

## Special Article:



### A Better Way to Size Up Your Nest Egg

What will your portfolio be worth when you stop working? Financial planners usually answer the question by taking a current portfolio, making an estimate of future savings, and--most important--plugging in a long-term rate of return on those assets. For instance, using historic data, a 10% return on a portfolio comprised of mainly stocks is a common assumption. Problem is, this widespread method relies on average returns. The flaw with using averages is that Lake Erie never freezes and stock market returns don't fluctuate.

Now a more sophisticated alternative is working its way into financial planning. Using computer software or a Web-based program, you can calculate the probability of achieving your goals through a "Monte Carlo" simulation (TABLE 1). Monte Carlo is a mathematical model for computing the odds or probability of an outcome, such as the value of your nest egg at retirement, by testing thousands upon thousands of possible results. "What is the last thing you do before you climb on a ladder? You shake it," says Sam Savage, senior research associate at Stanford University. "And that is Monte Carlo simulation." Adds economist and Nobel laureate William Sharpe: "The central premise is: Yes, Virginia, there is risk in investing," a concept long-term averages don't always capture.

**STARTLING RESULTS.** Certainly, the technique is an eye-opener. Savage uses this example: A recent retiree has a \$200,000 portfolio invested in the Standard & Poor's 500-stock index, and she would like to tap into that sum over a 20-year period. How much can she withdraw each year? Since the S&P has had an average annual return of about 14% since 1952, her adviser suggested taking out some \$32,000. However, the risk of hitting a string of bad years early on can easily upset the estimate. For instance, if she started her \$32,000 withdrawals during a period as bad as the stock-market returns of the mid-1970s, she would run out of money in eight years. "What traditional planning ignores is the timing of the returns," says Joel Goldhirsh, principal at the financial planning firm Goldhirsh & Goldhirsh in Irvine, Calif. A Monte Carlo analysis would highlight some of the problems that might arise in a down market.

Monte Carlo simulations have been around for more than 50 years, but only with advances in low-cost computing power have they expanded beyond the scientific community. Financial Engines, a Web-based financial-planning service, takes a Monte Carlo approach, as does the retirement income calculator built by mutual-fund manager T. Rowe Price Associates. Says Moshe Arye Milevsky, finance professor at York University in Toronto: "In five years, all financial planning will Monte Carlo."

Of course, probability is a centuries-old computational technique. The mathematics behind Monte Carlo came out of the Manhattan Project to build the atomic bomb during World War II. The work is largely credited to Stanislaw Ulam, an Austrian-born mathematician, along with computer pioneer John von Neumann. The simulations offered a way of arriving at approximate solutions to troubling problems associated with random neutron diffusion in nuclear material.

Ulam named the method "Monte Carlo" after a relative fond of sneaking off to Monaco's casinos.

When it comes to financial planning, a Monte Carlo simulation takes into account returns, volatility, correlations, and other factors, all based on historical statistical estimates. That's similar to the traditional financial-planning approach. Monte Carlo programs generate millions of different scenarios by randomly changing a component in each run, such as return. For example, 100,000 runs of 50-year simulations using monthly returns involves 300,000,000 separate monthly calculations, according to William Bernstein, editor of *Efficient Frontier*, an online journal. The program starts generating the odds of reaching a particular outcome once the scenarios are generated. The results can be startling. For instance, a straightforward calculation for a 40-year-old with a \$300,000 portfolio matching the overall market in a 401(k) shows that he can easily achieve a goal of retiring on \$120,000 a year (table). But a Monte Carlo simulation by Financial Engines figures that the worker has only a 40% chance of reaching his target retirement income. If he doesn't like those odds, then he will need to take greater risks with his retirement portfolio or start saving more money.

**"AN ATTITUDE."** Clearly, Monte Carlo represents an improvement over traditional methods of financial planning. Nevertheless, as with any financial model, the results are sensitive to underlying assumptions. Milevsky points out that a Monte Carlo simulation with 500 to 1,000 events wouldn't have generated the stock-market crash of 1987. The program would have needed 100,000 or more simulations to come up with an event as extraordinary as the 1987 market crash.

And some events are beyond the model's ability to predict them. The brainy sorts at Long-Term Capital Management, the hedge fund that imploded during 1998, employed sophisticated probability models. But those models failed dramatically during a financial calamity that was triggered by a default in Russia. That's a warning that this high-tech planning is not foolproof. Says Ross Levin, president of Accredited Investors in Minneapolis: "My concern is that people are using Monte Carlo as a certainty test. It isn't. It's a probability test."

What's more, thinking about probabilities isn't all that easy. What is the difference between a 65% and a 75% chance of achieving your retirement goal? Is 65% acceptable?

Despite these cautions, a Monte Carlo simulation is a far more realistic measure of financial risk and reward than any of the traditional financial planning alternatives. Even more important, Monte Carlo gets people thinking about investment and long-term planning in terms of probability rather than certainty. "It may be less a mathematical model and more an attitude," says Greg Anderson, professor of mathematics at the University of Minnesota. And once you think through the odds, you can make a smarter calculated bet.

By *CHRISTOPHER FARRELL*

TABLE 1

**Will You Have Enough?**

A 40-year old male earns \$150,000 a year and contributes the maximum to a 401(k), which is invested in stock and bond funds worth \$300,000. His annual expected return is 9.43%. He hopes to retire at 65 with an income of \$120,000 in today's dollars (including Social Security). The projections are adjusted for inflation.

***HE'S GOLDEN USING TRADITIONAL FINANCIAL PLANNING...***

**WEALTH:** \$1,700,000

**INCOME:** \$123,000

CHANCE OF MAKING INCOME GOAL **100%**

***...BUT FALLS SHORT WITH A MONTE CARLO SIMULATION***

**WEALTH:** \$1,440,000 (with a 5% chance of \$563,000 and a 5% chance of \$3,420,000)

**INCOME:** \$107,000 (with a 5% chance of \$53,000 and a 5% chance of \$228,000)

CHANCE OF MAKING INCOME GOAL **40%**

*DATA: FINANCIAL ENGINES, BUSINESS WEEK*