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A Partial List of Observations on Longevity and Financial Planning

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Abstract

The greatest concern of retirees is to maintain their lifestyle through retirement. They ponder if they have enough money, should they adjust their expenses, how should they invest their savings, and would they be able to leave anything for their children or charity. There are no unique answers to these questions. The answers depend on individual circumstances and references. In this note, we offer a list of observations that might help to provide answers to these important questions.

Introduction

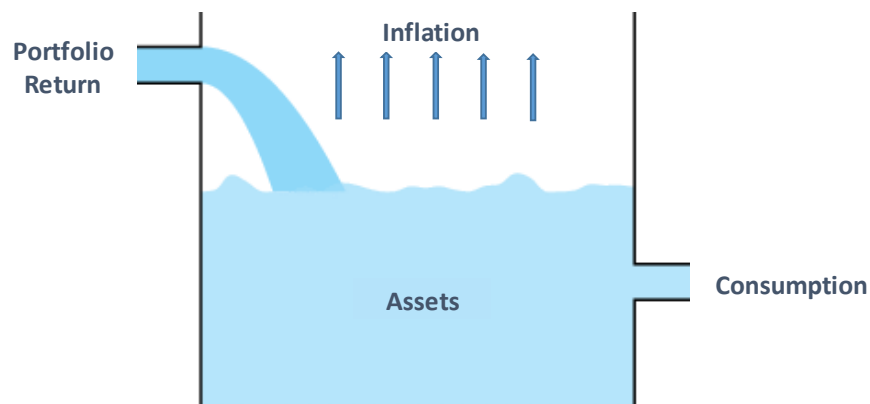
1) Think of a Reservoir

- Water Level will remain constant if
- Water level will drop if
- Water level will rise if

Outflow + Evaporation = Inflow

Outflow + Evaporation > Inflow

Outflow + Evaporation < Inflow



2) Two Goals

- Maintain lifestyle through life
- Leave money to children and charity

¹ I am grateful to Y. Y. Ma, Reiner Martin, Rene Mendez, and Brook Payner for many thoughtful conversations and suggestions. Several of the observations made in this paper were originally made by them.

3) Shortfall Risk

- a. The risk of failing to meet the two goals. It is no fun to die as a pauper! **Probability of shortfall** depends on four things:
 - i. Longevity
 - ii. Consumption level
 - iii. Inflation
 - iv. Return on investments

