ABSTRACT

Studies on the best ways to draw down wealth during retirement have claimed that households following the so-called 4 percent rule, which calls for consuming 4 percent a year of accumulated wealth during retirement, are at relatively low risk of outliving their wealth. This literature review investigates what, if anything, financial advisors can learn from the literature that models the relative merits of purchasing an annuity as opposed to following the 4 percent rule or other similar strategies. This review argues that the 4 percent rule and other similar rules of thumb are overly simplistic and that they fail to use household financial resources in the most effective way. In contrast, strategies that optimize the use of financial resources are too complex for most households or their advisors to implement. Annuities likely dominate the set of drawdown strategies that households could feasibly implement. This review argues that the 4 percent rule will be even less appropriate in a COVID-induced low-interest-rate environment. At current and prospective interest rates, the 4 percent rule, if we retain such a rule at all, must become the 3 percent rule.

WHAT CAN SCHOLARLY RESEARCH TELL US ABOUT THE MERITS OF ANNUITIZATION VS. DRAWING DOWN UNANNUITIZED WEALTH? DO LOW INTEREST RATES POST COVID-19 CHANGE THE RULES OF THE GAME?

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INTRODUCTION

Retired households face the challenge of converting their accumulated financial assets into a lifetime income.[1] At current interest rates and dividend yields, only the wealthiest households can afford to live off interest and dividends, while most households will need to spend down their capital. The challenge those latter households face is how to balance the need for income against the risk of outliving their wealth.

In an influential paper, Bengen (1994) argued that households that spend 4 percent a year of the value of their wealth during retirement historically faced a very low risk of outliving their wealth: this is the so-called 4 percent rule. This review critically appraises the literature on the 4 percent rule and concludes that, even before the COVID-induced decline in returns on financial assets, the evidence for the 4 percent rule's benefits was questionable. In addition, this review concludes that the rule violated many of the precepts of the life-cycle model of preretirement saving and postretirement asset drawdown. Given plausible assumptions regarding prospective returns on financial assets, this review calculates that a 3 percent rule is the new 4 percent rule. In any case, most retired households would obtain a significantly higher and more-secure income by purchasing an annuity than by following the 3 percent rule.

The remainder of this review proceeds as follows: The first section summarizes the 4 percent rule. The second section discusses the questionable

economic, statistical, and financial assumptions underlying the 4 percent rule. The third section explains why the rule violates important precepts of the life-cycle model. The fourth section compares the 4 percent rule with other strategies that households might plausibly follow. The fifth section recalculates the rule for the COVID-induced low-interest-rate environment and finds that, at the same risk of outliving their wealth, households can now consume only 3 percent a year. This review concludes by arguing that, although low interest rates have also led to a decline in annuity rates, most retired households would obtain a larger and more secure income by purchasing an annuity than they would by following the now 3 percent rule.

I. WHAT IS THE 4 PERCENT RULE?

In an influential article published in the Journal of Financial Planning, Bengen (1994) analyzed historical stock and Treasury bond returns for the period 1926–92. He calculated the share of households that would have exhausted their wealth had they survived 30 years, assuming they had allocated some percentage of their wealth to stocks that earned market returns and the remainder to Treasury bonds, with annual rebalancing; and that they had decided at retirement to take annual withdrawals equal to some percentage of their initial wealth, increasing or decreasing their withdrawals each year in line with inflation. Specifically, a household with a $1 million portfolio would withdraw and consume $40,000 in its first year of retirement. If inflation were 10 percent, the next year it would withdraw $44,000, regardless of investment returns. Bengen (1994) calculated that, historically, at a 4 percent withdrawal rate the savings of households holding a mixed stock-bond portfolio would have lasted at least 30 years, and typically would have lasted much longer.

II. THE ASSUMPTIONS UNDERLYING THE 4 PERCENT RULE

The fundamental problem with Bengen's (1994) analysis is that he lacked sufficient data to make statistically val-

id claims about the probability of investors exhausting their wealth.

