful contingency against living longer than the 30 years used in the analysis. Protecting against longevity risk is a valid concern but the solution is not to rely on market performance to obligingly deliver a few years of extra income to those who need it. We will discuss ways to address variable mortality in a future note.

In the next section we introduce a spending rule that overcomes some of the limitations of fixed withdrawal rates by converting all the retirement capital into retirement income.

[4] https://www.pwlcapital.com/en/Advisor/Waterloo/Graham-Westmacott/Blog/Graham-Westmacott/June-2017/Target-Wealth-The-Evolution-of-Target-Date-Funds

[5] Scott, Jason S., Sharpe, William F., Watson, John G.,"The 4%Rule- At What Price?", Journal of Investment Management, Third Quarter, 2009

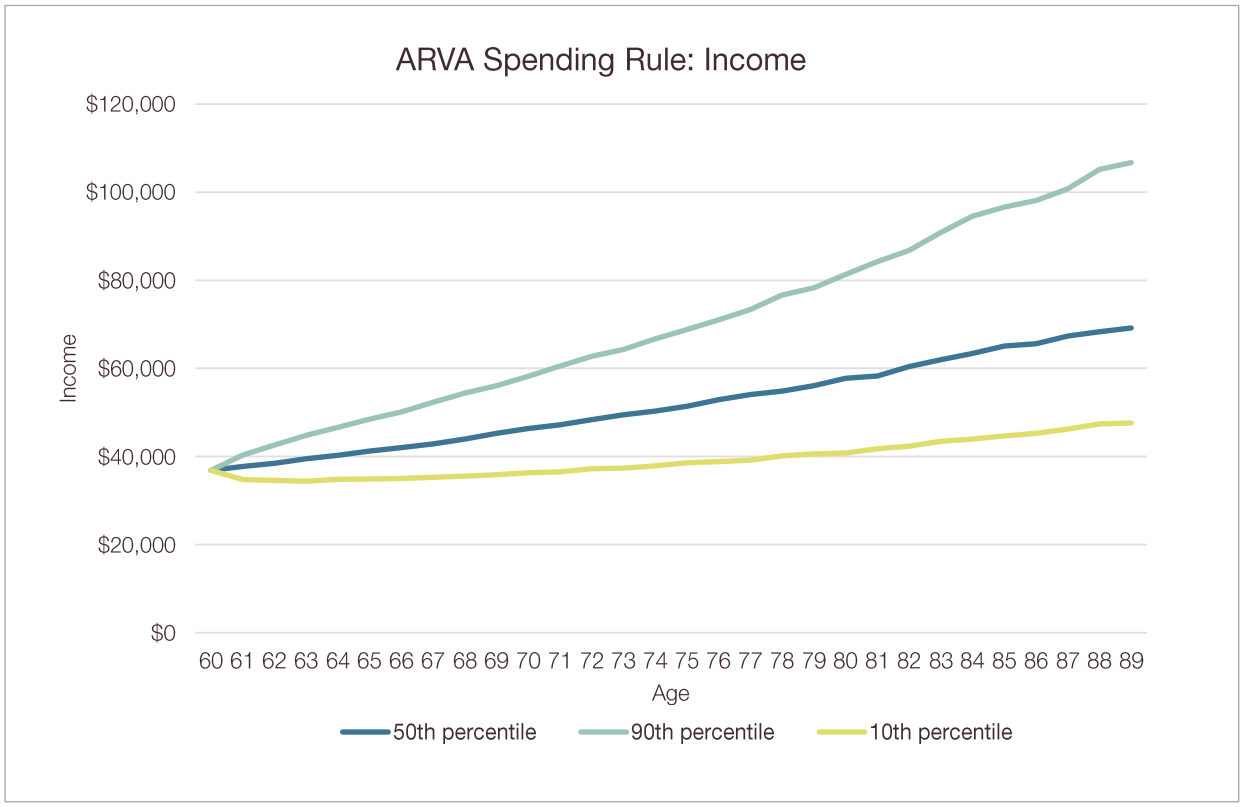
6 An Efficient Spending Rule – ARVA

Is there a more effective strategy that will eliminate downside risk and ensure all the retirees' assets are spent in retirement? The answer is yes; the trade-off is being willing to accept a variable income.