4) Our Take

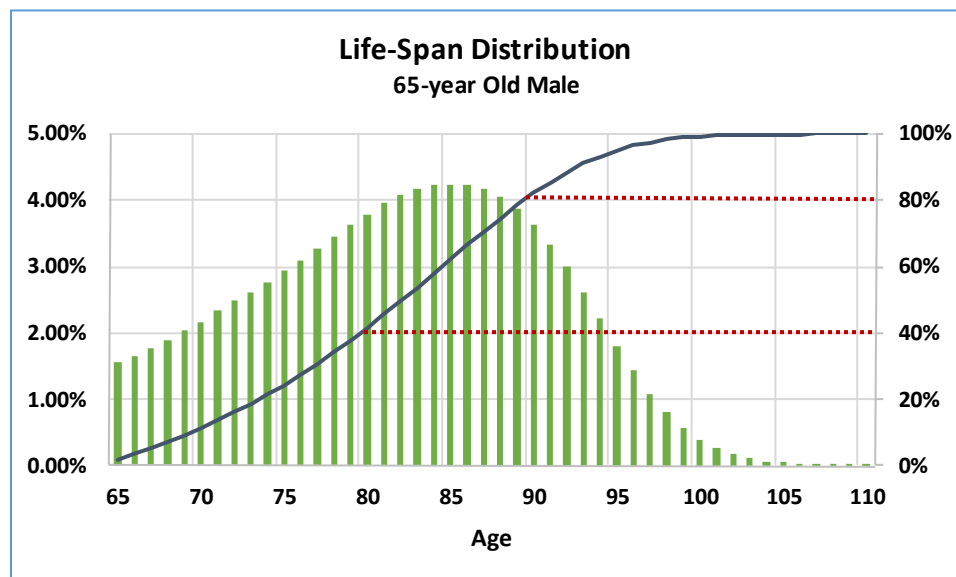
- a. There is no single good answer for an optimal consumption level. It depends on individuals' circumstances, preferences, risk aversion, and composition of their portfolio.
- b. A good place to start is to aim for a constant real consumption rate equal to your estimate of the expected **real** return of your portfolio. So, if your portfolio is expected to give you x% real return, plan on starting with x% for consumption. Be wary of the variation in the returns. If your portfolio is made of high return / high risk assets, then you probably have to spend less than your expected real return. Higher variation requires higher cushion and hence lower consumption.
- c. You should quantify your risks by calculating the probability of shortfall. You need a model for this. There are some available on the internet.² While useful, we thought that they are more detailed than needed for planning and might miss the bigger picture. Therefore, we built our own. Absolutely no warranty on its accuracy, but feel free to call us if you want to use ours.
- d. Circumstances change. Plan for re-calibration. You may get lucky and achieve superior returns early on. That would allow you to spend more than you had planned, to give a gift to your child, or to give a substantial donation to your favorite charity. Or, you may hit a rough patch in life. Re-evaluate your situation frequently and estimate your probability of shortfall.
- e. Early in your retirement, you may want to take higher risks by spending more. You may want to enjoy your wealth while you are relatively younger and healthier. If you want to go for it, note that you are betting on higher investment returns early on, as well as lower expenses in the future. These may, or may not happen. So, it is important to regularly re-evaluate your situation more carefully. Be warned that cutting expenses is a lot easier said than done. You will be swimming upstream. Everybody in your family will have an opinion. It is like expense reductions when you worked! It will be painful.

² See Portfolio Visualizer <https://www.portfoliovisualizer.com/monte-carlo-simulation>

Key Observations

1) Life-Span Distribution³

- a. Highest rate of passing is in mid-80s (slightly above 4% per year).
- b. About 40% of the 65-year old men don't make it beyond age of 80. This is the argument for spending more early on.
- c. About 20% of the 65-year old men live longer than 90. This is the argument for spending less and saving for the future.
- d. Probability of living longer than 100 is quite small – only 1% for 65-year old men and 3% for 65-year old women. That might be a good target for planning purposes.
- e. Women and more affluent individuals have longer life expectancy^{4 5}.



2) Portfolio Returns and Inflation

- a. The holdings of individuals, particularly for those with high net worth, are more complex than the popular index funds for stocks and bonds. In addition to public equities and bonds, individuals could own substantial cash or bank deposits, short-term bonds, several homes, income producing real estate, alternative investments (hedge funds or private equity funds),

³ Source of the data is "Period Life Table, 2011" from Social Security Administration.

⁴ Sabrina Tavernise, Disparity in Life Spans of the Rich and the Poor is Growing, New York Times, Feb 12, 2016

⁵ Barry Bosworth, Gary Burtless, Kan Zhang, The growing gap in longevity between rich and poor and its impact on redistribution through Social Security, Brookings Institute

concentrated ownership in a privately held business, art, jewelry, etc. A way to model a complex portfolio is to bucket it into two broad categories of high and low returns, akin to stocks and bonds, and estimate an expected return and volatility for each bucket. Indeed, this is the approach we have taken in our model. This is, of course, subjective and requires careful elaboration, but has the benefit of forcing a deeper consideration of the holdings, their purpose and characteristics.