First, for more-recent birth cohorts, Bengen (1994) lacked 30 years of return data because his return data ran only from 1926 to 1992 (for example, the 30-year retirement of the most recent cohort he studied ran from 1978 to 2007). He addressed this problem by extrapolating returns for missing years by assuming fixed nominal returns of 10.3 percent for stocks and 5.2 percent for bonds, with 3.0 percent for inflation, these being long-run average rates. The obvious drawback with this approach is that it assumes away rate-of-return risk. For a 50–50 stock-bond portfolio, the average return over the period 1926–92 was 4.75 percent net of inflation.[2] As long as the household had at least 84 percent of its wealth remaining in 1992, Bengen's assumed projected rate of return guaranteed it would never run out of money. Unfortunately, a study of the financial consequences of rate-of-return risk that starts by assuming away rate-of-return risk is fatally flawed.

Second, once the cohorts for which Bengen (1994) lacks 30 years of data are excluded, we are left with 37 overlapping 30-year periods, covering the periods 1926–56 to 1962–92. A sample size of 37 is extremely small. Worse, the returns experienced by these 37 cohorts are not statistically independent because the same year appears up to 30 times in the sample.

Third, a sizeable literature investigates why the US equity premium (the excess of the return on equities over the return on risk free assets) has been higher than the amount that economic theory and plausible assumptions about risk aversion indicate is required to compensate households for the risk of holding equities (Mehra 2003). A prominent explanation for this excess return is that rare and catastrophic events that might have occurred did not in fact occur: the United States prevailed in World War II, the Great Depression did not return after that war, and so on. An analysis based on a short and possibly unrepresentative period that fails to account for the risk of such occurrences will understate the risk of outliving one's wealth.

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1 I use the word "household" to refer to a couple, whether married or not; or to a single individual living alone without any other nondependent coresident individuals.
2 ((10.3% + 5.2%)/2) – 3.0%.

Subsequent studies have attempted to address these problems by conducting Monte Carlo simulations.[3] In a Monte Carlo simulation, researchers analyze historical stock and bond returns to calculate mean stock and bond returns and their variances and covariances. They make random draws from the joint distribution, simulate many thousands of return histories, and calculate the percentage of simulated histories in which households outlive their wealth. The hope is that some of these histories will include the catastrophic events that did not occur during the period 1926–92 even though they might have occurred.

Monte Carlo simulations typically assume that returns are normally distributed. But extreme events (e.g., one-day events such as the market crash of October 1987 and longer-term declines such as those of 2000–2002 and 2007–9) have occurred far more frequently than predicted under the assumption that stock and bond returns are normally distributed. The simulations might therefore understate the risk households following the 4 percent rule face of outliving their wealth.

In contrast to analyses of historical data, Monte Carlo simulations permit the researcher to adjust the return distribution to reflect changes in economic conditions. Economic theory suggests that the future return on equities will be lower than the return enjoyed over the past 100 years. For the long-term investor, long-dated Treasury Inflation-Protected Securities (TIPS) are the true risk-free asset (Campbell and Viceira 2001). Although the price of TIPS fluctuates, the federal government guarantees the real value of each interest payment and the final repayment of capital. From 2004 to 2020 the yield on long-dated TIPS declined from more than 2 percent to less than 0 percent (Federal Reserve Bank of St. Louis 2020). It seems implausible that the equity premium has increased over this period, so a reasonable assumption might be that prospective stock returns have declined by 2 percentage points, and perhaps by more.[4] Lower stock returns increase the probability that a household that follows the 4 percent rule will outlive its wealth. A re-searcher using Monte Carlo simulations can simply take historic returns and subtract the reduction in returns from the means of the respective distributions.

I note three further limitations of Bengen's analysis. First, Bengen disregarded fees. This is a major limitation. Although households can invest in exchange-traded funds with extremely low fees, many invest in high-cost actively managed funds and also pay advisor fees. Fees lower investment returns and increase the risk that a household will outlive its wealth (Pfau 2014).

Second, Bengen (1994) also disregarded idiosyncratic risk. He assumed that all households invested in the market index. Although index tracker funds have grown in popularity, households still mostly invest in actively managed funds or individual stocks. Half—or perhaps more than half—of investors in actively managed funds fail to match relevant benchmarks (French 2008), which puts them at elevated risk of outliving their wealth.[5]

Finally, the Bengen (1994) assumption of a 30-year retirement is much too short. Assuming average population mortality, a married couple aged 65 in 1994 faced an 18.7 percent risk of one or both spouses being alive 30 years later, whereas a married couple aged 65 in 2020 faced a 27.3 percent risk of one or both spouses being alive 30 years later.[6] Given the strong relationship between mortality and socioeconomic status, those possessing significant financial wealth face higher survival probabilities.