In an earlier paper[6], we introduced the concept of the Annually Recalculated Virtual Annuity (ARVA). ARVA is a dynamic spending rule that takes into account the time left in retirement and the current market value of the retirement portfolio. The idea behind ARVA is to calculate the income that could be expected if the retiree purchased an annuity at any stage during retirement. Provided that the retiree does not spend more than this amount the retiree will always convert all the portfolio assets into income, irrespective of how the market behaves.

We apply ARVA to the earlier example. In this case, the retirement income is no longer a constant $40,000 but fluctuates. In contrast, the final portfolio value is always zero. Figure 3 shows the range of real spending (i.e. spending absent the impact of inflation). By comparison, the 4% rule would be indicated by a constant $40,000.

Figure 3



Source: PWL Capital

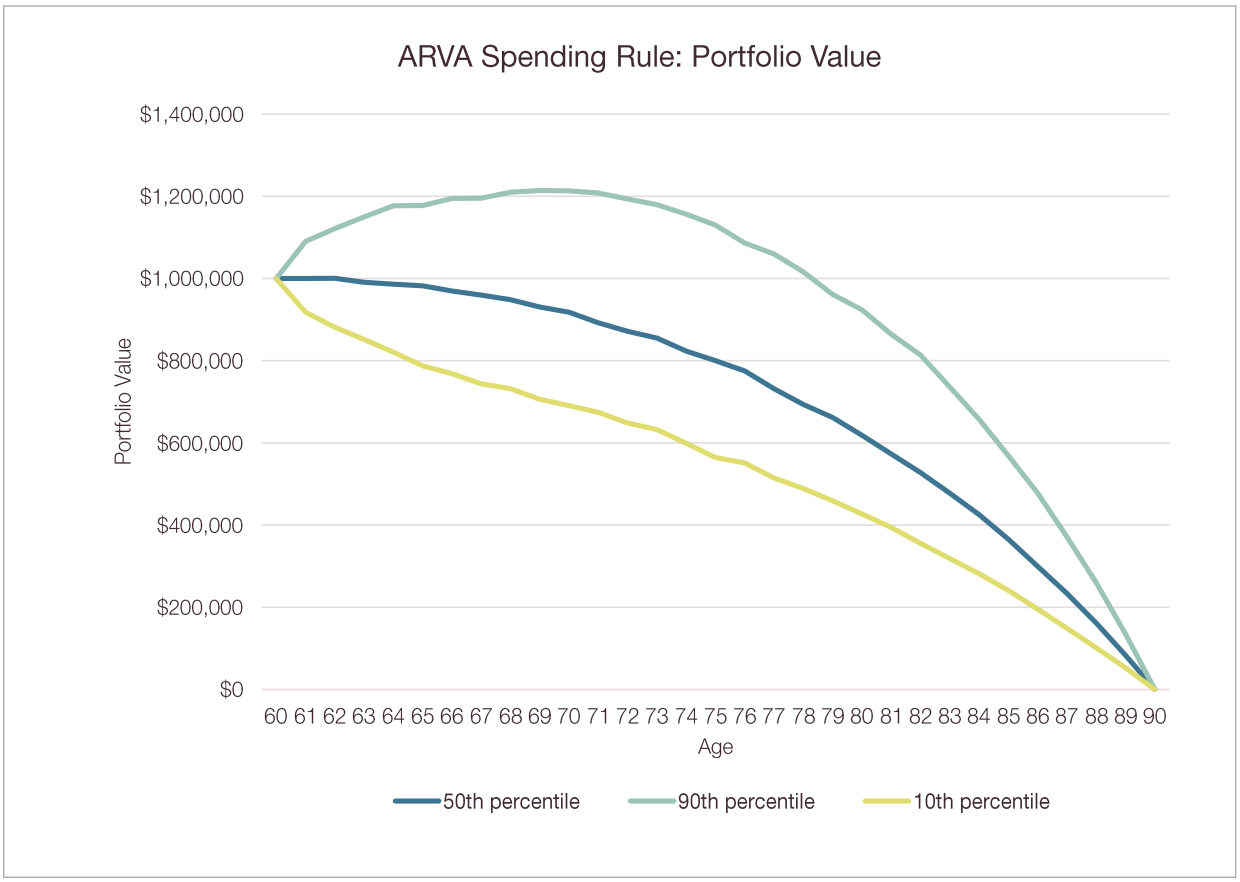
[6] Westmacott, G & Daley. S (2015), "The Design and Depletion of Retirement Portfolios" PWL White Paper. https://www.pwlcapital.com/pwl/media/pwl-media/PDF-files/White-Papers/2015-09-29-Wesmacott_The-Design-and-Depletion-of-Retirement-Portfolios_Hyperlinked.pdf?ext=.pdf

