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Nobel Laureate

# Harry Markowitz:

## Creator of the Modern Portfolio Theory

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*Harry Markowitz developed the modern portfolio theory which earned him the Nobel Memorial Prize and is today used in managing trillions of dollars in assets. Suresh Sethi describes the fascinating life of a scholar whose footprints led the way to almost everything in finance.*

One afternoon in 1950, a student at the University of Chicago ran across *The Theory of Investment Value* by John Burr Williams. The student's name was Harry M. Markowitz and he was about to transform the world. The book proposed that the value of a stock should equal the present value<sup>1</sup> of its future dividends. Given the uncertainty of future dividends, that would mean valuing a stock by the present value of its *expected* future dividends. An investor who adhered to this theory, and wanted to maximize the expected value of his portfolio, would thus need to invest in only one single security. As we all know, that is not how investors do or should behave.

Markowitz had a brilliant flash of insight, realizing that investors diversify out of a concern for risk as well as return. In other words, investors do not simply choose the stock that yields the maximum expected return regardless of its risk; they consider their own risk tolerance when selecting stocks for their portfolios. Markowitz put this idea into practical terms by selecting variance as the measure of risk. He thus concluded that an investor selects the stocks in her portfolio such that it yields the maximum expected return without exceeding her acceptable risk level. This approach to stock selection became

more plausible in view of the fact that portfolio variance depends on security covariances.

Once Markowitz realized these two criteria, risk and return, it followed that investors make their selections from the set of Pareto optimal risk-return combinations, which are located on what is called the efficient frontier.<sup>2</sup> With these realizations, the modern portfolio theory of stock selection under uncertainty was born. Markowitz's paper "Portfolio Selection" was published in 1952 by *The Journal of Finance*.<sup>3</sup> It earned Markowitz a PhD in economics in 1954 and the coveted Nobel Memorial Prize in Economic Sciences in 1990.<sup>4</sup> As *Investopedia* puts it, "You can divide the history of investing in the United States into two periods: before and after 1952!"

Markowitz also went to work for the RAND Corporation in 1952.<sup>5</sup> There, with the help of George Dantzig, who was honored in the previous issue of this journal,<sup>6</sup> he used optimization techniques to identify the optimal mean-variance portfolios. His procedure uses Dantzig's simplex method<sup>7</sup> to construct the efficient frontier. He described this work in his classic monograph *Portfolio Selection: Efficient Diversification of Investments*, published in 1959.<sup>8</sup>

By demonstrating that portfolio diversification can reduce invest-

ment risk, Markowitz's modern portfolio theory<sup>9</sup> (MPT) has become the bedrock of investment management practice. Modern money managers<sup>10</sup> routinely follow its tenets. Financial and retirement advisors create optimal portfolios for their clients by maximizing the expected return for specified risk tolerance. Passive investors use MPT to choose low-cost, well-diversified index funds. Diversification, the financial equivalent of not putting all your eggs in one basket, limits the damage that losses in any individual stock can cause. The extraordinary success and prevalence of passive investing is a clear indication of the popularity of MPT, with trillions of dollars in institutional assets invested under MPT guidelines.<sup>11</sup> *Pensions and Investments Magazine*<sup>12</sup> justly named Markowitz "Man of the Century," in its December 27, 1999 issue, declaring, "Harry Markowitz laid the foundation for investment management in the second half of the 20th century."

In his long and productive life, Markowitz has worked with many scholars and on many topics, but his focus has always been the application of mathematics and computer techniques to the practical problems of making business decisions under uncertainty. In 1989 he was awarded the John von Neumann Theory Prize by what is now the Institute



for Operations Research and the Management Sciences (INFORMS)<sup>13</sup> for his contributions to portfolio theory, sparse matrix methods, and simulation language programming (SIMSCRIPT).<sup>14</sup> Sparse matrix methods are widely used to solve large systems of simultaneous equations with many zero coefficients, which often arise in management, economics, and engineering applications. SIMSCRIPT allowed programmers to describe the system to be simulated rather than listing the actions the computer must take to accomplish the simulation, significantly reducing programming time. And because simulations are so ubiquitous, SIMSCRIPT has been used to program computer simulations in such areas as manufacturing, transportation, agriculture, and war games.

As well as becoming the universal paradigm of modern finance, Harry Markowitz's portfolio theory established financial microanalysis as a respectable area of research in economic analysis. It laid the foundation for the capital asset pricing model or CAPM,<sup>15</sup> a theory of price formation for financial assets for which William Sharpe was also awarded the 1990 Nobel Memorial Prize in Economic Sciences. Indeed, noted financial historian Peter L. Bernstein wrote, "Markowitz's work on portfolio selection was the foundation of all that followed in the theory of finance in general and of the capital asset pricing model in particular."

