

# Motivation for the Equity Portfolio Withdrawal Simulator

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This project grew out of my own retirement planning. There are many algorithms for managing cash flow during retirement. The most famous is Bill Bengen's, from his 1994 paper [Determining Withdrawal Rates Using Historical Data](#), now known as the "**4% Rule**." Many others have been published since, and a good number can be modeled at [F1Calc](#). Nearly all of them work by drawing down a portfolio of stocks, bonds, and cash. These methods can be back-tested against history, or stress-tested with parametric models of the securities markets, but none comes with a guarantee. You can tune the parameters to make the investments and withdrawals more aggressive or more conservative, yet without the certainty that you will not outlive your money, it is hard to resist panic-selling in a deep down market.

## Sharkansky's spending rule

In 2024, Stefan Sharkansky published [The Only Other Spending Rule Article You Will Ever Need](#). His method has the following steps:

1. **Determine how much annual income you need.** This may be less than you would ideally like, but it should be enough that — knowing it will arrive every year, with a raise to match inflation — you can resist panic-selling when stocks drop sharply from their all-time high.
2. **Lock in that needed income.** Add up what you will receive each year from Social Security and any other pension that provides an annual cost-of-living adjustment. If that falls short of your minimum, buy a TIPS ladder to close the gap.
3. **Invest the remainder in equities** — the portion of your assets you are willing to spend down in retirement.
4. **Each year, withdraw from the equity portfolio** up to the amount a fixed-term annuity lasting as long as your life expectancy would pay. For example, if you are 67 and determine that your life expectancy is 85, calculate the payout percentage of an annuity with a 22-year term.

The appeal of Sharkansky's method is that Treasury bonds and Social Security backstop the funding of your needs: even if the stock market went to zero, your essential needs would still be met.

## My modifications

I wanted to make a few modifications to the method and model them out.

1. **Use a life annuity instead of a fixed-term annuity.** Rather than computing payments for a fixed-term annuity, look up an estimate of what you would be paid annually for a *life* annuity, which keeps paying for as long as you live. Estimated quotes are available at [immediateannuities.com](http://immediateannuities.com).
2. **Add a capital-preservation rule.** You may not need the money from your equity portfolio, but you also don't want it to run out. Cap how much you spend from the portfolio relative to your first year's withdrawal, adjusted for inflation — for example, allow yourself no more than 30% above what you took out in real terms in the first year. If equities rise sharply you can take less than the indicated amount to preserve capital; then, when the market comes down, you are less likely to have to take a pay cut.

## The simulator

The scripts `montecarlo.py` and `montecarlo_gui.py` run simulations so you can test different parameters and assumptions. Inflation is a big assumption, and the latest version of the software simulates inflation, interest rates, and equity-market returns together. Several parameters can be tuned, and you can also choose how many years to simulate.