Properties of the ARVA spending curves worth noting are:

1. The spending increases because, with a 60% equity allocation, the long term return exceeds the risk free rate which is used by ARVA.
2. If markets perform badly, as indicated by the 10th percentile curve, then spending from ARVA may be less than the 4% rule for an extended period.
3. In favourable market conditions, spending may increase significantly (a factor of 3) beyond the 4% rule, with the bulk of this spending in later years.

With the ARVA spending rule, the portfolio is always depleted to zero as shown in Figure 4.

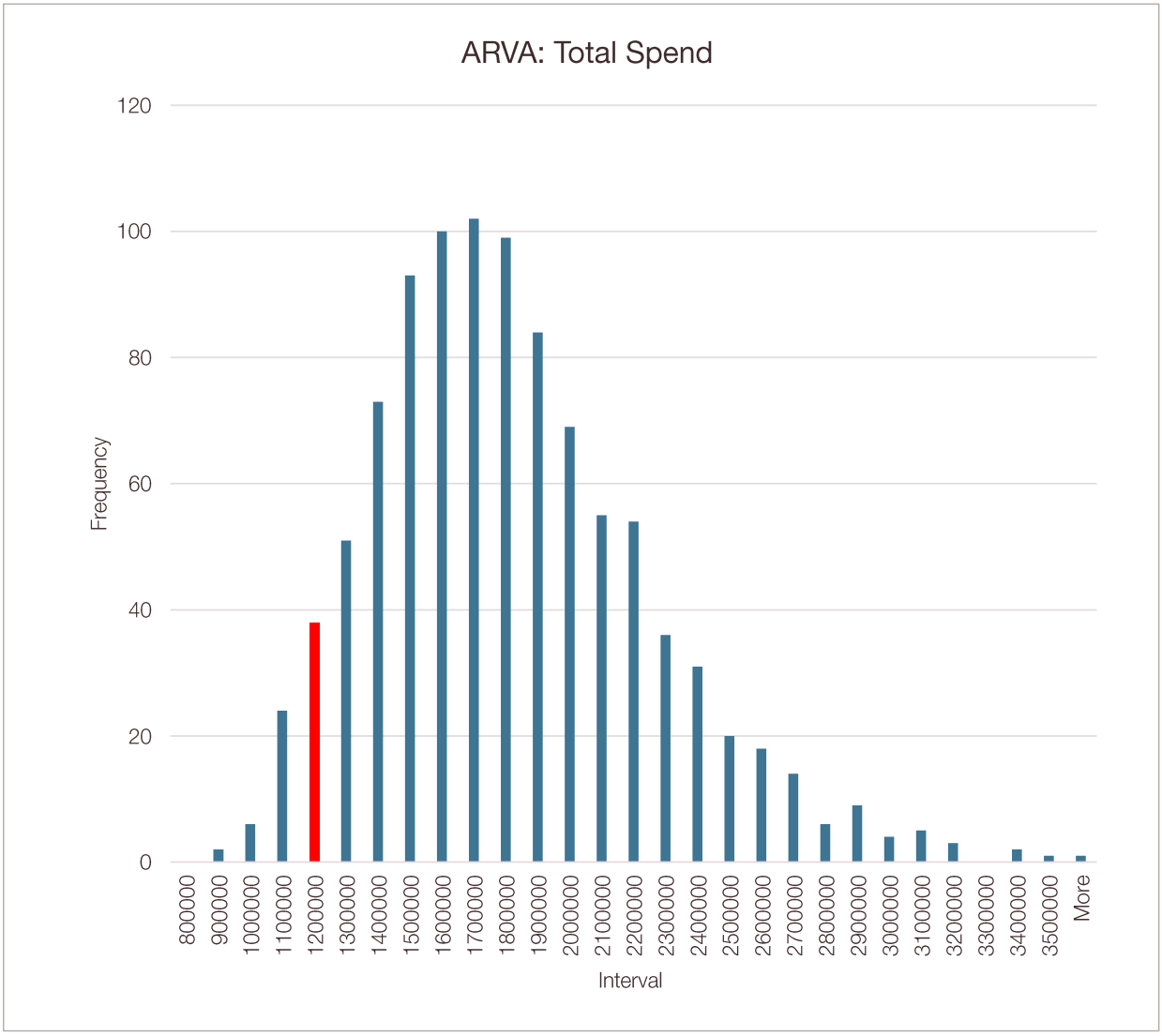
Figure 4



Source: PWL Capital

We also calculate the distribution of the total real spend, as shown in Figure 5. The total real spend from the 4% spending rule over 30 years is $1.2 million (30x$40,000) and is highlighted in red. However, recall that using this spending rule risks a 10% chance of running out of money. The mean spend using ARVA is, $1.714 million, a 43% increase over the 4% spending rule, simply because all the portfolio is spent. Also to be noted is that the distribution has a long tail to the right and a short tail to the left. In other words there are a significant number of occurrences of high income which might be considered pleasant but also wasteful and a small number of occurrences of income below $40,000 annually.

