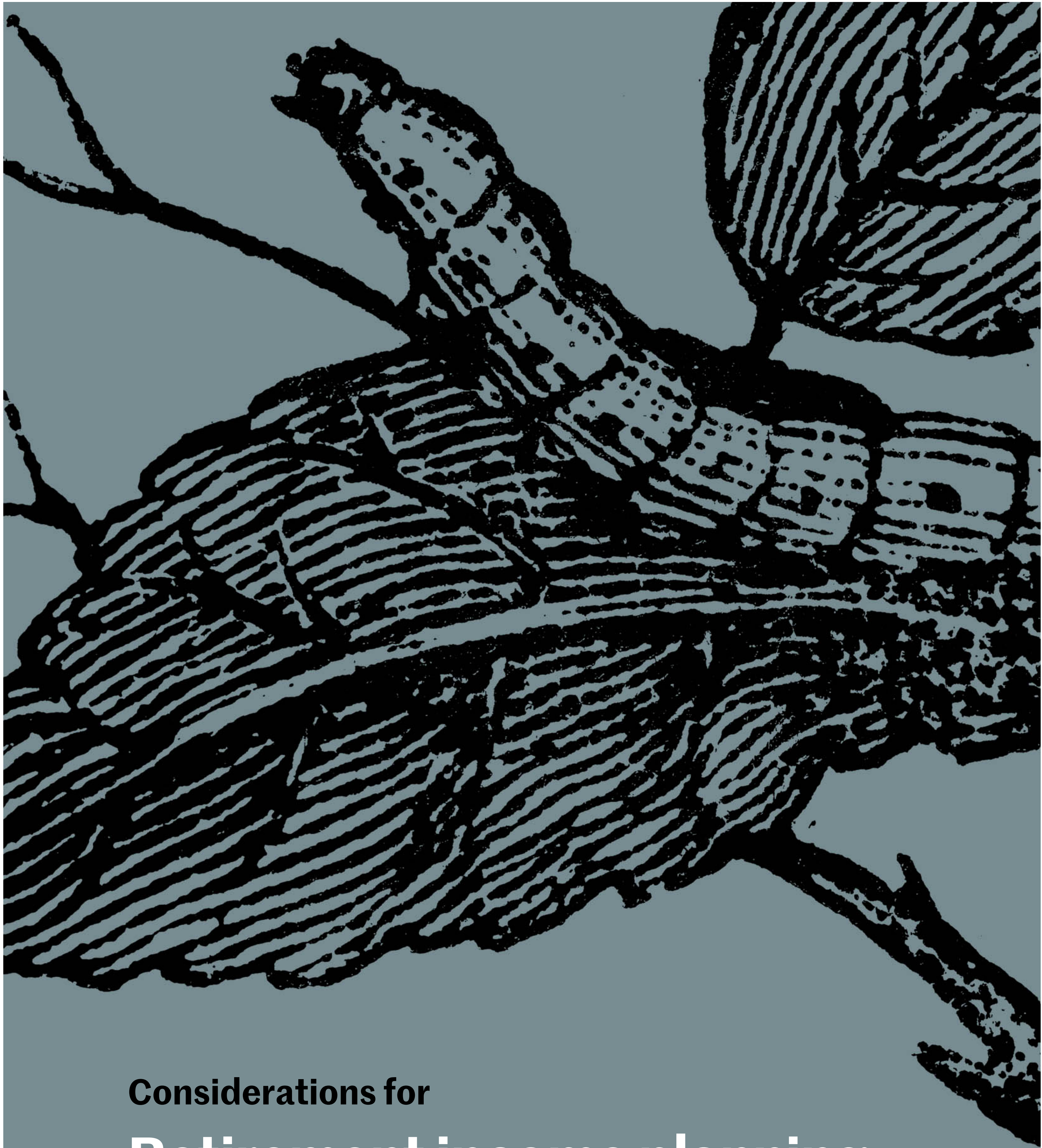


Considerations for

Retirement income planning

FINANCIAL FREEDOM *for* PROFESSIONALS

the {gosling} factor

Contents

Important note

Nothing in this paper should be taken to represent financial advice. It is generic commentary based on typical or example circumstances and not tailored to your own situation. Retirement income planning is complicated. If you're not sure what to do, you should take financial advice.

Introduction

Retirement income planning is a complex issue. In this paper we review common withdrawal strategies through the lens of financial economics.

We find that strategies based on safe withdrawal rates suffer from four weaknesses.

- First, the probability of falling short of minimum acceptable retirement income levels, although small, is uncertain and it is questionable whether it is really tolerable for many people.
- Second, minimizing this probability requires excessive asset buffers to be maintained, suppressing consumption early in retirement and resulting in excessive funds at death or late in retirement in many scenarios.
- Third, this is a consequence of unnecessary and self-inflicted exposure to "sequence of returns" risk imposed by the strategy, which is an inefficient risk in the sense it is not rewarded with higher returns.
- And fourth, safe withdrawal rates calculated with the benefit of hindsight would not have felt safe at the time, raising questions as to whether the strategy would actually have been executed.

