



# Monte Carlo Simulation

Integrated Analyst, January 2025

Editors: Dan Chin, PhD and Lisa Michalski, CFA

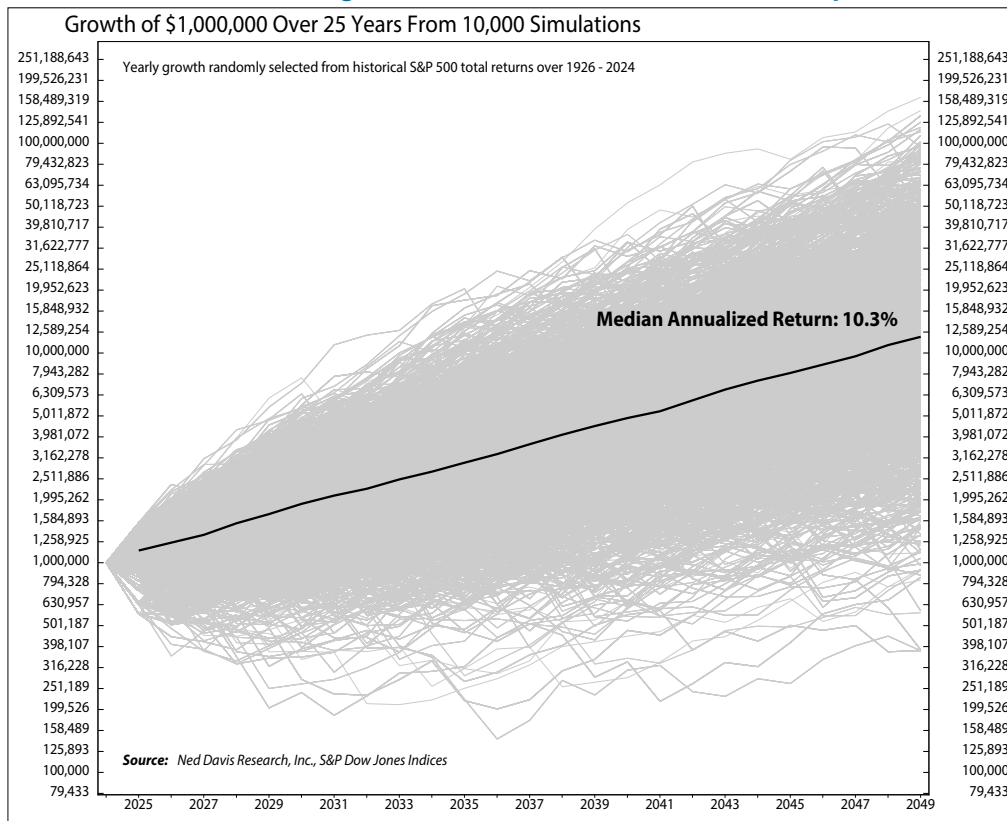


Welcome to the 3<sup>rd</sup> edition of NDR's *Integrated Analyst*, a quarterly publication showcasing the wide-ranging capabilities of NDR's Custom Research Solutions (CRS) group. Looking to settle a debate from your internal team meetings, increase the productivity of your organization, launch a new product suite, or quickly respond to an in-depth customer question? CRS can serve as an extension of your research team to assist with projects large or small. We build tailored solutions through direct engagement. This issue of *Integrated Analyst* demonstrates how CRS can help you visualize market uncertainty through simulation.

**Q: How are simulations and uncertainty related to each other?**

A: Simulation refers to the creation of artificial data that looks plausibly similar to the actual data it is meant to simulate. An early implementation occurred during nuclear weapons testing in the 1940s and was dubbed "Monte Carlo" to describe the virtual dice-rolling used to randomly generate the data. We can apply the same basic tools to modeling the different ways the future might look. The chart at left shows 10,000 simulations of a 25-year investment in the S&P 500 using a method called *bootstrapping*, where historical yearly returns are randomly shuffled and spliced together to create a single time series. While the typical bootstrapped return is around 10% per year, the simulation also illustrates the wide range of potential paths, with the lowest and highest annualized returns around -3% and 22%, respectively.