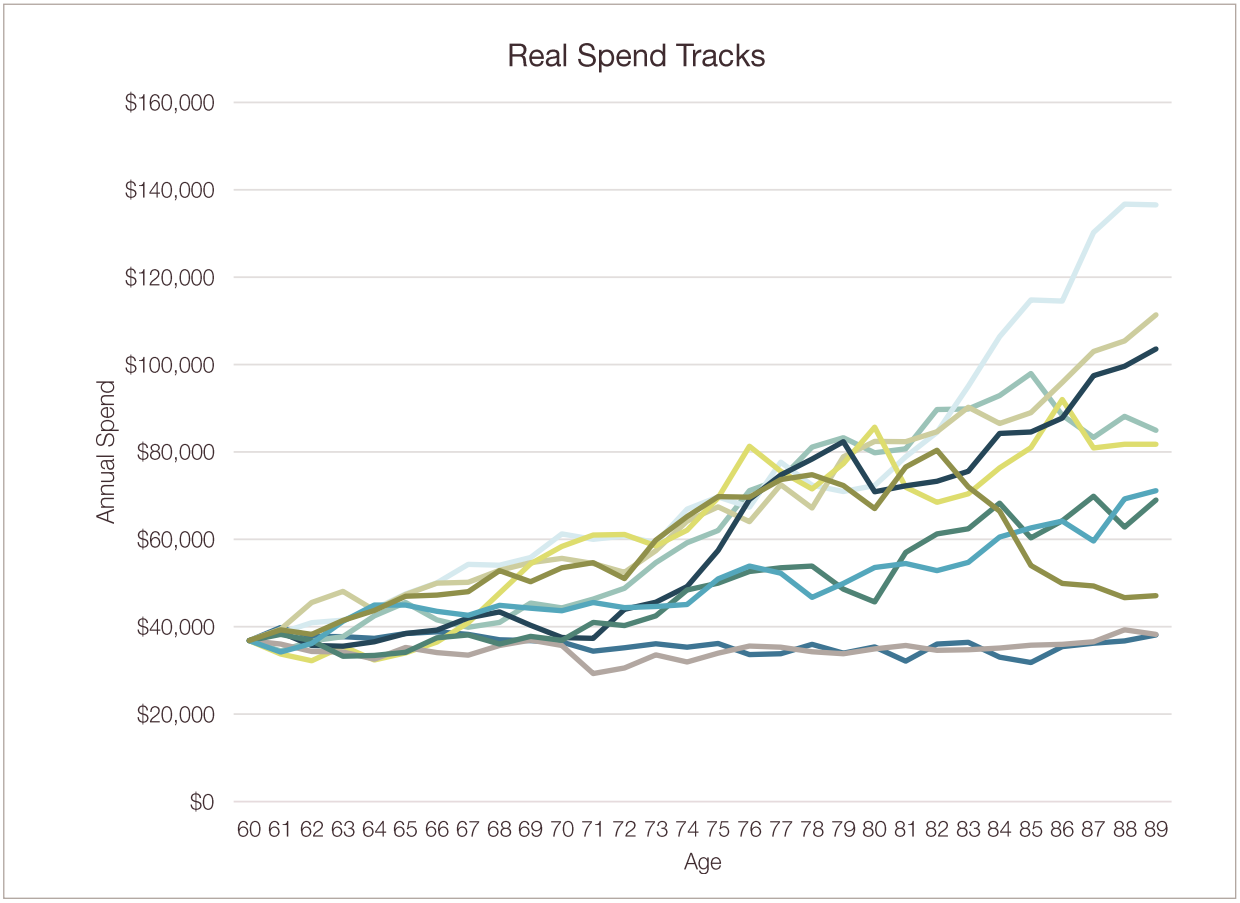
Figure 5



Source: PWL Capital

Our final perspective on the ARVA spending rule comes from looking at individual spending tracks as shown in Figure 6. We see that the spending can vary from one year to the next as the market value of the portfolio changes.

Figure 6



Source: PWL Capital

While ARVA is clearly a more effective and efficient spending rule than the 4% rule, it has some downsides from the perspective of a retiree:

1. A wide distribution in possible total spend, reflecting a wide dispersion in spending tracks. This is a challenge for retirees who need to plan their income with a high degree of certainty.
2. Income variability from year to year that reflects the annual market volatility of the underlying portfolio.

In the next section we consider how to trade some of the upside potential to address these issues.

7 Dealing With Income Risk – Asset Liability Management (ALM)

There is not much argument that more income is better than less income. Nonetheless, most retirees, perhaps with a bit of prodding, can come up with a required (or minimum) level of income below which they would be significantly disappointed with their standard of living. This required income should be met even in adverse market conditions. It is quite possible that the required income is met from assets outside of a retiree's investment capital; from a combination of government benefits and company pensions. In those circumstances, the shortcomings of ARVA may not be a concern.