We propose an alternative strategy that will provide preferable risk-return characteristics for many individuals and is founded on the principles of financial economics. This strategy involves:

- Using part of the portfolio to purchase an annuity to secure a minimum level of income and insure against longevity risk.
- The remainder of the portfolio is invested in a risky asset mix to generate higher returns. However, crucially, the risk is reflected in variable annual expenditure by predefining withdrawal rates as a proportion of the *current* portfolio value each year rather than the *initial* portfolio value.

The proposed strategy contrasts with so-called "safe withdrawal rates" which push the risk into significant tail risks relating to exhaustion of the fund and consequent collapse in retirement income. Instead, the proposed strategy accepts the risk in annual income variability, which allows all risk to be rewarded through higher potential market returns.

We propose rules for defining the withdrawal rate in our alternative strategy. These withdrawal rates are set at the start of retirement and can be followed mechanistically if desired.

We find that the alternative strategy works even better in realistic scenarios that recognize the likelihood of declining real terms expenditure through retirement and the presence of underpinning income through the State Pension.

Our proposed strategy has three significant advantages over safe withdrawal strategies:

- Sequence of returns risk and the consequential catastrophic tail risk is completely removed.
- The strategy requires some up-front advice but then can be defined as a “set and forget” strategy capable of easy self-implementation.
- The existence of a guaranteed income and withdrawals based on the current rather than initial portfolio means that in unfavourable markets the strategy does not approach the “cliff edge” in the way that safe withdrawal strategies do, thereby making the strategy much more implementable in practice from a psychological point of view.

We outline a number of areas for future research to improve development of the class of strategies proposed and provide a practical roadmap for the advice process based on this method.

Drawdown and safe withdrawal rates

Annuities out of favour

Since full pension freedoms were introduced in 2015, the number of retirees using their pension to purchase an annuity has plummeted. Figures from the Financial Conduct Authority[1] show that in 2019/20, of people accessing pots greater than £250,000 for the first time, only 6% bought an annuity, compared with 85% who commenced partial drawdown (the remainder either just took tax free cash or withdrew their entire pot). Overall annuity purchases where over 80% lower than a decade previously.

Annuities have developed a reputation for being expensive and inflexible. And absurdly generous inheritance tax treatment has added a further incentive to keep funds invested in your pension pot.

According to Hargreaves Lansdown, at the time of writing a £100,000 pot would buy a 60-year-old an inflation-linked annuity of a measly £2,131 a year. Based on a 25 year further expected life, this represents an expected real return of between -4% and -5% a year, well below the real yields on the underlying index-linked gilts that insurance companies use to price these products. Even over upper decile life expectancy the real return is around -2% a year.

Given that a global portfolio of equities has never delivered a negative real return over 25 years, this makes it very tempting to try to eke out a higher income by going into drawdown and keeping the assets invested in a mix of stocks and bonds.

Safe withdrawal rates

Increasingly, drawdown portfolios of bonds and stocks are being used to provide income through retirement in place of an annuity. Such portfolios are expected to deliver substantially more than -4% to -2% pa average real

[1] https://www.fca.org.uk/data/retirement-income-market-data

return implied by an annuity. Therefore, the idea is that use of such a portfolio will allow a drawdown rate that exceeds the annuity income.

The question of exactly how much more is the subject of studies on so-called "safe withdrawal rates". Originated as a concept by William Bengen in the mid 1990s, the idea is that study of history can show what the highest possible level of withdrawal would have been without exhausting the portfolio over a typical retirement period. Bengen's analysis led to the famous 4% rule. This rule states that a retiree with a $1m portfolio at retirement can draw an initial income of $40,000 a year, increasing in line with inflation in subsequent years, and be assured that their pot will last a typical retirement period of 30 years.

The safe withdrawal rate is the highest percentage for which this holds true, and so is based on the worst-case historical scenario for returns. A similar approach can be taken with Monte-Carlo models. In this case the safe withdrawal rate is based on a given probability level, for example a 90 or 99% chance of not running out of money.

Abraham Okusanya, in his book *Beyond the 4% Rule*[2], extends the analysis to portfolios of UK and global equities and bonds. He finds that in these markets, and allowing for a 1% per year adviser fee, the safe withdrawal rate for a balanced portfolio of equities and bonds is around 2.8% to 3.2%. This equates to taking an inflation-linked income of £28,000 to £32,000 from a £1m portfolio. Our own historical dataset for global equities[3] suggests a safe withdrawal rate of 3% for a 50/50 global equity/bond portfolio over a 30 year retirement period, which is what we will assume for the analysis in this paper.

Problems with safe withdrawal rates

Safe withdrawal rates suffer from a number of problems, however.

1. Safe withdrawal rates aren't safe

The worst case in history is not a reliable estimate for the worst case in future. The relative market prices of annuities and equity/bond portfolios

[2] https://finalytiq.co.uk/beyond-4-rule/

[3] Our dataset is based on the Damodaran dataset for historic real returns on US stocks and bonds since 1926 (http://people.stern.nyu.edu/adamodar/New_Home_Page/datacurrent.html). We adjust historic equity returns down by 1.3% pa to adjust for the historic difference between global and US long term equity returns (source Credit Suisse Yearbook). There is no long term difference between US and global bond returns. This dataset closely replicates safe withdrawal rates for global portfolios by other authors.

in part reflect risks that haven't yet been realized in the past but could be in future. A historical dataset of 120 years only contains four non-overlapping (and hence entirely independent) 30 year periods. We can't pretend to know the complete distribution of long-term returns.