III. COMPARING THE 4 PERCENT RULE WITH THE PRECEPTS OF THE LIFE-CYCLE MODEL

The life-cycle model describes how households should save and draw down wealth over the life cycle so as to optimize the trade-off between maximizing consumption and minimizing the risk of very low consumption in any period.[7] The 4 percent rule violates three important precepts of the life-cycle model. First the 4 percent

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3 See, for example, Pfau (2015). Monte Carlo simulations underpin the stochastic retirement planning tools offered by financial institutions.
4 This assumption is consistent with movements in prospective equity earnings yields, which equal the inverse of the price-earnings ratio.
5 Do-it-yourself investors could fail to optimize the trade-off between risk and return, which would increase the risk that they will outlive their wealth at any given asset allocation.
6 Author's calculations based on Social Security Administration cohort life tables.
7 In technical terms, the life-cycle model describes how households should maximize expected utility.

rule implicitly imposes the assumption that households have a preference for the same level of consumption throughout retirement, or at least until financial assets are exhausted.[8] In practice, households may prefer to spend more when both spouses are alive and to spend less after the death of a spouse. Households may be willing to accept lower consumption should one of more members still be alive at the ages to which few survive if that enables households to enjoy greater consumption at younger ages to which they are more likely to survive. In contrast, households concerned about the risk of health and long-term-care costs may prefer to plan for greater spending at older ages.

Second, the 4 percent rule does not allow the household to choose a withdrawal rate and thus a probability of exhausting its financial assets that reflects its degree of aversion to the risk of outliving its wealth. Households with sizeable guaranteed incomes—for example from annuities or defined benefit retirement plans—might be better able and willing to bear this risk (Finke, Pfau, and Williams 2012).

Third, the 4 percent rule does not permit a household to adjust its consumption in response to realized returns on its financial assets.[9] Consider a household where all members retired in October 2007 and decided to annually consume 4 percent of the value of the household's financial assets at that time. By March 2009 the stock market had more than halved, so unless the household reduced its consumption, it might now be consuming 8 percent of its remaining wealth. If the household believed the decline to be permanent, it would now face the virtual certainty of outliving its wealth. If it believed the decline to be temporary, current consumption would now carry a high cost in terms of future consumption foregone because financial assets would be expected to earn a high return. Under both assumptions, the household should cut its current consumption.

We now know that the stock market dip in 2009 was temporary. Investors have enjoyed 11 years of stellar returns they could use to increase consumption while holding constant the risk of outliving their wealth. But the 4 percent rule at worst would prohibit investors from enjoying those returns in the form of higher consumption, and at best provides no guidance as to how households could adjust their consumption.

IV. HOW DOES THE 4 PERCENT RULE COMPARE WITH OTHER STRATEGIES?

Although the 4 percent rule is deeply flawed, it could still be preferable to the alternative strategies that households that choose not to annuitize might feasibly adopt (Webb 2009). To illustrate, a strategy of spending interest and dividends while preserving capital, can result in an unnecessarily low level of consumption. In my view, the underappreciated danger of a strategy of spending the interest and dividends is that it could result in the household holding an undiversified portfolio. This would happen, for instance, if the household chooses stocks based on dividend yield rather than on the basis of the household's contributions to a portfolio that optimizes the trade-off between risk and total return.

Sun and Webb (2013) compared six alternative feasible strategies, including the 4 percent rule and the purchase of an inflation-indexed annuity, using a ranking of alternative strategies that assumed that households were averse to having very low consumption in any period, but were protected from destitution by Social Security benefits.[10] For married couples, single men, and single women, an inflation-indexed annuity and other unannuitized drawdown strategies ranked higher than the 4 percent rule, regardless of any assumed degree of risk aversion. Even with an optimal asset allocation, by age 88, 10 percent of households following the 4 percent rule would have exhausted their wealth. The inflation-indexed annuity provided a similar level of income to the 4 percent rule, but without the risk of outliving one's wealth. The base case in Sun and Webb (2013) was an optimal drawdown of unannuitized wealth. Even with simplifying assumptions, calculating the optimal drawdown is well beyond the capabilities of households and their

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8 Technically, the implicit assumption is that each spouse gains the same utility from the other spouse's consumption as from their own, and that the intertemporal elasticity of consumption is zero.