- b. A benchmark portfolio for retirees is a balanced portfolio of stocks and bonds⁶. With the U.S. 10-year U.S. Government bonds yielding below 2% and the P/E of U.S. stocks well above their long-term averages⁷, a reasonable estimate of expected return of a portfolio of 50/50 stocks and bonds should not be too far from 4%. And, its expected volatility (standard deviation) should be consistent with the historical levels of about 10%.
- c. For inflation it is reasonable to assume that it will follow a mean-reverting process centered around the Fed's target of 2% with a volatility of 1.2%, consistent with the historical levels post Volcker.

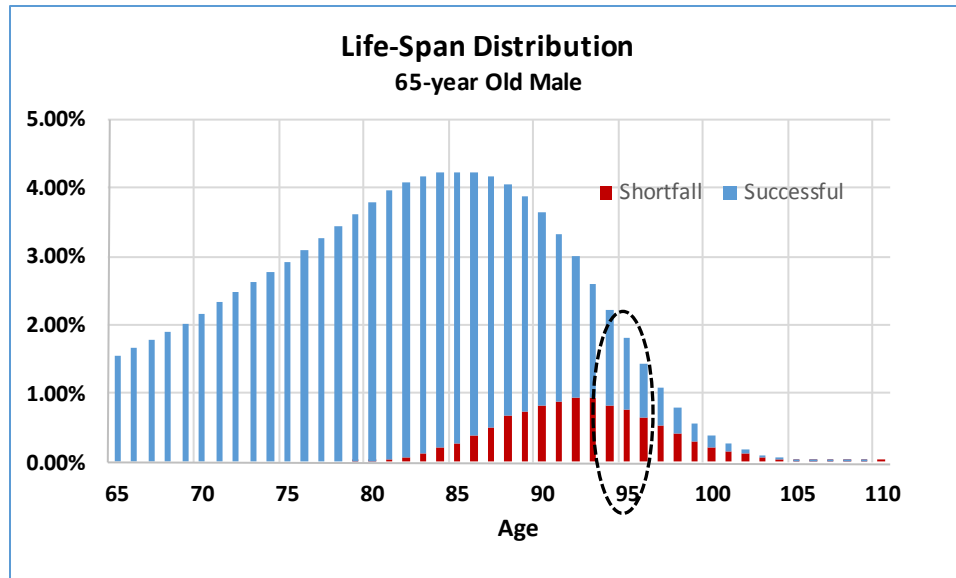
3) Constant Real Consumption⁸

- a. A commonly prescribed rule of thumb is to start drawing 4% from savings and allow it to grow with inflation over time. The rule was set when the interest rates and markets were more favorable to investors. With current market expectations of returns, the 4%-rule results in higher risks for longer lives.
- b. Using a Monte Carlo simulation of 100,000 randomly selected life spans, the following chart shows the composition of the distribution into "Successful" and "Shortfall" outcomes for the 4% rule. The blue bars indicate the probability of an individual being able to maintain his lifestyle through life and to leave a bequest. The red bars indicate the probability of not being able to meet the goals. The chart illustrates that consuming at 4% results in a significant probability of shortfall for individuals with higher longevity. For example, a person living until the age of 95 has only 50% chance of having a successful retirement. He has 50% chance of a shortfall.

