Portfolio Return Simulations

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In this application, the user simulates the possible results of investing in an instrument that replicates the S&P500 (for example, the SPDR S&P 500 ETF Trust (https://finance.yahoo.com/quote/SPY/). The user can select an initial investment amount and, if desired, an investment amount every year.

The application will generate a Monte Carlo simulation using the empirical annual returns of the S&P500 from 1982 to 2024. Each simulation consists of 10,000 simulated trajectories of S&P500 prices over the time horizon specified by the user to calculate 10,000 possible final investment values accordingly. The final investment is then calculated based on the investments specified by the user (initial and/or through each year). These values are presented on the right side of the window (the distribution of final values).

It is important that this is a didactic exercise to understand the relationship between the time horizon of the investment and the final investment when investing in a diversified instrument such as the S&P500. The final investment results and annual investments have not been adjusted for inflation.

An example

When starting the application, the default is an initial investment of $0.5 and an additional $0.5 reinvestment each year for 20 years. The Figure shows the distribution of possible final investment values. The red line indicates all investments made in the periods (0.5 + 20x0.5 = $10.5), and the light green line is the median of the final value. The simulation shows a final value of $29.46.

The results will not necessarily be the same when repeating the exercise since it is a simulation. However, it gives a good idea of the range of possible results that could be obtained.

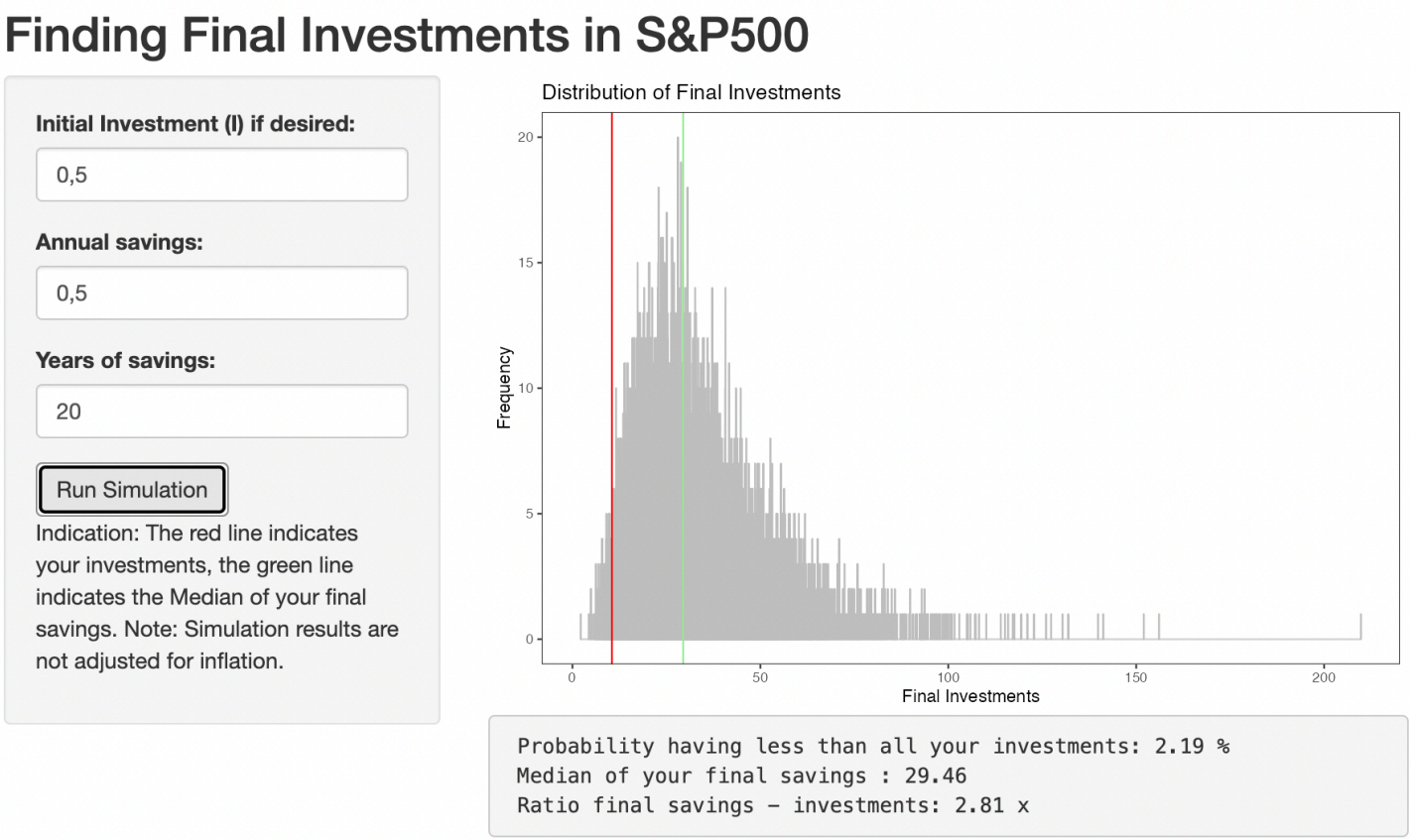

Figure 1

Investment simulation with an initial investment of $0.5, with additional annual investments of $0.5, 33% in the S&P500 for 20 years. The results are not adjusted by inflation.

According to the results obtained, if the total investment was $10.5 and the final result at the end of 20 years was $29.46, the return achieved would be (29.46-10.5)/10.5) = 180.57%, or in other words, the initial investment would be multiplied by 2.8x.

Since investing in the stock market is not risk-free, there is also the possibility (albeit quite small) of ending up with a final value that is less than the total investments. This is also presented in the application, which, for the example shown, corresponds to 2.19%.

By adjusting the investment period, users can witness a reassuring trend-the probability of loss steadily diminishes as the investment term extends. This gradual reduction in risk can provide a sense of security and confidence in the investment strategy.

The challenge

As a long-term investor, you want to invest in the S&P500. For this, you have available the prices of this index for many years. Your investment horizon is 20 years (for a retirement fund). With the application, you can estimate the distribution of annual returns of the S&P500 achieved over that period.

You can try different initial and/or annual investment amounts to achieve the desired retirement fund at the end of 20 years.

Reassure yourself by comparing these results to the potential returns from a time deposit or treasury bonds.

Is the return from investing in the S&P500 better than another less risky alternative?