### Monte Carlo and Long-Run Stock Market Uncertainty



CRS202501\_01



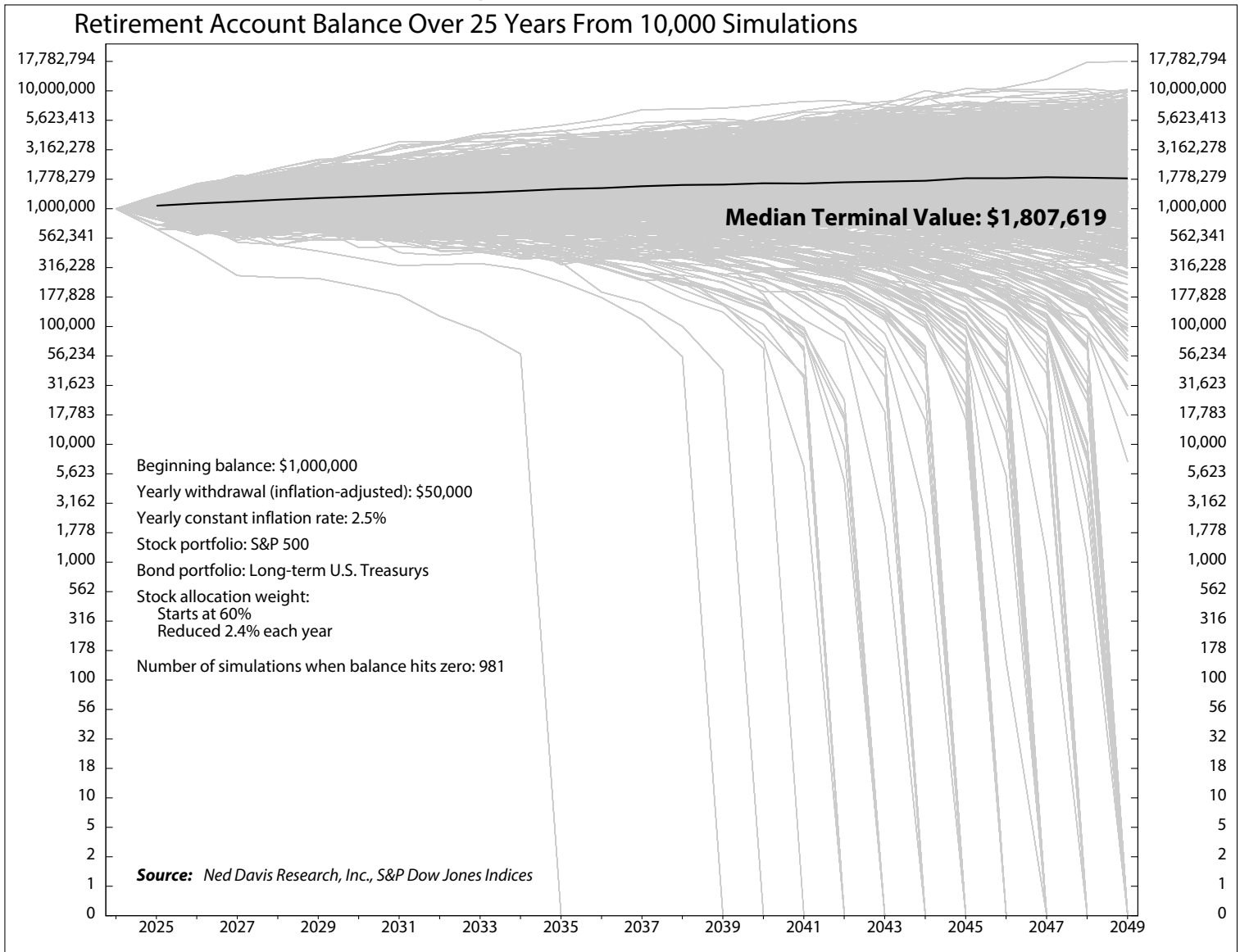
© Copyright 2025 NDR, Inc. Further distribution prohibited without prior permission. All Rights Reserved. See NDR Disclaimer at [www.ndr.com/copyright.html](http://www.ndr.com/copyright.html). For data vendor disclaimers refer to [www.ndr.com/vendorinfo/](http://www.ndr.com/vendorinfo/)