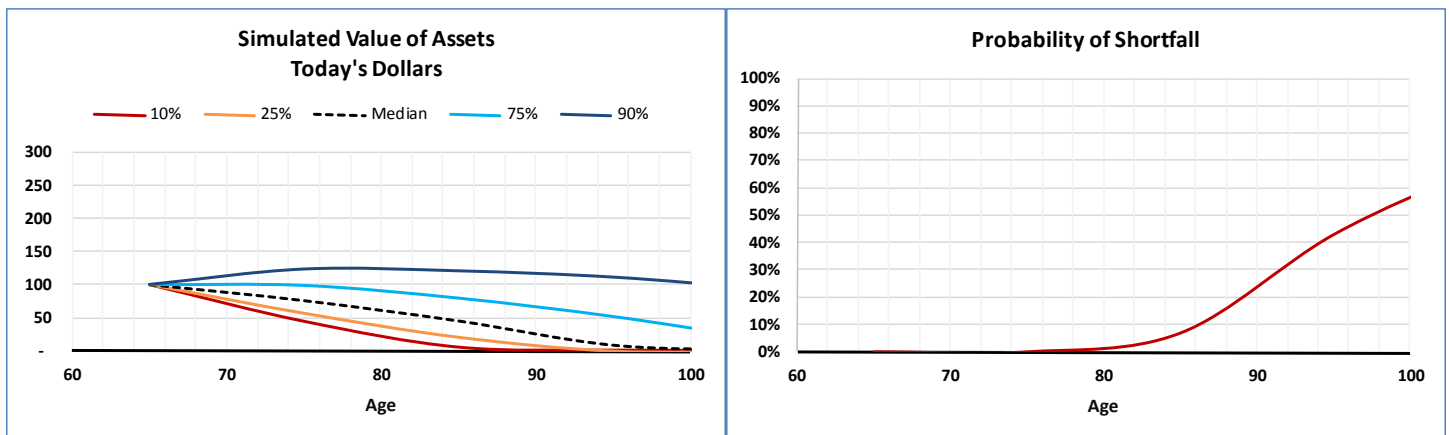
⁶ Some recommend a glide path allocation scheme which reduces allocation to higher risk assets as age increases. Such schemes are risk reducing and result in lower expected returns and volatility. While risk reduction with age is intuitively appealing and comfortable, we have found no material difference between glide path investing and a steady, but lower allocation to the riskier assets -- say 20%.

⁷ Yale University, On Line Data Robert Shiller, <http://www.econ.yale.edu/~shiller/data.htm> .

⁸ For a detailed discussion of patterns of consumption see the Appendix.



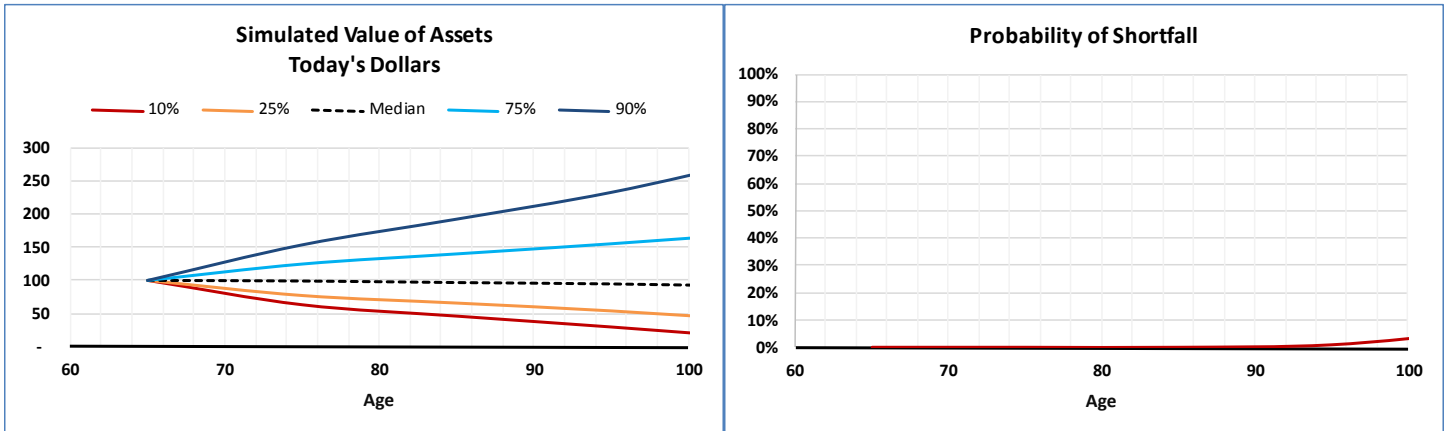
c. The following two charts show the percentiles of asset values and probability of shortfall over time for our 65-year old individual following the 4% constant real consumption. The asset values are floored to zero. The charts⁹ show the downward trend of asset values and higher probability of shortfall with higher longevity. This result is not surprising as 4% expected return of the portfolio is less than the consumption level plus Inflation (4% +2%). Think of the reservoir! On average there is more outflow and evaporation than inflow. Even with no accommodation for volatility, assets are bound to decay to over time.