For others who rely heavily on their investment capital as the primary source of income, a method of structuring their investments to meet this minimum income is of interest. In a previous paper we described Asset Liability Management (ALM) as a process for determining how much investment capital should be set aside to meet a minimum future income stream. We call this allocation the Security Portfolio. The role of the Security Portfolio is to provide a minimum level of income with a high degree of confidence through an investment grade bond portfolio. In our simulations, the Security Portfolio is constructed from ETFs representing short term bonds, the overall bond index, and long term bonds. The duration of the Security Portfolio adjusts to match the duration of the pension liability, so the ETF bond allocation in the Security Portfolio typically changes with age. The allocation to the Security Portfolio is dictated by the liability horizon, the interest yield curve and the minimum income required. The remainder of the assets form the Growth Portfolio which is a mix of equities and bonds that would satisfy the investor if he was not subject to income constraints.

A risk averse investor would place all the assets into the Security Portfolio, but for many retirees that would confine them to an income limited by current bond yields which are barely above the rate of inflation. Most retirees do not have sufficient savings to generate sufficient income without taking some market risk.

Here are examples of statements from clients that would determine how much to allocate to the Security Portfolio:

1. "We want to be confident to be able to withdraw a minimum of $20,000, indexed to inflation, throughout retirement "
2. "At any time we want to have at least 10 years of $25,000 of secure income, indexed to inflation."