Furthermore, safe withdrawal rates are based on fixed retirement terms, whereas life expectancy is uncertain. A 30 year assumed retirement for a 60 year old takes you beyond the average life expectancy of 85 for a man and 87 for a woman. But there's a 1 in 10 chance that the same individual lives to nearly 100, meaning that the pot may need to last 40 years.

Although the risks of falling short may be small, is anyone prepared to accept even a 1 in 50 chance of running out of money before they die, given the impact of such a scenario?

2. Mismatching assets and income creates sequence of returns risk

A much talked about risk in retirement income planning is 'sequence of returns risk'. This risk arises when you are taking a fixed annual income from a volatile portfolio. In essence poor returns early in the withdrawal period have a disproportionate impact on retirement income. This is because too large a proportion of the portfolio is sold at a loss to fund early expenditure. Even if returns subsequently recover, it's too late for the portion of the portfolio that has already been spent.

This sequence of returns risk is the primary driver of the risk of running out of money when drawing down a retirement portfolio. A buffer of assets needs to be held to protect against this risk.

Sequence of returns risk is an unusual risk. Two scenarios that have the same cumulative return over 20 years can lead to different supported expenditure in year 21 if the pathways of returns in the two scenarios is different. Noble Laureate William F. Sharpe[4], together with co-authors Jason S. Scott and John G. Watson, shows that this sequence risk is a self-inflicted wound that arises from a fundamental mismatch between a fixed income withdrawal and a risky portfolio. This is a risk faced by the individual that is not rewarded by higher returns. As such, it is economically inefficient.

Rather than bearing the risk of the fund running out at some point in future, driven by the attempt to match a fixed income with volatile assets,

[4] https://core.ac.uk/download/pdf/286031592.pdf

it is more efficient from a utility-maximisation perspective to allow for volatility in each year's expenditure. This is achieved by matching each future year's expenditure with a combination of risk free and risky assets that reflect the individual's risk profile. This ensures that the risk taken is fully compensated by higher expected market returns.

3. Avoiding spending too much often leads to spending too little

Safe withdrawal rates are set low enough that even given worst case historic returns (and sequence of returns) the fund lasts for 30 years. But most scenarios are much better than the worst case. As a result, the safe withdrawal approach leads to excessive saving in the majority of cases. Indeed, around a third of the time the portfolio after 30 years is bigger in real terms than it was at the point of retirement!

These first three problems are illustrated in the table below, which assumes a withdrawal strategy based on the 30-year safe withdrawal rate of 3% and a £1m portfolio at retirement. The results based on our dataset, which simulates a global 50/50 equity-bond portfolio since 1927, are shown in the table below. In each case a 1% pa adviser fee is allowed for and all numbers are in real terms.

In each case the fund supports an income of £30,000 for 30 years from age 60 to 89. The table shows the residual fund at 90 and the subsequent income that this fund can support.

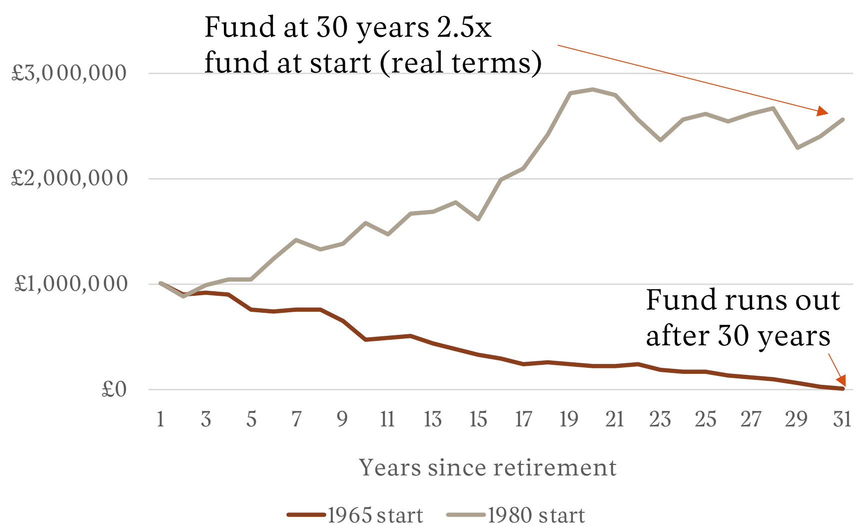
Scenario	Fund at 90	Income 90+
Minimum	£1,033	£103
Bottom 10%	£214,000	£21,400
Median	£670,000	£67,000
Top 10%	£2,160,000	£216,000

To estimate the income from age 90 we've converted the fund at 90 into an inflation-linked annuity using a factor of 10, based on projected improvements in life expectancy.

The table illustrates two important points. The first is that in the minimum scenario, income collapses once the individual reaches 90, which is clearly an unacceptable outcome. Although the fund is sufficient to fund lifetime income of £30,000 in 4 out of 5 scenarios, we find that in 8% of scenarios income beyond 90 falls to less than half this amount. Given the high probability (around 1 in 3) of an individual aged 60 today exceeding 90, this results in a 2-3% failure probability. Although this sounds small, should we really be prepared to roll the dice in this way when we only have one life? Especially when this probability is based on the extremes of a historic sample and hence a very unreliable estimate. We really don't know whether the true probability is 1% or 5%. And this analysis is based on a single person – the odds are worse for a couple.

