Harry Markowitz
Father of Modern Portfolio Theory

STILL DIVERSIFIED

By Alan Lavine

Harry Markowitz's Nobel Prize winning Modern Portfolio Theory was put to the supreme test in The Great Recession of 2008. The stock market plunged nearly 40%, stock and corporate bond markets crashed, the money markets froze up. Uncle Sam had to bail out major banks, while letting Bear Stearns and Lehman Brothers fail.

It raised the big question: Does Modern Portfolio Theory hold up during once-in-a-lifetime events?

"It is sometimes said that portfolio theory fails during a financial crisis because all asset classes go down and all correlations go up," Markowitz said in a telephone interview from his office in San Diego, CA.

But this, stressed the Ph.D. winner of the Nobel Prize for economics, is already predicted by his Modern Portfolio Theory.

"Generally, asset classes move roughly in proportion to their historical betas," he said. The beta value is a measure of how risky an asset is in relation to the overall stock market. The S&P 500, for example, has a beta value of one. So a stock or mutual fund that has a beta value greater than one will lose more money when the market declines than a stock that has a beta value less than one.

Portfolio managers that limited risk during the 2008 recession kept a percentage of their portfolios in US Treasury bonds and gold bullion. These investments performed well while stocks worldwide and high-yield corporate bonds plunged, Markowitz says.

For over six decades, "MPT," as Modern Portfolio Theory is nicknamed, has provided money managers and sophisticated investors with a tried-and-true way to select portfolios.

Markowitz's work is the key to squeezing the best returns with the least amount of risk out of portfolios of different asset classes. It analyzes the effects of asset risk, correlation and diversification on expected portfolio returns. But much depends upon how you split up your investment pie, Markowitz stresses.

Markowitz, at 84 years old, teaches his landmark Modern Portfolio Theory at the Rady School of Management at the University of California, San Diego. He is also working on a book and consulting with companies, such as Index Fund Advisors, an investment advisory firm, and Guided Choice, advisor to 401(k) plan sponsors.

Markowitz was born an only child in Chicago in 1927. His parents, Morris and Mildred, owned a neighborhood grocery story. Because his family was in the food and dry goods business, he was not severely affected by the Great Depression. Like other boys his age, he liked playing basketball and football. He also played the fiddle in the high school orchestra and liked reading comic books. But in high school, he took to studying physics and astronomy. He also read the philosophy of David Hume and Charles Darwin's *The Origin of Species*.

Markowitz said he had no plans to go into economics when he graduated from the University of Chicago after completing a Bachelor's degree in two years. He was fascinated with the economics of uncertainty, and credits a course on "Observation, Interpretation and Integration" with having a strong impact on him.

Modern Portfolio Theory did not emerge from a vacuum. The use of statistical methods has its roots in the 17th and 18th centuries. Christian Huygens, in 1657, published a work on the calculus of probabilities, based on communications with French mathematicians Blaise Pascal and Pierre de Fermat. Swiss mathematician Johann Bernoulli published studies on mathematical expectations. Work by English mathematician Thomas Bayes in 1763 determined probabilities based on observed frequencies could be applied to social decision making. In 1812, a Pierre-Simon Laplace book, *The Analytic Theory of Probabilities*, revealed probability estimates could be used to solve many different types of problems.

In the early 20th century, many of the faculty members in the economics department of University of Chicago emphasized

mathematics in economic decision-making. His mentors included renowned faculty members Leonard Savage, Tjalling Koopmans, Milton Friedman and Jacob Marschak.

One study, published by Milton Friedman and Leonard Savage in *The Journal of Political Economy* in August 1948, especially influenced him. The study, "The Utility Analysis of Choices Involving Risk," revealed that when individuals choose occupations, investments or business ventures, they essentially make one of two decisions. They either take risks or play it safe. Also influencing his thinking was Tjalling Koopmans' graduate course on activity analysis.

While working on his Ph.D., Markowitz was invited to become one of the student members of the Cowles Commission for Research in Economics, now the Cowles Foundation at Yale University in New Haven, CT. The commission, affiliated with the University of Chicago from 1939 to 1955, fosters the development and application of rigorous logical, mathematical and statistical methods of analysis in economics. Economist Alfred Cowles III, its founder, was a fellow and treasurer of the New York-based Econometric Society, an international society for the advancement of economic theory in relation to statistics and math. Cowles, whose grandfather was a founder of *The Chicago Tribune*, applied statistical techniques to compare financial performance.

