How to make good use of Monte Carlo projections

Projections are essential for planning but they rely on the quality of the variables used

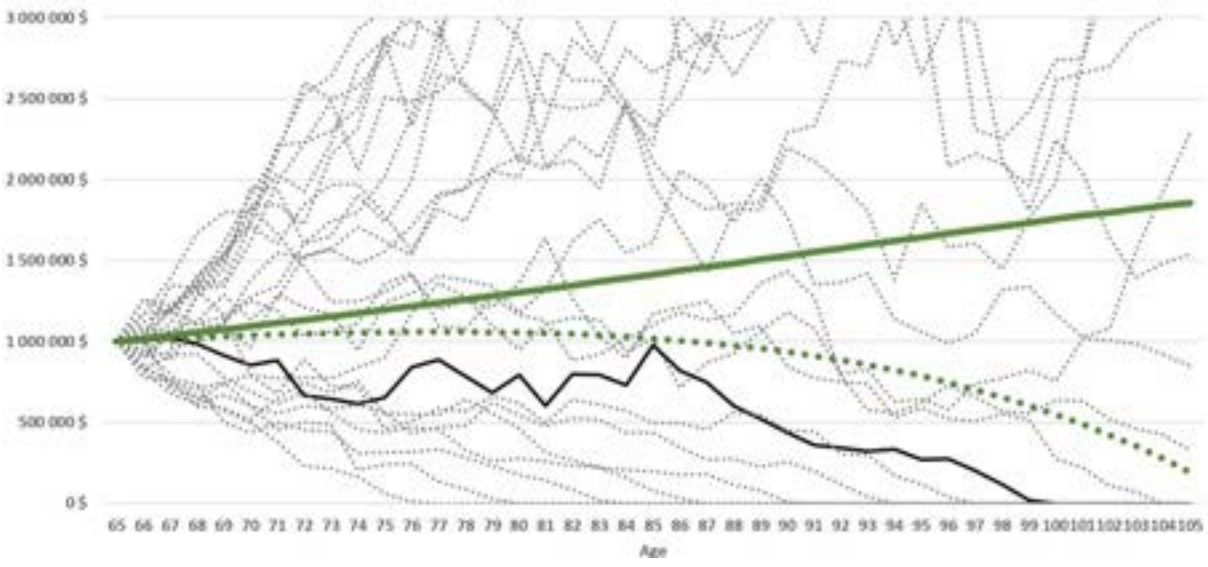
The projection assumption standards used by the FP Canada Standards Council and the Institut québécois de planification financière (IQPF) provide rate assumptions for developing realistic projections, but there are two approaches to reach those projections.

Linear projection modelling, also referred to as deterministic modelling, is the most widely used in financial projection software. It uses a single set of assumptions, gives a single result and does not apply the notion of probability. The advantage of this approach is its simplicity.

Random return projection modelling, also called stochastic modelling, makes it possible to determine the probability of various results under different conditions. The best known of these is the Monte Carlo method. The stochastic model presents data and predicts outcomes that account for certain levels of unpredictability or randomness. Stochastic investment models generate multiple sequences of random returns taking into account the expectation of long-term returns, volatility and the correlation between different asset classes. Since returns are not linear, a projection using this type of model leads to more realistic and concrete results.

Rather than using an annual linear average return, a random return projection could use a sequence of random and independent returns from one year to the next. It is then repeated with different combinations to give a wide range of results. This allows for a very large number of possibilities to be pooled and better illustrates risk. The higher the number of iterations, the more credible the range of results will be. The dotted curves in Figure 1, below, demonstrate some possibilities for random projections.

Figure 1: Comparing linear and stochastic modelling



However, there are drawbacks to using the stochastic approach. The first is that the geometric mean assumptions from the FP Canada standards must be converted into arithmetic mean assumptions. The arithmetic mean is the sum of the data divided by the amount of data; the geometric mean uses the nth root of the product of the data.

Then there is the volatility of returns, or the standard deviation, which determines the range of possible outcomes. Although it is possible to estimate a future expected return based on economic models, there is not yet a norm for the expected standard deviation or a correlation matrix between asset classes.

Using the stochastic model leads to a different interpretation of the results than we are used to. We won't necessarily talk about sufficient savings to achieve long-term goals, but rather about the success rate of all combinations. For example, it can be said that 70% of the random projections achieve the retirement objectives. The parameters of the success rate will depend on the level of comfort in achieving the results.

However, planners are not trying to achieve a 100% success rate — or no capital depletion. It is good to doubt some extreme random curves, as the scenario is unlikely to occur. We must also consider the curves where only a few years are needed to achieve the long-term objectives. They should be accepted, as the plan will be revised along the way. A 70% success rate is generally accepted in the stochastic projection industry, but that doesn't mean that a 50% success rate is unacceptable, especially for those who are willing to adjust their expenses in retirement.

The following example helps to illustrate the two models.

- Elaine is trying to retire at 65 with $1 million in savings with a cost of living of $45,000 per year.
- According to a linear projection (the green curve in Figure 1, above), she will succeed at her current spending rate. But according to a stochastic model, her goal has a 70% chance of success (curves above the black curve); there is a 30% chance of undershooting her goal.
- As an advisor, you have more information with the stochastic model and can tell Elaine about the factors that might lead to over- and undershooting her goals — such as better- or worse-than-average market returns, bonuses from her employer, an inheritance, etc. — so you can adjust her plan for real-world events.
- The purpose of using the stochastic approach is to demonstrate the sensitivity of returns used in retirement projections. If your projection software can only make linear projections, you can make a more conservative projection to simulate an acceptable success rate. A linear projection with a return minus 1% (the dotted green curve in Figure 1) will encompass the majority of long-term projections that are 70% sustainable.

This article written by David Truong was first published in the June 2021 issue of Conseiller, under the original title "Les projections financières avec Monte Carlo", and then in the August 2021 issue of Advisor's Edge, in the present version.

David Truong, Pl.fin, CFP, CIWM, M.Fisc, works as a senior consultant, expertise centre, at National Bank Private Banking 1859. He also teaches at McGill University.

Published on September 1st, 2021 by National Bank