The second point illustrated by the table is the excessive buffer maintained in most scenarios. There's roughly a 1 in 3 chance of still having as big a portfolio in real terms at age 90 as you had at 60. This represents very significant forgone consumption. Of course, it can be argued that the withdrawal rate could be reset later in retirement. But it's fundamental to the operation of the safe withdrawal approach that the buffer is maintained until sequence of returns risk subsides, which means that the added expenditure will always be deferred out of the early years of retirement when we are arguably most active and best placed to enjoy the additional expenditure.

These points are illustrated below which looks at the real-terms fund after 30 years of taking £30,000 withdrawal, based on 1965 and 1980 start dates.



An alternative approach

Lessons from financial economics

As we've described in more detail elsewhere[5], the fundamental problem with the safe withdrawal rate is that it takes risk in terms of how long the money will last rather than taking risk in year-by-year consumption. Okusanya implicitly accepts this by adopting a number of variable withdrawal approaches to mitigate the effects. However, these approaches, when simply calibrated using backtests, only solve the problems of the past rather than addressing the risks of the future.

The fundamental mindset change required, as described by Sharpe and co-authors[6], is to instead accept risk in each year's consumption. This involves matching each future year's consumption by a portion of your portfolio invested in a mix of risk free and risky assets. In essence the portion of your portfolio used to match a given future year is put in a separate notional account and preserved for that year. Sharpe calls this approach either the "lock box" or "ear marking" approach. Its crucial feature is that each year's available expenditure depends only on the cumulative returns to that year and not the sequence of returns.

On the face of it this sounds complex, requiring you to split your portfolio into 40 or 50 pots, one for each future year of your life. But in fact the strategy can be vastly simplified through a mix of purchasing an annuity and investing the remainder of your portfolio in a risky portfolio. Each future year's income is funded by:

- Securing part of each year's income with an inflation-linked annuity; and
- Providing the rest of each year's income by selling a pre-determined percentage of your remaining risky portfolio in that year.

The annuity component clearly meets the "lock box" requirement. We will now show that rules based on drawing a percentage of *current* rather than *initial* portfolios satisfy this requirement also.

[5] https://thegoslingfactor.com/investment/how-do-nobel-laureates-approach-retirement/
[6] https://core.ac.uk/download/pdf/286031592.pdf

Withdrawal rules based on current not initial portfolios

Any rule that involves selling a proportion *P(t)* of the *remaining* portfolio in year *t* can be translated into assigning a proportion *P*(t)* of the *initial* portfolio to that year as follows:

Equation (1): $$P^*(T) = P(T)\prod_{t=1}^{T-1}[1 - P(t)]$$

Here t=0 is the point of retirement. Note that *P** is entirely independent of the sequence of returns. As such the income from sale of the portion of the portfolio in year *T* only depends upon the cumulative return to year *T*. Therefore, any such strategy meets the conditions of Sharpe's "lock box" or "ear marking" strategy. The portfolio is economically efficient, and sequence of returns risk is removed, and converted to annual consumption risk.

The proportion secured through an annuity will depend on the individual's risk appetite, and the minimum level of income that they require to be guaranteed in absolutely all circumstances.

What about the function *P(t)*? Again, this depends on risk appetite and many options are available. A logical approach would be to choose a withdrawal function that in "normal" market circumstances might lead to a broadly level expenditure profile in real terms. For example:

Equation (2): $$P(t) = \frac{1}{a_{LE(t,q),r}}$$

Here *LE(t,q)* is the remaining life expectancy at time t with probability q. For example, for *LE(10,25%)* for a 60 year old retiree would be their upper quartile remaining life expectancy in ten years' time at age 70. The term $a_{LE,\,r}$ is an annuity of term LE calculated at a real interest rate of *r*.

This formula calculates the annual payment that can be funded from the *current* portfolio over the future life *LE* assuming a constant real return on assets of *r*. In essence, therefore, this distribution approach involves annual re-estimation of the sustainable withdrawal level based on the current portfolio, life expectancy, and a fixed future return assumption.

The choice of *q* and *r* will again depend on risk profile. Choosing *q* close to 50% would result in use of average remaining life expectancy at each future age. This will result in higher withdrawal values earlier in retirement and lower withdrawal values later. Similarly for investment return: a high assumed investment return will result in higher withdrawals early in retirement.

A simple approach to implement

Although this approach sounds complex it is in fact very simple. At the start of retirement, assessment of the retiree's desired risk-return profile leads to:

- A chosen level of income to secure through annuity purchase.
- An asset allocation for the remaining portfolio.
- A set of withdrawal percentages for the remaining portfolio.

Although the withdrawal percentages have some mathematics behind them, once they are set they can be applied in a mechanical way in retirement by the retiree.

Therefore, while such an approach would almost certainly require some financial planning advice at the point of retirement, from that point on it could largely be a "set and forget" approach, which could be self-implemented by the retiree with only occasional need for review advice, say every five years.