**Q: How can the simulations be shaped to account for what happens in the real world?**

A: As long as rules and decisions can be codified, much can be done with simulations to help see what might happen through the investment horizon. For example, we can add on to the previous chart to create a retirement planner that incorporates asset allocation as well as assumptions for inflation, withdrawal amounts and retirement years.

The chart below shows 10,000 simulated paths with constant inputs for annual withdraw and expected inflation. We use these inputs to calculate both an expected terminal value of the hypothetical portfolio as well as the probability of prematurely running out of funds (where the portfolio value reaches zero).

### Monte Carlo and Retirement Planning



CRS202501\_02



© Copyright 2025 NDR, Inc. Further distribution prohibited without prior permission. All Rights Reserved. See NDR Disclaimer at [www.ndr.com/copyright.html](http://www.ndr.com/copyright.html) For data vendor disclaimers refer to [www.ndr.com/vendorinfo/](http://www.ndr.com/vendorinfo/)

**Q: If simulated paths are being generated, couldn't what-if analysis be done?**

A: Absolutely. For instance, the table below summarizes the simulation results that describe the distribution of retirement account balances. If the results are not to the client's liking, the assumptions and requirements that go into the simulation can be changed to produce a range of expected outcomes.

Additional variables can also be included in the simulation, such as the required minimum distribution, taxes, additional assets with different rules for allocation, and so on. CRS analysts will work with you to determine the most suitable parameter options.

### Retirement Planning Simulation Summary

#### Terminal Values

Percentile	Balance	Annualized Return
75th	\$3,281,242	4.5%
50th	\$1,807,619	2.3%
25th	\$788,888	-0.9%
Chance of going broke:		9.8%

**Important note:**

The charts and table presented above are not intended to be projections of actual account or model future performance. These are purely illustrations, provided simply to show that we can provide simulated return analysis by adjusting variables that can affect market returns and are specific to your clients' portfolios.

While bootstrapping makes use of historical, realized data, keep in mind the future can look very different from the past. We can also create non-bootstrapped simulations that can induce correlations among assets or hold certain conditions, like a regime, for a certain period of time. For more information, contact us at [CRSQuestions@ndr.com](mailto:CRSQuestions@ndr.com).

## NED DAVIS RESEARCH

NDRsales@ndr.com  
www.ndr.com  
(800) 241-0621

### SARASOTA

3665 Bee Ridge Road Suite 306  
Sarasota, FL 34233

United States

800 241 0621 (U.S. & Canada)

941 412 2300

### NEW YORK

1270 Avenue of the Americas

11<sup>th</sup> Floor

New York, NY 10020

(800) 241-0621

### LONDON

4 Bouverie Street

Temple, London

EC4Y 8AX

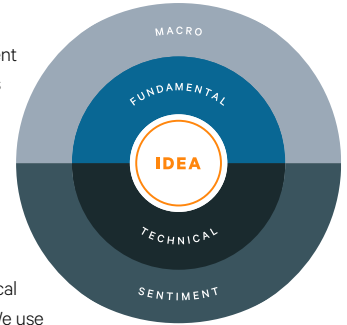
+44 20 7779 8454



**NDR**  
NED DAVIS RESEARCH

## See the Signals.™

Founded in 1980, NDR (Ned Davis Research) is a leading independent research firm with clients around the globe. With a range of products and services, we deliver award-winning solutions to the world's leading investment management companies. Our clients include professionals from global investment firms, banks, insurance companies, mutual funds, hedge funds, pension and endowment funds, and registered investment advisors. NDR uses the weight of the evidence, a 360-degree approach, to frame our market insights. Evidence, data that has been continually amassed over decades, shapes historical perspective and allows us to build proprietary indicators and models. We use this methodology to help our clients make objective investment decisions.