d. Performing the same analysis, but with 2% constant real consumption yields the next two charts. This time, the average outflow and evaporation is the same as average inflow. Note, how the median of the asset values in today's dollars stays steady over time. The percentiles are no longer pointing downward and instead are skewed upwards. The probability of shortfall even in longer lives is quite small, and there is even a 25% chance that at the age of 90, an individual can bequest more than 1.5 times his original wealth.

⁹ For a wider scaling of the Value of Assets chart see the Appendix.

This analysis motivates our recommendation of setting the consumption level at the expected real return of the portfolio, but be wary of volatility.

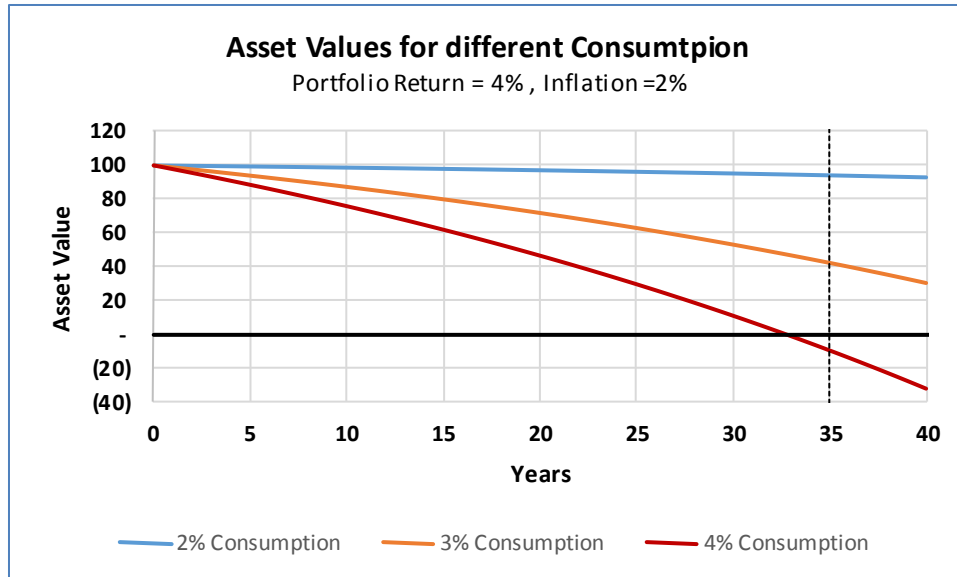


Three Important Factors

1) Importance of Break-Even Consumption

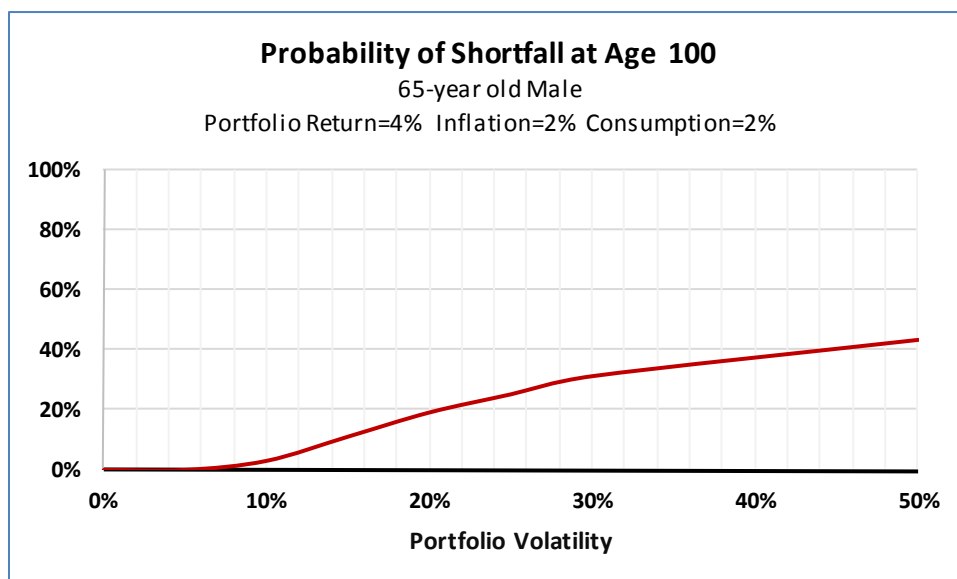
- a. Break-even (BE) consumption is the initial consumption rate which results in a steady level of assets over time, assuming **no volatility** in portfolio return and rate of inflation.
- b. BE Consumption is approximately equal to **(Portfolio Return – Inflation Rate)¹⁰**.