We don't claim any great originality for this approach. It is closely based on the work of the Nobel Laureates William F. Sharpe[7] and Robert C. Merton[8]. The approach is also closely related to the snappily titled Mortality Updating Failure Percentage strategy[9] defined in 2012 by David Blanchett, Maciej Kowara, and Peng Chen of Morningstar. Rather than using a formula to define the withdrawal rate for each year of retirement they use safe withdrawal rates (based on historic data) for the remaining estimated lifetime each year. Their approach adds unnecessary complexity and conservatism to the proposed strategy because we have already secured a minimum baseline through annuitisation.

[7] https://dash.harvard.edu/bitstream/handle/1/4554335/Laibson_AgeofReason.pdf?sequence
[8] https://robertcmerton.com/wp-content/uploads/2017/08/The-Crisis-in-Retirement-Planning-HBR-2014-Merton.pdf
[9] https://investmentsandwealth.org/getattachment/90eb6376-d090-4904-9f82-786553ff5ed9/RMJ023-OptimalWithdrawalStrategy.pdf

Comparison of approaches

Level targeted expenditure in real terms

To illustrate how the alternative approach compares with a traditional safe withdrawal rate approach, we have run the alternative approach through our historical dataset using the following assumptions:

- 50% of the portfolio is applied to purchase an annuity. This is a question of risk and return, but examination of a number of scenarios suggests that using half the retirement pot for secured income will be close to the "sweet spot" between security and level of income.
- The annuity rate is £2,131 per £100,000 for a single person age 60 with an inflation-linked annuity (based on Hargreaves Lansdown best buy annuity rates[10] as at the date of writing) so a guaranteed income of £10,655 is purchased with £0.5m of funds.
- We assume that the remainder of the portfolio is 100% invested in equities. This makes the initial asset mix comparable to the 50/50 equity/bond portfolio assumed for the safe withdrawal approach.
- For withdrawal rates calculated using Equation (2), we model life expectancy based on the upper decile life expectancy at any point. This is a prudent assumption reflecting the undesirability of dramatically reduced income late in life and is designed together with the other assumptions to produce a fairly stable baseline income profile. We use a real return of 4% per annum. This is broadly aligned with the expected long-term real return on a global equity portfolio, albeit slightly prudent. See Appendix 1 for the resulting portfolio withdrawal rates.
- Again we assume that any remaining fund at age 90 us used to buy an inflation-linked annuity at a rate of £10 per £1 of income to add to the annuity purchased at retirement.

The results for annual income under the alternative strategy are shown in the table below. Recall that the safe withdrawal approach delivered £30,000 for 30 years but then had very significant income reductions from age 90 in 8% of scenarios.

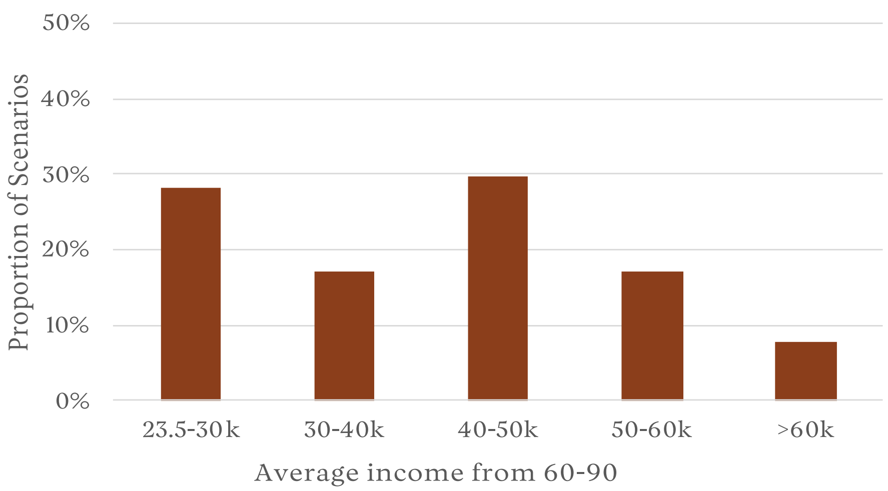
10 https://www.hl.co.uk/retirement/annuities/best-buy-rates

Scenario	60-69	70-79	80-89	Fund at 90	Income 90+
Minimum	25,700	20,100	21,200	93,300	20,000
Bottom 10%	28,900	22,200	22,500	108,000	21,500
Median	38,500	40,100	39,000	211,000	31,800
Top 10%	50,000	67,600	61,400	336,000	44,300

A few observations can be made when comparing with the safe withdrawal approach:

- The possibility of running out of money is **entirely removed** and even the worst-case scenario provides an income for life of £20,000, as compared with a fall to effectively zero in the worst-case for the safe withdrawal approach.
- The average income from 60 to 90 is in all cases at least 78% of the amount in the safe withdrawal approach.
- The fund at age 90 is consistently lower, being 70% lower at median meaning much less “wasted” buffer.
- As a result, in over 70% of scenarios, average expenditure from 60 to 90 is higher, and is fully 40% higher at the median (£42,500).

