

# Harry Markowitz in Memoriam

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Harry Markowitz is the undisputed father of modern portfolio theory and its leading light in practice. Markowitz's work fundamentally transformed the profession, theory, law, and methods of investment management. The innovations he introduced have improved the lives of countless people who directly or indirectly rely on financial returns to provide for their economic future.

Markowitz's article "Portfolio Selection" appeared in 1952a in the *Journal of Finance*, and in the years to follow it transformed the mission of the investment professional from a bottom-up process of individual security analysis to a top-down approach to portfolio construction. He introduced the radical notion that investing could be represented as an optimization problem with quantitative inputs, a defined objective function based on axiomatically grounded utility, and a mathematical expression with an algorithmically discoverable solution.

In proposing his mathematical approach to portfolio choice, Markowitz was the original Wall Street quant. His methods and intellectual framework owed much to the emergence of operations research in the mid-20th century, a discipline that applied mathematical tools to solve practical problems. To express the investment problem, Markowitz sought ways to simplify and quantify the goals of the investor to make them analytically tractable. Risk and reward became standard deviation and expectation of future return. He reduced the complex interplay of multifarious investments down to their statistical covariance. To solve the problem, he had to invent a new algorithm. His critical path method—which he gave away freely to the world—was a fundamental innovation in the field of operations research. It was recognized as such by the 1989 John von Neumann Theory Prize of the Institute for Operations Research and the Management Sciences.<sup>1</sup>

Harry Markowitz continued throughout his long and productive career to develop and apply algorithms to financial problems. In doing so, he practically single-handedly made computer programming the new

investment tool. Harry himself was a path-breaking practitioner. He led one of Wall Street's earliest algorithmic trading firms, joining Arbitrage Management Company in 1968 where he collaborated with economists Paul Samuelson and Robert Merton.

The award of the Nobel Medal in Economics in 1990 to Harry Markowitz is resounding testimony to the fact that his influence on academia was no less monumental than his influence on practice. Harry Markowitz's Nobel award not only honored him for his path-breaking work, but it raised the profile of finance as an exciting new subfield of economics. He was the first of a series of many of subsequent Nobel Laureates who made seminal contributions as financial economists.

Mean-variance analysis, the innovation he is best known for, was not simply a solution to an investment problem. In the hands of generations of academic researchers, it became an analytical framework leading to important insights—chief among them the capital asset pricing model, a result derived from considering the equilibrium implications of mean-variance investor choice. The fundamental tool of modern portfolio theory—the maximization of expected utility over portfolio choice—remains the workhorse of modern financial economics. Modern portfolio theory was joined but not eclipsed in recent decades by behavioral finance—yet another field in which Harry Markowitz was an important pioneer.

Behavioral finance focuses on investor beliefs and preferences. The former are required inputs to the mean-variance model; the latter are typically mathematically expressed as utility functions. In *Portfolio Selection*, written during a year spent at the Cowles Foundation at Yale, Markowitz grounded investor choice in the maximization of a quadratic utility function to uniquely identify the optimal point on the efficient frontier—quadratic because the objective function is expressed using mean and variance. As he put it, the quadratic function, "... shows a surprising flexibility in approximating smooth, concave curves."<sup>2</sup> The landmark book was written in a style broadly

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accessible to non-academic readers. As such, it effectively operationalized the abstract notion of expected utility to guide real and socially important human decisions.

While some of Markowitz's contemporaries raised doubts about the feasibility of this approach,<sup>3</sup> the representation of preferences by investor utility functions remains the core of modern behavioral finance. Markowitz himself considered a variety of alternative specifications to the utility function. For example, he introduced the idea of "semi-variance" to capture the intuition that investors were only averse to downside risk.<sup>4</sup> In his 1952b article "The Utility of Wealth," Markowitz explored even more complex formulations positing that investors may feel differently about gains versus losses. For example, he conjectured an inflected "... utility curve consistent with insurance, betting and diversification."<sup>5</sup> Behavioral researchers have found that reference-dependent utility can explain many seemingly inconsistent economic decisions in practice and stock market anomalies in markets.<sup>6</sup>

Markowitz remained active in behavioral finance research throughout his career. A particularly noteworthy example is his 2010 *Financial Analysts Journal* article coauthored with Bruce Jacobs and Kenneth Levy, in which the authors find that varying the proportion of value and growth investors in a market can generate explosive bubbles.