- c. The following chart shows asset levels over time for different consumption rates. The blue line is close to the BE rate. Note the negative convexity and how compounding reduces asset values! If you spend more than the BE, you get hurt more as time passes!

¹⁰ The exact formula is $(R - I) / [(1+R) * (1+I)]$, where R and I are Portfolio Return and Inflation Rate



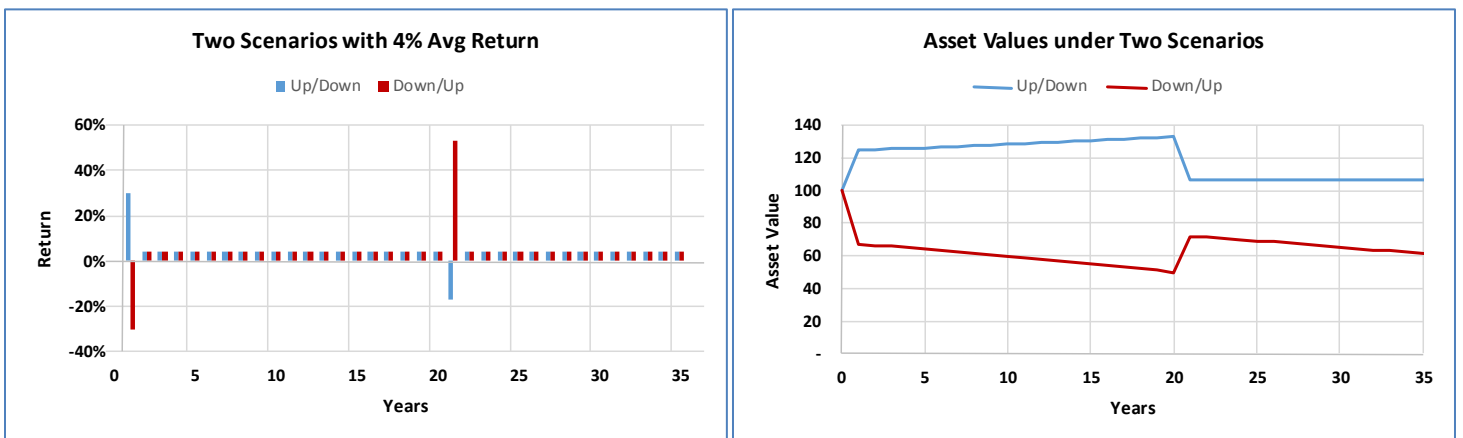
2) Importance of Volatility

- a. Variability in returns and inflation impacts the probability of shortfall. Everything else constant, higher variability results in wider distribution for assets and higher risk of shortfall.
- b. Like in a reservoir, to adjust for variability of inflow and evaporation, the outflow should be calibrated to insure the water remains above a certain threshold.
- c. Assuming a 2% consumption level, and the same parameters as above, the following chart shows the probability of shortfall at the age of 100 for different levels of return volatility. Everything else constant, higher volatilities result in higher shortfalls. Hence, to achieve the same probability of shortfall, consumption should be reduced at higher volatilities.