In the first case the Security Portfolio delivers a minimum income throughout retirement. In the second case there is a moving 10 year horizon that avoids relying on equity markets for short term income needs in the expectation that 10 years is sufficient time for any down market to recover. The second strategy is riskier than the first, with a smaller Security Portfolio but a larger potential to realize equity gains from the Growth Portfolio. These are illustrations – it is possible to define any spending profile that matches the retirees' perceived income risks, subject to the constraint that the spend in any year cannot exceed the spend calculated by ARVA.

8 All Together Now

We are now in a position to integrate the ARVA spending rule with ALM. In any simulation, we proceed through the following steps:

1. Calculate the future liability based on stated minimum spend and allocate assets to the Security Portfolio.
2. Allocate other investment assets to the Growth Portfolio.
3. Match the bond structure of the Security Portfolio to the cash needs of future liabilities.
4. Deduct the annual spend from the total portfolio based on ARVA.
5. Calculate the portfolio return by using a Monte Carlo sampling of returns and volatility from a six asset portfolio .
6. Calculate the total portfolio value at the end of each year.
7. Repeat 1-6 until the end of retirement.
8. Repeat 1-7 for a specified number of Monte-Carlo simulations (usually set to 1,000)

The simulations will be discussed in more detail in subsequent notes.

The first priority is to meet the requirements of the Security Portfolio. If at any stage, the Security Portfolio requires all the investment assets, then the Growth Portfolio will go to zero and remain at zero. In this case the portfolio becomes a 100% bond portfolio. At the other extreme, if markets perform well, then annual income rises and the equity allocation increases (even as the portfolio value decreases). We could make other choices. For example, we could impose a maximum income so that there is a residual estate when markets are favourable. In practice, it seems better to stick to simple rules to aid comparisons between different scenarios, while acknowledging that in any individual case when markets are positive, retirees have options such as increasing lifestyle spending, gifting or leaving an estate.

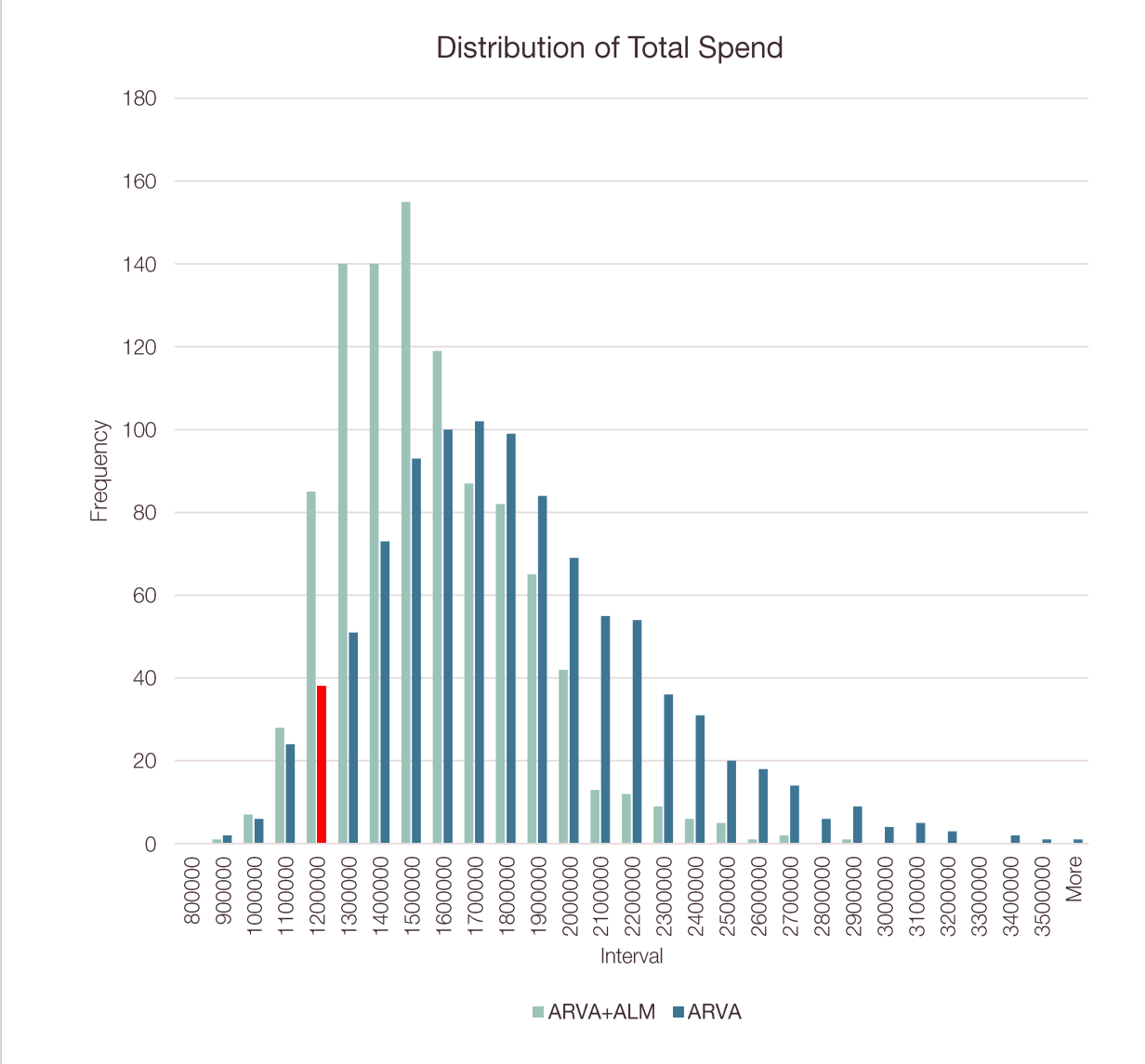
To this basic sequence we can select additional options:

1. Simulations can be started pre-retirement so the Security Portfolio grows gradually as the future pension liability draws closer.
2. We can choose to index (inflation) match the pension liability or not. There is some evidence that retirees spending decrease with age roughly at the current rate of inflation.
3. We can apply mortality weighting. Mortality weighting discounts the future pension liability by the probability of dying in the period. The mortality weighting can be chosen for males, females or couples (last to die).

To illustrate ARVA and ALM working together, we repeat the simulation of the previous section but impose the constraint that the minimum spend should not fall below $30,000 over a rolling 10-year horizon.

Figure 7 shows the income distribution compared to the previous simulation without the minimum income constraint. In our previous example, without the minimum income constraint, the equity allocation is constant at 60%. Forcing the Security Portfolio to provide the minimum $30,000 annually raises the fixed income allocation and reduces both the portfolio and spending volatility. In this example, the average equity allocation falls from 60% to 30% over the retirement period reducing the yearly variation in spending by 46%.

Figure 7



Source: PWL Capital

We also observe the spread of the spending distribution has tightened considerably so a higher percentage of total spend is within a narrow band, so retirees can plan their expenditure with greater confidence.

The example we have chosen is only one combination of ARVA and ALM to achieve a minimum and median income that satisfies the client needs. Raising the minimum spend or extending the minimum spend horizon would both drive the spending distribution closer to a constant spending rule and the portfolio asset allocation would tend towards 100% fixed income.

9 Conclusions

We have described an integrated approach to retirement income planning that efficiently uses assets set aside for retirement while minimizing downside risk. We have introduced a flexible framework that encompasses elements of total return, bucket and annuity strategies, weighted according to the needs of the client. In future papers, we will illustrate this integrated approach with specific case studies.

Compared with fixed spending rules, the ARVA dynamic spending rule more efficiently depletes the portfolio, resulting in 10%-40% more lifetime income. Coupling ARVA with asset liability management (ALM) reduces both the annual income variability and concentrates the total spend into a narrower range of outcomes, both positive outcomes for investors planning retirement.

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