## Important Information and Disclaimers

The data and analysis contained in NDR's publications are provided "as is" and without warranty of any kind, either expressed or implied. The information is based on data believed to be reliable, but it is not guaranteed. **NDR DISCLAIMS ANY AND ALL EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTIES OF MERCHANTABILITY, SUITABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE.**

NDR's reports reflect opinions of our analysts as of the date of each report, and they will not necessarily be updated as views or information change. All opinions expressed therein are subject to change without notice, and you should always obtain current information and perform due diligence before trading. NDR or its affiliated companies or their respective shareholders, directors, officers and/or employees, may have long or short positions in the securities discussed in NDR's publications and may purchase or sell such securities without notice.

NDR uses and has historically used various methods to evaluate investments which may, at times, produce contradictory recommendations with respect to the same securities. When evaluating the results of prior NDR recommendations or NDR performance rankings, one should also consider that **NDR may modify the methods it uses to evaluate investment opportunities from time to time, that model results do not impute or show the compounded adverse effect of transaction costs or management fees or reflect actual investment results, that other less successful recommendations made by NDR are not included with these model performance reports, that some model results do not reflect actual historical recommendations, and that investment models are necessarily constructed with the benefit of hindsight. Unless specifically noted on a chart, report, or other device, all performance measures are purely hypothetical, and are the results of back-tested methodologies using data and analysis over time periods that pre-dated the creation of the analysis and do not reflect tax consequences, execution, commissions, and other trading costs. For these and for many other reasons, the performance of NDR's past recommendations and model results are not a guarantee of future results.**

Using any graph, chart, formula, model, or other device to assist in deciding which securities to trade or when to trade them presents many difficulties and their effectiveness has significant limitations, including that prior patterns may not repeat themselves continuously or on any particular occasion. In addition, market participants using such devices can impact the market in a way that changes the effectiveness of such devices. NDR believes no individual graph, chart, formula, model, or other device should be used as the sole basis for any investment decision and suggests that all market participants consider differing viewpoints and use a weight of the evidence approach that fits their investment needs. Any particular piece of content or commentary may or may not be representative of the NDR House View, and may not align with any of the other content or commentary that is provided in the service. Performance measures on any chart or report are not intended to represent the performance of an investment account or portfolio, as some formulas or models may have superior or inferior results over differing time periods based upon macro-economic or investment market regimes. NDR generally provides a full history of a formula or model's hypothetical performance, which often reflects an "all in" investment of the represented market or security during "buy", "bullish", or similar recommendations. This approach is not indicative of the intended usage of the recommendation in a client's portfolio, and for this reason NDR does not typically display returns as would be commonly stated when reporting portfolio performance. Clients seeking the usage of any NDR content in a simulated portfolio back-test should contact their account representative to discuss testing that NDR can perform using the client's specific risk tolerances, fees, and other constraints.

NDR's reports are not intended to be the primary basis for investment decisions and are not designed to meet the particular investment needs of any investor. The reports do not address the suitability of any particular investment for any particular investor. The reports do not address the tax consequences of securities, investments, or strategies, and investors should consult their tax advisors before making investment decisions. Investors should seek professional advice before making investment decisions. The reports are not an offer or the solicitation of an offer to buy or to sell a security.

Further distribution prohibited without prior permission. Full terms of service, including copyrights, terms of use, and disclaimers are available at <https://www.ndr.com/web/ndr/terms-of-service>.