Markowitz's portfolio theory also transformed production and operations management, with its mean-variance criterion being used extensively in supply chain management for risk-averse agents.<sup>16</sup>

These days, Markowitz consults from his offices at the Harry Markowitz Company. He also teaches at the Rady School of Management, the University of California at San Diego, and gives invited video lectures. He serves on the advisory boards of several blue-chip investment firms and advises ProbabilityManagement.org,<sup>17</sup> a 501(c)(3) non-profit founded by Dr. Sam L. Savage to reshape the communication and calculation of uncertainty. Markowitz remains an active member of GuidedChoice which uses MPT in its investing methodology, ensuring that its clients' investments will succeed. ■

### Author Bios



**Suresh P. Sethi** is the Eugene McDermott Chair Professor of Operations Management at the Jindal School of Management at the University of Texas at Dallas. He earned his Ph.D. from Carnegie Mellon University and conducted post-doctoral work with George Dantzig at Stanford University. Harry Markowitz kindly wrote the foreword to Sethi's 1997 book *Optimal Consumption and Investment with Bankruptcy*<sup>18</sup> and, in 2006, delivered the keynote address at a conference held in Sethi's honor<sup>19</sup> at the University of Texas at Dallas.

### Endnotes

1. For more information on present value, see [https://en.wikipedia.org/wiki/Present\\_value](https://en.wikipedia.org/wiki/Present_value)
2. [https://en.wikipedia.org/wiki/Efficient\\_frontier](https://en.wikipedia.org/wiki/Efficient_frontier).
3. [https://www.math.ust.hk/~maykwok/courses/ma362/07F/markowitz\\_JF.pdf](https://www.math.ust.hk/~maykwok/courses/ma362/07F/markowitz_JF.pdf)
4. <https://www.nobelprize.org/prizes/economic-sciences/1990/press-release/>
5. [https://en.wikipedia.org/wiki/RAND\\_Corporation](https://en.wikipedia.org/wiki/RAND_Corporation)
6. Birge, John R. "George Bernard Dantzig: The Pioneer of Linear Optimization," *Management and Business Review* 1, No.1 (2021):161-163. <https://mbrjournal.com/2021/01/26/george-bernard-dantzig-the-pioneer-of-linear-optimization/>
7. <https://www.britannica.com/topic/simplex-method>
8. <https://cowles.yale.edu/sites/default/files/files/pub/mon/m16-all.pdf>
9. Markowitz's modern portfolio theory is described at greater length here: [https://en.wikipedia.org/wiki/Modern\\_portfolio\\_theory](https://en.wikipedia.org/wiki/Modern_portfolio_theory) and <https://www.investopedia.com/terms/m/modernportfoliotheory.asp>
10. <https://www.investopedia.com/terms/m/moneymanager.asp>
11. A 2012 article in US News and World Report described why modern portfolio theory still works. [https://money.usnews.com/money/blogs/on-retirement/2012/12/13/why-i-am-clinging-to-failed-investment-strategies?\\_ga=2.6496242.1199904918.1590253800-1018108278.1590087401](https://money.usnews.com/money/blogs/on-retirement/2012/12/13/why-i-am-clinging-to-failed-investment-strategies?_ga=2.6496242.1199904918.1590253800-1018108278.1590087401)
12. <https://www.pionline.com/article/19991227/PRINT/912270716/markowitz-demonstrated-importance-of-diversification> (this link requires a subscription to P&I)
13. To learn more about INFORMS, see: <https://www.informs.org/> and [https://en.wikipedia.org/wiki/Institute\\_for\\_Operations\\_Research\\_and\\_the\\_Management\\_Sciences](https://en.wikipedia.org/wiki/Institute_for_Operations_Research_and_the_Management_Sciences)
14. <https://en.wikipedia.org/wiki/SIMSCRIPT>
15. <https://www.investopedia.com/terms/c/capm.asp>
16. See, e.g., Gan, X., Sethi, S.P., and Yan, H., "Coordination of a Supply Chain with Risk-Averse Agents," *Production and Operations Management*, 13(2), 2004, 135-149. <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1937-5956.2004.tb00150.x>
17. <https://www.probabilitymanagement.org/> For more information on probability management, see: [https://en.wikipedia.org/wiki/Probability\\_management](https://en.wikipedia.org/wiki/Probability_management)
18. <https://www.springer.com/gp/book/9780792397557> Markowitz's foreword to Sethi's book can be found on pp. xiii-xviii
19. <https://utdallas.app.box.com/s/w17jqhuramf940n35pcjrz4m4hrzjjo3>