9 Scott, Sharpe, and Watson (2009) discuss the economic inefficiency of the 4 percent rule in more detail.

10 They assumed households had a constant relative risk aversion utility function and had an uncertain lifespan; and they ranked the strategies in terms of the expected present value of lifetime utility.

advisors.[11] Thus, Munnell, Wettstein, and Hou (2019) assume a base case that households follow the rule of thumb of using Internal Revenue Service's Required Minimum Distribution tables to determine how much to consume each period. Sun and Webb (2013) showed that basing drawdown on these tables is suboptimal, so the calculations show annuities in an even more favorable light.

V. HOW DOES THE 4 PERCENT RULE COMPARE WITH OTHER STRATEGIES?

Previous studies have documented the impact that low interest rates can have on the probability of a household following the 4 percent rule outliving its wealth (Pfau 2015). A recent calculation suggests that a sustainable rate might be as low as 2.4 percent (Rusoff 2020). But researchers either differ in their assumptions or leave their assumptions unstated with the result that estimates of the decline in the sustainable withdrawal rate may be biased by changes in the underlying assumptions.

To obtain consistent estimates, I proceed as follows. First, using Monte Carlo simulations, I calculate the probability that a household following the 4 percent rule will outlive its wealth.[12] I assume population mortality data and that the portfolio is allocated 50:50 to large capitalization stocks and long-term corporate bonds with annual rebalancing. I use total return data for 1926–2012 (Ibbotson Associates 2015), I assume a normal distribution, and I ignore fees, so my calculation represents a lower-bound estimate. Second, I reduce stock and bond returns by 2 percentage points and recalculate the risk.[13] Finally, I recalculate the withdrawal rate so as to yield the initial probability of the household outliving its wealth.

I find that at historic returns, 6.1 percent of households outlive their wealth, but that at prospective returns, 18.3 percent outlive their wealth. To reduce the percentage to 6.1 percent, households would need to cut their withdrawal rate to 3.0 percent. Hence, even though still an overly simplistic rule of thumb, a 3 percent rule should replace the outdated 4 percent rule.

VI. HOW DOES THE 4 PERCENT RULE COMPARE WITH OTHER STRATEGIES?

Reflecting declining interest rates and increasing longevity, annuity rates have declined substantially in recent years. But annuities still compare favorably with a drawdown of unannuitized wealth. Given that the 4 percent or 3 percent rule assumes a constant inflation-indexed level of consumption, the cleanest measure of the superiority of annuitization would be to compare the income obtainable from a drawdown with that obtainable from an inflation-indexed annuity. Unfortunately, companies have withdrawn this product from the market over the past few years. I use the closest substitute, a joint life annuity and 100 percent survivor benefit annuity with the income payments subject to a cost-of-living adjustment of 2 percent a year.[14] A well-known marketplace quoted a lifetime income of 4.74 percent at age 65 (so that someone paying $100,000 would receive an initial income of $4,740 a year), which is 60 percent more than the reasonably safe unannuitized drawdown rate of $3,000 a year and with, of course, zero risk of outliving one's wealth.

CONCLUSION

I recognize that relative income is not the only yardstick to consider when evaluating drawdown strategies: households must also weigh a bequest motive and the risk of incurring uninsured health-care costs (Webb 2021). But the 4 percent rule is a bad rule that needs to be discarded and replaced by a careful analysis of how best to manage drawdown.

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11 This calculation requires numerical optimization techniques in which the researcher figures out the optimal strategy in the final period before death and work backward, period by period. Because the "decision tree" has numerous branches based on the number of choices and financial outcomes in each period, the calculation requires high-powered computers and advanced programming skills.
12 I chose 2012 to predate recent interest rate declines.
13 I chose not to incorporate fat tails or mean reversion to permit comparison with previous calculations.
14 Two percent is close to professional economists' long-run inflation expectations (Federal Reserve Bank of Philadelphia 2020).

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