Distribution of average income from alternative strategy (50% annuitisation)



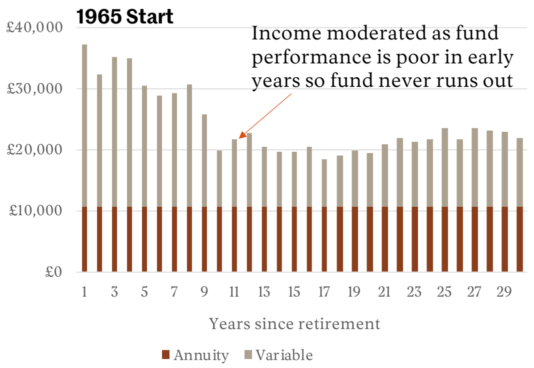
In summary, the revised approach removes all chance of running out of money (sequence of returns risk is neutralized) and creates the opportunity for significantly higher spending, at the cost of expenditure being reduced by a little over 20% in very poor scenarios.

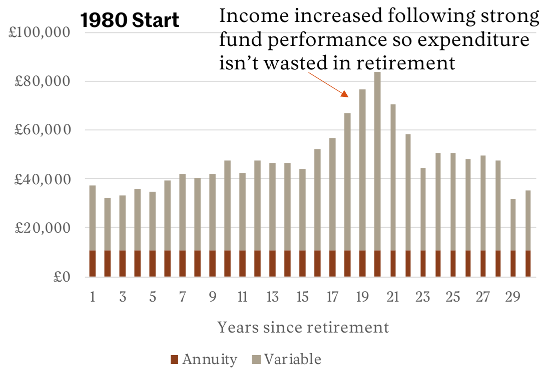
In effect the strategy moves from one of false certainty, with a cataclysmic tail risk, to one of controlled variability. The revised strategy can be thought of as providing a “base salary” of a little over £10,000 coupled with a “bonus” that typically varies between £10,000 and £50,000, with a central expected outcome for the bonus of around £30,000.

In practice, rather than accepting the annual variability in expenditure in full, it could be smoothed over rolling three year periods, say.

The charts below show how the alternative approach would have operated for the extreme start years of 1965 and 1980.

Annual income from a £1m initial fund for extreme start years





For the 1965 start, following poor returns in the early 1970s, income is adjusted down towards £20,000, which level can be maintained through retirement until death. By contrast, under the level withdrawal approach, £30,000 a year is withdrawn until the fund runs out after 30 years.

For the 1980 start, following strong returns in the 1980s, income is maintained at around £40,000 throughout retirement, and indeed temporarily increased further. After 30 years, remaining funds are sufficient to ensure an income until death of over £30,000 a year. By contrast, under the level withdrawal approach, £30,000 a year is withdrawn but this leaves an excessive fund of £2.5m in real terms to accumulate after 30 years and less is available early in retirement.

Note that under our proposed strategy *exactly the same percentage* of the current fund is withdrawn each year in either scenario.

Developing more realistic scenarios

The benefits of the proposed approach can be seen even more strongly in more realistic scenarios, where we take account of two further factors:

- As summarised by Okusanya, there is significant evidence that expenditure in retirement falls by 1% to 1.5% a year in real terms. This makes sense as people move from more to less active phases of retirement, and family related expenditures continue to decline.
- A portion of retirement income will be met for most people through the State Pension, currently around £9,000 a year.

We therefore adapt our scenario as follows:

- Our 60-year-old retiree is single and has a pot of £1m at retirement.
- Their expenditure in real terms from 70-79 is 10% lower than their expenditure from 60-69 and that from 80 onwards is 20% lower.
- They are eligible for a State Pension of £9,000 a year from age 67.

Based on these assumptions the following 30-year expenditure is supported under the safe withdrawal approach:

<table>
<tr><th>Scenario</th><th>60-69</th><th>70-79</th><th>80-89</th><th>Fund at 90</th><th>Income 90+</th></tr>
<tr><td>Minimum</td><td rowspan="4">39,500</td><td rowspan="4">35,500</td><td rowspan="4">31,600</td><td>49,100</td><td>13,900</td></tr>
<tr><td>Bottom 10%</td><td>243,000</td><td>33,300</td></tr>
<tr><td>Median</td><td>689,100</td><td>77,900</td></tr>
<tr><td>Top 10%</td><td>2,087,000</td><td>217,700</td></tr>
</table>

Again we see the characteristics of the safe withdrawal approach coming through. In the downside scenario there is an unacceptable possibility of income fall-off from age 90. At the same time, in the median scenario there is an excessive fund at age 90, which represents forgone expenditure earlier in retirement. This buffer is the price of insulating against self-inflicted sequence of returns risk, which is even more severe in a reducing withdrawal scenario.

We can compare this outcome with our proposed approach. As before we assume that half of the fund is used to buy an inflation-linked single life annuity and the remainder is invested fully in equities. Note that this is a reasonable assumption for a desired level of secured income: the resulting guaranteed income is, at around £20,000 a year, in line with the "moderate" retirement living standard set out by the Pension and Lifetime Savings Association[11].

