

MONTE CARLO SIMULATION

Rolling the dice on returns.

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When a man walks into a casino in Monte Carlo and rolls a pair of dice at the craps table, he has a 1 in 36 chance ($6^2=36$) of the dice lying face up in any particular combination. He knows this because each of the six sides of each die - if the casino is a fair house - has an equal chance of turning face up.

Financial markets and the economy have far more variables than a six sided die. Instead of only six potential outcomes that have an equal chance of happening, investing has a myriad of possibilities and outcomes. Furthermore, each possibility has a wide range of chances of occurring.

To help investors get a better handle on this wide range of possible outcomes the market can give them, statisticians look to the gambling houses of Monte Carlo. They modify their theoretical dice to make them best resemble the real world - full of different outcomes with different possibilities. They add more sides because there are more than just 6 different events that could influence a portfolio's return. They change the size of each side, because in the real world the probability of each event happening is different. If the statistician believes that a certain market or economic event is more likely to happen, then that side of the die will be bigger. If there's a small chance that some event might happen, then that side is small. These statisticians then give their theoretical dice thousands of virtual tosses via computer.

After all the "virtual" tosses of their theoretical dice, measurements are made. How many times did each event happen? The total of all these tosses and the potential events that might occur can give investors useful information about potential results for their portfolio.

Monte Carlo simulations are commonly used to estimate potential answers to questions like "Do I have enough money to retire?" or "What are the chances that I'll outlive my money?" Simulations can show the probability - considering thousands of possible outcomes - that an investor may reach their goal.

For example, a financial professional can enter a client's total assets, current contributions to retirement plans, spending habits and age into a Monte Carlo simulation. According to the assumptions built into the simulation, they may find that investor has an 80% chance of achieving certain financial goals. If that doesn't sound like good enough odds, the variables in the simulation can be changed to illustrate what may increase the investor's odds of reaching those goals.

These “what-if” scenarios can help both the investor and their financial professional balance risk and return.

One risk that a Monte Carlo simulation may help to illustrate is the chance that a particular "outlier" may occur. An outlier is a possible result that lies outside of the normal grouping of results ... a bit like a bolt of lightning striking suddenly on a cloudless day. An outlier, in essence, is something with little probability that holds big consequences. Perhaps there is a 3% chance that a series of negative effects could occur that would totally decimate the investor's portfolio. If that's the case, the investor may choose to alter his portfolio to eliminate or reduce the chance of those outliers.

To illustrate, let's assume that an investor has a portfolio of 65% stocks, 30% bonds and 5% cash. Let's also assume that a simulation has show he holds an 80% chance of reaching his retirement goals, but there's still that 3% chance he'll fall short. The Monte Carlo simulation may be able to run “what-if” scenarios that show how a change in investment allocation could affect those outcomes. The simple act of moving 5% of his portfolio from stocks to bonds may lower his chance of reaching his ultimate goal to 79.5%, but at the same time completely eliminate those outlier risks. If this is the case, the investor may decide that change is worthwhile, even if it slightly lowers the probability of reaching every goal.

The Monte Carlo simulation technique does face criticism.

The main issue is that these simulations assign a low probability to dramatic events. Downturns, such as the market crash of 2008, had only a small probability of happening ... but it did happen. The effects of that one event had the power to set some portfolios and retirements back a decade. To counter this, investment professionals and statisticians are always on the lookout for better statistical models and improvements to the Monte Carlo simulation technique.

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