Markowitz said his experience working on the Cowles Commission helped him get an idea for his dissertation. While waiting to see his dissertation advisor, Jacob Marschak, he began chatting with Marschak's stockbroker, who also awaited Marschak. Markowitz already had learned from Marschak about using probability mathematics to study the elasticity of demand for money and the relationship of money to wealth. So he naturally expanded that idea to financial market performance.

Markowitz got some basic ideas of portfolio theory while reading John Burr William's book, *Theory of Investment Value* (Fraser). Williams' book stressed that the value of a stock should equal the present value of future dividends that a company is expected to pay shareholders. He began applying probabilities to determine the risk and return of portfolios.

Investors already had been spreading their risks ever since the first bull market on Wall Street in 1792. But the investments were often more highly correlated and riskier than anticipated. The reason was that they failed to use the tools to mathematically evaluate performance relationships.

Markowitz believed variance should be used as a measure of risk in conjunction with expected rates of return on a portfolio of stocks. The expected rate of return, simply put, is the average of the probability distributions of returns. The variance, or standard deviation, which is the square root of the variance, measures how far the numbers spread out from each other.

"Variance came to mind as a measure of risk," Markowitz said. "The fact that portfolio variance depended on security covariance added to the plausibility of the approach. Since there were two criteria — risk and return — it was natural to assume that investors selected from the set of optimal risk-return combinations."

In the 1959 edition of his book, *Portfolio Selection* (Blackwell), Markowitz explained that that variance does not go to zero when risks are correlated. Variance can be substantial even if correlations are just .1 to .3 among securities, on average.

Markowitz said investors should estimate the likely returns, risks and correlations among various asset classes and use these inputs to conduct a Modern Portfolio Theory analysis. This produces a curve of "efficient" risk-return combinations. If you want greater return on average, you have to take on greater risk. If you want less month-to-month and year-to-year fluctuations, you have to accept less return on the average in the long run.

In 1989, Markowitz won the John von Neumann Theory Prize by the Institute for Operations Research and Management Sciences, a Hanover, MD organization dedicated to applying scientific methods to help improve decision-making, management and operations. The honor was for his research on portfolio theory, sparse matrix analysis to solve simultaneous equations and SIMSCRIPT, which is used to program computer simulations in business and war games.

His dissertation, "Portfolio Selection: Efficient Diversification," was published in the *Journal of Finance* in 1952 and in book form in 1959. That work won him the Nobel Prize in economics in 1990.

Though this sounds glorious, it wasn't easy sailing in 1955 when he defended his dissertation. At the time, he was working for the Cowles Foundation. Economist Milton Friedman argued that portfolio theory was not economics, so Markowitz should not be awarded his Ph.D. But after a short debate by the dissertation committee, the work was approved.

"At the time I defended my dissertation, portfolio theory was not part of economics," he said. "But now it is."

Markowitz looks at the world based on utility and personal probability. When he goes for daily lunchtime walks, he notices license plate numbers and routinely calculates the probability of seeing the same number reoccur. For example, the probability of seeing a license plate with four of a kind such as 6666 is one in one thousand, he said. But every year, if you walk enough you will see another license plate with four of a kind. It's the same, he said, with the stock market.

Markowitz advocated optimizing portfolios to get the best return per unit of risk by using asset correlations dating back to 1926, rather than short-term and current correlations. History tends to repeat itself, he believes, but not in the same sequence. So there is always a chance the investor could experience losses similar to 1929, 1982, 2002 and 2008.

"Personally I think that nature draws from the basket known as the S&P 500 randomly every year," he said. "The stock market losses in 2008 have a probability of occurring about once out of every 40 years. The 38.5% loss on the S&P 500 was more than 2.5 standard deviations below the mean."

Yes, the 2008 market crash could happen again, he said, but you don't know when. The losing cards are in the deck.

Markowitz's famous portfolio theory for allocating assets was refined by later research. The Capital Asset Pricing Model, designed by William Sharpe in 1963, gave money managers an extra measure of risk to consider. Sharpe's theory considers systematic risk, or how an asset moves in relation to the overall market. Under Sharpe's theory, systematic risk is measured by a portfolio's "beta" value.