CFA Institute members will likely be aware that the Markowitz revolution also transformed standards for fiduciaries. Prior to the 1970s, standards for fiduciary prudence focused on selection of safe securities. Markowitz showed that diversification across risky securities is a powerful tool to reduce beneficiary risk. Based on this, legal scholars argued persuasively for the incorporation of modern portfolio theory into fiduciary standards.<sup>7</sup> The 1992 revision of the Uniform Prudent Investment Act governing the duties of trustees explicitly mandates diversification in most cases—a change that can be traced directly back to the Markowitz revolution.

Implicit in the modern guidelines for defined-contribution plans is the requirement that investors must have a sufficiently wide opportunity set to construct a portfolio reflecting their personal risk preferences. For example, since the Pension Protection Act of 2006, target date funds have been a widely used safe harbor for sponsors of defined-contribution pensions such as 401(k) plans. The logic of target-date funds as a default option is clearly founded on the

fundamental insight of Markowitz's mean-variance frontier—that investors can differ widely in their preferences; however, there exists an optimal portfolio for each investor that maximizes their unique trade-off between risk and return.

Harry Markowitz was loved and deeply respected by everyone in the world of finance. Due to his longevity and passionate engagement with both academia and the investment profession, many of us have had the privilege of knowing him.

My first meeting with Harry came in the early 1990s when I was a young professor at Columbia. To my astonishment, he had read my work in preparation for the visit. I knew I was in a wonderful profession when the founding father of our field just wanted to talk research. Over the years since, Harry Markowitz set the "tone at the top" for our field, collaboratively sharing insights and exploring new and interesting problems. To all who knew him, he was forever curious, enthusiastic, modest, engaged, generous with his insights, and encouraging to young scholars.

The *Financial Analysts Journal* served early on as an important forum for research and discussion about how best to apply Harry Markowitz's innovations. The discourse was often guided by Harry Markowitz's own reflections on the challenges of such things as selecting inputs and evaluating investor risk-aversion. It took little time for his revolutionary ideas to appear in the journal. Only a year after Markowitz published his seminal 1952 article, journal readers were introduced to the mean-variance model by his RAND colleague G. H. Fisher (1953).

Markowitz himself published nine articles over five decades in the journal, the first in 1976, the last in 2010. We encourage our readers to explore them on our website. I particularly recommend "The Early History of Portfolio Theory: 1600–1960" in which he explains his relative contribution to this important new field in his own, perhaps overly modest terms. For instance, he gracefully credits A. D. Roy with mathematically identifying an optimal portfolio that minimizes the probability of a return below a chosen lower bound—an idea Markowitz independently discovered and developed into a transformational and important domain of research and practice.

In many ways, Harry Markowitz was the archetypal Nobel Laureate. Alfred Nobel specified the prizes to be given to "those who, during the preceding year, have conferred the greatest benefit to humankind."<sup>8</sup> Mean-variance is one of the most widely used models in investment management today. It emphasizes

rational portfolio construction based on diversification. It quantifies—and thus demonstrates the expected magnitude of—the benefit to allocating across multiple assets. Its widespread adoption undoubtedly reduced the economic risk of millions—perhaps billions—of people around the world. It continues to stimulate innovation in the practice of investment management—there is hardly an article published in the *Financial Analysts Journal* that does not, in some way, rely on Harry Markowitz's contributions.

Interesting enough, the Nobel Foundation is one of the beneficiaries of Markowitz's insights. In his will, Alfred Nobel specified that the capital from his estate be "converted to safe securities by my executors." In the early 1950s, the Swedish government allowed the Foundation board to relax the "safe securities" constraint and invest in a diversified portfolio of "real estate, bonds and secured loans ... also in most types of stocks." All Nobel laureates since then have Harry Markowitz—in part—to thank.

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## Notes

1. Cf. Cottle and Infanger (2010).
2. Markowitz (1959), 285.
3. See, for example, Alchian (1953).
4. Markowitz (1959) Chapter 9m p. 188.
5. Markowitz (1959), 218.
6. Cf. Barberis, Jin, and Wang (2021).
7. Cf. Langbein and Posner (1976), Longstreth (1986), and Sterk (2009).
8. <https://www.nobelprize.org/alfred-nobel/alfred-nobels-will/>.

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