In the flat withdrawal case, when calculating withdrawal rates from the remaining equity portfolio, according to Equation (2), we assumed a real return of 4% a year, reflecting a prudent assumption for real returns on the equity portion of the portfolio. In this case, after allowing for the State Pension, the secured annuity and the falling aggregate expenditure requirement, the remainder to be funded by the equity portfolio falls by around 2% a year over the long term. To reflect this, we therefore use an annuity based on an 6% real interest rate (rather than 4%) in Equation (1) and continue with upper decile remaining life expectancy. The resulting withdrawal rates are in Appendix 1.

The results of the proposed strategy are shown in the table below.

Scenario	60-69	70-79	80-89	Fund at 90	Income 90+
Minimum	30,500	28,800	27,900	59,200	25,600
Bottom 10%	34,200	30,800	28,900	68,600	26,500
Median	45,300	47,900	41,800	133,900	33,000
Top 10%	58,200	74,300	59,800	213,000	41,000

Again, the comparison with safe withdrawal approach is very attractive:

- Sequence of returns risk and mortality risk have been entirely removed and so there is now no chance of income collapsing towards the State Pension level. In the worst case, income is between the "moderate" and "comfortable" Retirement Living Standards.
- In 80% of cases the average income is higher under the alternative strategy and is 32% higher at median. The cost of this is a chance of income being up to 15% lower on average over the ages 60 to 90.

[11] https://www.retirementlivingstandards.org.uk/

Further benefits

There are two key further benefits of the alternative approach.

1. Financial competence

Detailed research[12] has shown progressive cognitive decline, and consequence impairment of financial decision making, and at an ever increasing rate, from the early to mid 50s. Securing a significant portion of income with an annuity provides protection against poor decision making later in life, and results in an increasing proportion of expenditure being funded in a simple way through monthly payments as life proceeds.

2. Psychological sustainability of withdrawal strategy in poor markets

Examination of the scenarios under the safe withdrawal rate show how challenging sticking to the safe withdrawal strategy could be in difficult market circumstances. Take, for example, the period starting in 1968. Early on in the withdrawal period there were devastating bear markets in equities *and* bonds as a result of the 1970s stagflation.

As a result, by 1984, half way through the period, the fund has fallen 75% in real terms from £1m to £0.25m. At that point in time, with £26,500 a year still being withdrawn, the portfolio would have been looking very much like it would run out of money. It so happens that just around the corner was a bull market in equities and bonds that delivered double digit *real* returns on a 50/50 equity/bond portfolio over the next 15 years. So with the benefit of hindsight we see that the fund did indeed last the 30 years to 1998. However, this would have been far from obvious at the time, and the precipitous drop in portfolio value would very likely have resulted in significant downwards adjustment in spending.

By contrast, under our proposed approach, £20,000 a year of income is absolutely guaranteed, so it is possible to take more risk with the remaining portfolio. Moreover, the withdrawal approach based on a percentage of the *remaining* fund rather than *original* fund provides a natural dampening of withdrawals to ensure income is scaled back so that the fund does not run out. This approach enabled a total income of around £30,000 a year to be retained throughout this period. Importantly, the existence of a fully secured baseline and dampened withdrawal approach would give confidence to stick with the strategy.

[12] https://dash.harvard.edu/bitstream/handle/1/4554335/Laibson_AgeofReason.pdf?sequence

Conclusions

We have shown that conventional “safe withdrawal strategies” are far from safe and expose the user to significant tail risks. Sequence of returns risk, in particular, is a self-inflicted form of risk that does not attract a return premium in financial markets. To protect against this risk, safe withdrawal strategies require the holding of excessive buffers that keep expenditure, especially early in retirement, artificially low in most cases.

Financial economics shows that economically efficient strategies will be invariant to the sequence of returns and involve segregated portfolios for each year of retirement. Although this sounds complicated, simple withdrawal strategies based on the *current* rather than the *original* portfolio value meet this criterion.

We have shown that mortality risk and sequence of returns risk are easily removed by using a portion of the retirement fund to secure an annuity and using the remainder to fund annual withdrawals according to a formula that determines the proportion of the current portfolio to be sold. We base our formula on an annuity formula using an expected real equity return of 4% pa over remaining 90^{th} percentile life expectancy.

In a realistic scenario involving reducing expenditure and the State Pension, we find that this alternative strategy removes the significant mortality and investment return tail risk at relatively low cost (no more than 15% income reduction in the worst historic case to remove all risk of running out of money). The revised strategy produces higher income in 80% of cases and 32% higher at the median through preventing build-up of excessively large balances.

Such strategies, based on principles of financial economics, should receive greater attention in the financial adviser community. In Appendix 2 we set out the practical steps required to enact such a strategy.

Further research could include assessment of income volatililty using stochasit models, the link between annuitisation level and remaining portfolio asset mix, and simple smoothing rules (e.g. three year averaging) to lessen the impact of consumption volatility.

Appendix 1

Withdrawal rates – level scenario

The table below shows the withdrawal rates from the equity portfolio implied by our rule in the alternative strategy. These are for the scenario where a level income is targeted.

These have been calculated using Equation (2) using estimated upper decile expected remaining life using the Office for National Statistics life expectancy calculator[13] for the term of the annuity and a 4% real return.

Note that the fact that part of the portfolio has been used to provide a guaranteed income base allows a much more aggressive withdrawal strategy to be adopted on the remainder of the portfolio than would be the case with typical safe withdrawal strategies.