Additional refinements were devised by Eugene Fama and Kenneth French in 1995. They fine-tuned the model to account for investment styles, such as large company, medium-sized company and small company growth and value stocks. So to reduce volatility today, financial advisors often

use Modern Portfolio Theory to construct portfolios and incorporate a wide range of United States and overseas asset classes.

Markowitz says that investors concerned about re-experiencing large market losses should optimize portfolios with the idea of trading off some return for less risk. Such portfolios would have lost less in 2008, and they would have hit their break-even point in a shorter period.

For example, the S&P 500 lost 38% in 2008, and higher beta emerging markets asset class indexes fell 54%, he said. Corporate bonds fell in value, but much less than stocks, and government bonds rose in value. The five-year government bond index rose 8.4%. Small capitalization stocks dropped in value, but not as much as expected based on their standard deviations. Meanwhile, large capitalization stocks performed worse than expected. A simple 50% S&P 500 and 50% Lehman Brothers Government Bond Index split would have lost just 12.5%.

Over the long run, Modern Portfolio Theory helps spread risk and build wealth. Nevertheless, the theory is not without critics. A chief complaint is that Markowitz's model assumes that asset returns are normally distributed. Frequently, however, stock market returns are not normally distributed. There can be large swings of three to six standard deviations from the mean that occur more frequently than they would if the returns were normally distributed. Other research shows that the Capital Asset Pricing Model cannot always be explained by a portfolio's beta value. Low beta stocks sometimes deliver higher returns than high beta stocks.

Markowitz disagrees. He says he does not assume that the probability distribution is normal. His research shows that mean variance portfolio relationships are a good approximation of the expected value of a portfolio.

"It is not true that I ever assumed probability distributions are normally distributed," he said. "It is another myth that you can't invest in assets (using Modern Portfolio Theory) that are not normally distributed."

For example, he stressed that derivatives, such as stock options, might be optimized in a portfolio to improve risk-adjusted rates of return as long as there is good data on the covariance relationships to other portfolio assets.

It is better to diversify across asset classes as well as within asset classes, he says. Diversifying between asset class portfolios as well as within portfolios is more "efficient" than doing only one of these, or neither. For example, riskier portfolios may contain greater weightings in emerging market and small company stocks, based on investment style. Less risky portfolios might be weighted more toward large capitalization US and foreign stocks, based on investment style, as well as short-term and intermediate-term bonds.

He emphasizes that the shorter the investment horizon, the greater the risk of losses because there is fatter tail risk. But the longer you hold asset classes, the greater the probability the distribution is normal. As a result, two-thirds of the time, returns typically fall between about -10% and +30%.

Markowitz is wary about adding alternative assets, such as private placements, commodities or exchange traded funds, to portfolios. Those assets, he believes, must be properly valued and thus, are best left to people like Warren Buffett and David Swenson of Yale University's endowment fund.

He also won't rely too much on Monte Carlo simulations that show the probabilities of how long someone's money will last. Monte Carlo simulations can scare the general public because investors can see that one out of 20 times, their money might not last as long as they do. On the plus side, however, the simulations often inspire 401(k) defined contribution plan participants to save more for retirement.

Markowitz cautions against "model risk." If you are using a specific type of investment model that makes decisions about how to invest, based on fundamental, economic and/or technical data, the model may ignore or downplay the possibility of large losses that have a one out of 20 or one out of 40 chance of occurring, he said.

It's also important, he said, to properly allocate assets. Investors must identify their risk exposure, based on five dimensions that include the time horizon, liquidity needs, net income, net worth, investing knowledge and attitude toward risk.

"At any point in time, we look back at the past, and make our estimates and decisions for the future," Markowitz said. "The future is always uncertain. We should make our best estimates for 'the next spin of the wheel,' and then choose an appropriate point from the implied risk-return trade-off curve.

"Depending on our risk capacity, perhaps we will select a more cautious portfolio, loaded with lower beta securities or asset classes; or conversely, we will choose a point higher on the frontier, with higher yield, but with higher beta securities or asset classes.

"If the market goes up dramatically, those with high beta portfolios will be happy; if it goes down, they will be sad. You pays your money and you takes your choice!" **$**

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