3) Importance of Timing

- a. Given a finite horizon, the timing of returns has a major impact on asset values. Higher returns early on when assets are higher will result in higher assets at the end.
- b. To illustrate, consider asset values under two scenarios with time varying returns. The two scenarios both give 4% every year except in years 1 and 21. The average cumulative returns of the two scenarios are both 4%. We have assumed 2% constant real consumption with inflation rate of 2%. The Up/Down (blue) scenario starts with +30% return in year 1 followed by a correction in year 21 to bring the average down to 4%. The Down/Up (red) scenario does the reverse.
- c. The path of asset values under the two scenarios show the importance of timing. The asset values under the Down/Up (red) does not catch up with the UP/Down (blue) even after a mid-course correction of more than 50% and with 15 more years to go. To have a successful retirement, it helps to get the higher returns early on. The good returns would not do any good at the end. Conversely, poor returns early on can make it difficult to meet the goals throughout. Therefore, it is important to regularly plan, measure risks, and be ready to re-calibrate.



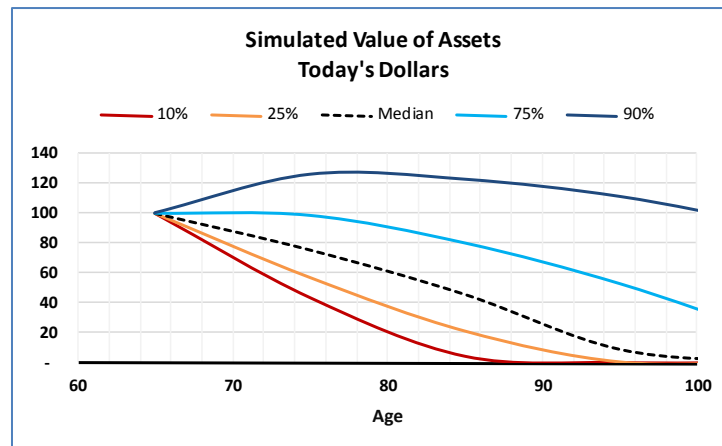
Appendix

1) Consumption Level

- a. The common assumption in retirement planning is constant real spending. That is, to start with a consumption level which grows with inflation. It is meant to provide a steady inflation-adjusted consumption through life.
- b. Constant real model is a reasonable starting point for planning purposes. Changes in life circumstances and different inflation rates for different expense categories are important. But, for planning, it is best to start with simplicity.

- c. There are phases of consumption in retirement. Many variations are discussed in the literature. According to research from BLS¹¹
 - i. Age 65-74, spending drops about 16% from pre-retirement.
 - ii. After age 75, spending drops about 40% from pre-retirement.
- d. End of life expenses could be significantly higher to cover medical and long-term care, although some may be covered by insurance.
- e. The composition of spending is likely to change over time. The importance of various categories such as housing, health care, food, clothing and others have different relevance at different stages of life. For example, early retirees might spend more on leisure while older retirees would spend more on medical expenses. BLS publishes an experimental CPI called CPI-E for elderly to reflect the importance of different categories over time.¹² As it stands, CPI-E is not materially different than CPI-U.

2) Value of Assets for the 4% Rules



¹¹ Ann C. Foster, "Consumer Expenditures Vary by Age", U.S. Bureau of Labor Statistics, Beyond the Numbers, December 2015.

¹² Alicia Munnell and Anqi Chen, "Do We need a Price Index for the Elderly?", Center for Retirement Research, Boston College, October 2015.