Monte Carlo

Are they good for your client?

Monte Carlo simulators are becoming more and more popular, but beware of their flaws before it's too late, warns JIM OTAR

Since the last bear market, more and more advisers are switching from the standard retirement calculators to Monte Carlo (MC) simulators to forecast portfolio asset values.

What makes the MC different from a standard retirement calculator is that it adds random fluctuations to a steady growth of the portfolio. The user selects a base line (assumed base growth rate) and a standard deviation from that base line. The model then runs thousands (or millions, if you choose so) of projections by randomly varying this base line. Finally, it reports range and probability of these projections.

The MC model is a step forward from the standard retirement calculator. It brings into the open the reality that markets do not grow on a straight line. However, that does not mean that we should ignore its shortcomings.

Flaw 1

The first flaw of the MC model is how it generates randomness. The randomness is generated using a distribution curve. There are many types of distribution curves, such as: normal, lognormal, triangular, uniform, binomial, exponential, and geometric to name a few (see Figure 1).

The reality

In real life, the distribution curve is significantly different than these idealised distribution curves. Not only that, the market history shows that the distribution curve changes its shape over time. Some of these changes are: flattening of the curve, shifting towards left, the tail ends 'flapping'. Figure 2 shows the actual distribution curve of a portfolio after five years and 20 years. As time passed, the distribution curve flattened significantly.

When the distribution curve used in the MC model does not match the reality over the entire retirement time period, the resulting simulations will be significantly different from actual market history (see Figure 2).

Flaw 2

The second flaw of MC is that it generates outcomes that are random. It ignores the effects of cyclical and secular trends.

FIGURE 1: TYPICAL DISTRIBUSTION CURVES

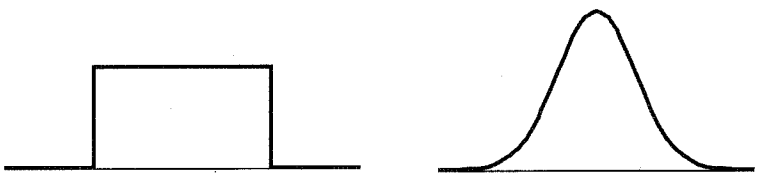
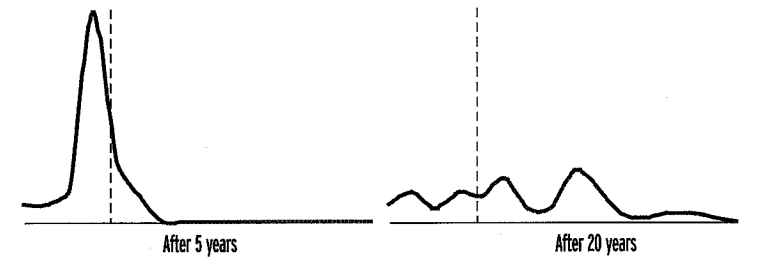


FIGURE 2: ACTUAL PROBABILITY DISTRIBUTION CURVE FOR A DISTRIBUTION PORTFOLIO



simulators

FIGURE 3: SECULAR AND CYCLICAL TRENDS IN THE MARKET

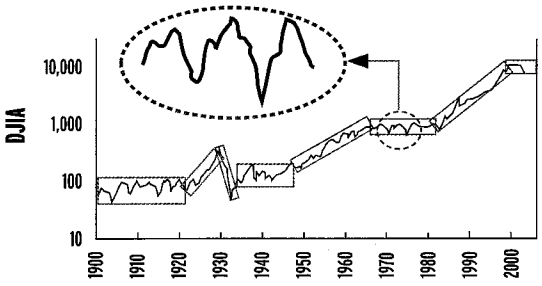


FIGURE 4: THE ACTUAL MARKET HISTORY: MEDIAN, LUCKY, AND UNLUCKY OUTCOMES DURING RETIREMENT

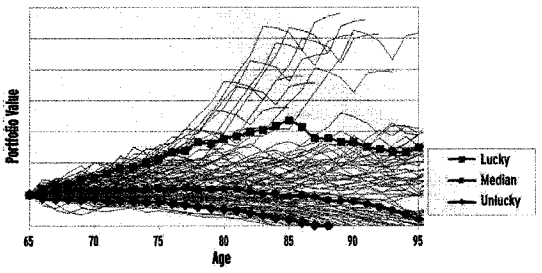


TABLE 1

Years after retirement	Monte Carlo	Actual
10	0%	0%
15	1%	3%
20	14%	36%
25	37%	68%
30	55%	86%

The reality

When we look at history, we observe that markets are random in the short-term, cyclical in the mid-term, and trending in the long-term as depicted in Figure 3. In addition, the sequence of market events are not random, they are correlated: higher inflation eventually causes the short-term interest rates to rise, which can have bearish effects on the stock and bonds, and vice versa (see Figure 3).

Consequently, what happens in practice is, users of the MC model increase the range of outcomes, say from ±15 per cent to ±30 per cent. This broad-brushes all trends. Doing so only masks this problem, it does not solve it. If the model does not fit well, then running 10 million simulations instead of 10 does not make it more accurate.

Flaw 3

The third flaw of MC is the unrealistic sequence of outcomes.

The reality

In real life, usually during the last one-third of a secular bull trend, good news begets more good news. The index moves up higher just because many bet that it will continue moving higher. On the other hand, when a bear market starts, bad news begets more bad news. These create what is known as 'fat' tail ends on the distribution curve.

MC simulators ignore this effect. They will rarely produce multi-year, back-to-back 'streak' of multiple bear or bull outcomes, as happens in real life. When you look at the asset projection lines of the MC simulator, they move horizontally for a number of years, and then suddenly they drop down to zero in a sharp, vertical freefall. This rarely happens in real life.

When we look at retirement portfolios using actual market history (Figure 4), the median line, where half of the portfolios do better and half do worse, is a lot closer to the bottom decile (unlucky) than the top decile (lucky), even though both lucky and unlucky portfolios have the same probability of occurrence. In other words, after retirement, the path to an unlucky outcome is a lot shorter than the path to a lucky outcome, an effect that no financial adviser should ignore.

I compared the outcomes of a MC simulator with actual market history using the same case. Table 1 compares the probability of depletion.

In the final analysis, most Monte Carlo simulations forecast outcomes that are too optimistic. Feel free to download my retirement calculator based on actual market history. You will probably reach the same conclusions that I did. ✤

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