Age	% of current portfolio	% of original portfolio
60	5.3%	5.3%
65	5.7%	4.3%
70	6.1%	3.4%
75	6.8%	2.7%
80	7.8%	2.2%
85	9.3%	1.7%

13 https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/healthandlifeexpectancies/articles/lifeexpectancycalculator/2019-06-07

Withdrawal rates – reducing scenario

The table below shows the withdrawal rates from the equity portfolio implied by our rule in the alternative strategy. These are for the scenario where the portfolio meets the difference between a reducing expenditure level and a fixed real terms base, comprising annuity and Basic State Pension.

These have been calculated using Equation (2) using estimated upper decile expected remaining life using the Office for National Statistics life expectancy calculator for the term of the annuity and a 6% real return reflecting a 4% estimated prudent return on the equity portfolio coupled with a 2% a year reduction in the real income to be funded by the portfolio over the long term.

Again, the fact that part of the portfolio has been used to provide a guaranteed income base allows a much more aggressive withdrawal strategy to be adopted on the remainder of the portfolio than would be the case with typical safe withdrawal strategies. The percentages are higher in this case reflecting the fact that the non-annuitised portion of the portfolio is funding a decreasing income requirement.

Age	% of current portfolio	% of original portfolio
60	6.9%	6.9%
65	7.2%	5.0%
70	7.6%	3.6%
75	8.2%	2.6%
80	9.1%	1.9%
85	10.6%	1.3%

Appendix 2

A practical framework for retirement planning

We set out below the steps required to translate the thinking in this paper into a practical retirement planning approach.

1. **Separately identify one-off and recurring lifestyle expenditures**
   On entering retirement, there may be one-off non-recurring expenditures such as remaining children's education, in-life gifts to children, purchase of a dream holiday or the like. These should be separated out and assigned their own matching investments based on timescale and tolerable risk profile. The remainder of the portfolio goes towards meetings targeted lifestyle expenditures.

2. **Identify trajectory of withdrawals to meet target recurring retirement expenditures**
   This should allow both for onset of state pensions later in retirement and the evidence that overall expenditure reduces in real terms during retirement.

3. **Identify the minimum expenditure required in retirement**
   This should be a relatively extreme floor: the amount the retiree simply cannot envisage living without. This can be done on a bottom-up basis using current essential expenditure, or can be done on a top-down basis making use of information such as the Pension & Lifetime Savings Association Retirement Living Standards.[14]

4. **Calculate the cost of using a mix of temporary and permanent annuities to meet minimum requirements**
   Calculating the cost of using annuities to meet the minimum expenditure identified in 3 and deduct this from the portfolio value (which has already had the value of one-off expenses deducted) to leave a residual portfolio. Also deduct the annuity income from the trajectory of withdrawal needs identified under 2, leaving a residual withdrawal requirement.

[14] https://retirementlivingstandards.org.uk

5. **Estimate the residual withdrawal that can be supported by the residual portfolio**
   Estimate the annual real rate of decrease (most likely) in the residual withdrawal requirement. Using equation (2) calculate the withdrawal level, decreasing at this rate, that can be supported by the residual portfolio for reasonable real rates of investment return (e.g. 2% to 4% pa). Compare this with the desired residual withdrawal amount calculated under 4. More sophisticated modelling could calculate withdrawal profiles based on non-linear trajectories.

6. **Review viability of the plan**
   At this point the plan either stacks up at reasonable rates of return or not. If not, then iteration is required, either to reduce the overall targeted withdrawal amount or decrease the amount that is considered guaranteed under Step 3.

7. **Determine the investment strategy consistent with the required real rate of return to make the plan add up**
   E.g. if 4% real return is required on the residual portfolio, close to 100% equity investment may be required. Lower rates of return could enable a different asset mix in the risky portfolio. Recall that part of the portfolio has been used already to secure an annuity so is risk free.

8. **Model the range of total expenditures arising from the strategy**
   This should be modelled through retirement, using historic modelling or, better still, stochastic models to determine the level of likely income variability and so test suitability with the individual. Note that asset variability is much less relevant than income variability.

9. **Maintain a buffer of expenditure in cash for smoothing**
   Many people will want forewarning of expenditure changes rather than year-on-year volatility. To enable some smoothing, shortly before retirement shift, say, two to three years' worth of residual withdrawal requirement (from step 4) into cash-like investments. This gives total visibility over short-term expenditure. This should be taken into account in the chosen investment mix for the risky portfolio.

10. **Execute annual withdrawals in line with targeted withdrawal rate**
    Each year of retirement, withdraw the proportion of the remaining residual portfolio implied by the withdrawal schedule derived from Equation (2) using remaining life expectancy. Add this to the cash account. If the amount is lower than expected this gives some adjustment time, as the reduction can be spread over three years. If higher than expected then choices are available about timing of consumption. Note that the factors implied by Equation (2) can be calculated for each year of age *at the outset of retirement* enabling a "set and go" strategy.

This simple approach provides an optimal balance of certainty and efficiency for the client, whilst enabling a largely "set and go" strategy that only needs to be revisited in the case of expenditure requirements that are significantly different from those anticipated at the outset or expected return requirements that have changed very significantly.

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