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A Discussion with Nobel Laureate Harry M. Markowitz, PhD

Best known for his pioneering work in portfolio theory, Harry M. Markowitz is a recognized innovator in the fields of finance, economics, and technology. His efforts during the 1950s in creating what is now known as modern portfolio theory—a statistical method for analyzing investment risk and reward—revolutionized the way investments were viewed and evaluated and continues to influence portfolio management today. In 1990, Dr. Markowitz's work was recognized, along with that of William F. Sharpe and Merton H. Miller, with the Nobel Memorial Prize in Economic Sciences.


Harry M. Markowitz, PhD

Dr. Markowitz earned his undergraduate degree from The University of Chicago in 1947. Although he has stated that becoming an economist was never a childhood dream, Dr. Markowitz chose to specialize in economics while pursuing graduate studies at The University of Chicago, attracted by "the mathematics and rigor" of the field. While still a student, he was invited to become a member of the Cowles Commission for Research in Economics (now known as the Cowles Foundation). For his doctoral dissertation, Dr. Markowitz suggested the possibility of applying mathematical methods to the stock market, which evolved into the basic concepts of portfolio theory. The subject matter was so novel that, while Dr. Markowitz was defending his dissertation, acclaimed economist and University of Chicago professor Milton Friedman argued that Dr. Markowitz should not be awarded a PhD in economics because the dissertation was not in economics. Nevertheless, Dr. Markowitz received his PhD in economics from The University of Chicago in 1955. In 1951, Dr. Markowitz joined the RAND Corporation, where his research focused on optimization techniques such as "sparse matrix" techniques for linear programming. He also developed the critical line algorithm for the identification of optimal mean-variance portfolios on what was later named the Markowitz, or efficient, frontier. In addition to the RAND Corporation, Dr. Markowitz has worked for companies such as General Electric and IBM. In 1962, he and Herbert Karr founded California Analysis Center, Inc. (now known as CACI International) to provide support and training for the Simscript programming language they helped to developed while working at RAND.

During his long career in research, teaching, and consulting, Dr. Markowitz has served in academic posts at numerous universities including Baruch College, London School of Economics, London Business School, University of Tokyo, Rutgers University, Hebrew University, The Wharton School, and University of California at Los Angeles. He was a board member and former president of the American Finance Association. Dr. Markowitz currently serves as president of Harry Markowitz Company, which works to extend and apply portfolio theory, and as chairman of the investment committee at Guided Choice, an investment advisory firm for retirement plan participants.

In addition to numerous articles for professional journals, Dr. Markowitz is the author of *Portfolio Selection: Efficient Diversification of Investments* (1959) and co-editor (with Frank J. Fabozzi) of *The Theory and Practice of Investment Management* (2002). In 1989, he was awarded the John Von Neumann Prize in Operations Research Theory by the Operations Research Society of America for his work on portfolio theory, sparse matrixes, and Simscript. In 1999 *Pensions & Investments* named Dr. Markowitz "Man of the Century" for his life's work in the field of investments. In 2009, IMCA presented the Matthew R. McArthur Award to Dr. Markowitz in recognition of his outstanding commitment and contributions to the profession of investment management consulting and to the advancement of the skills of investment management consulting.

In February 2009, Dr. Markowitz spoke with members of the *Journal of Investment Consulting*'s Editorial Advisory Board about the evolution of portfolio theory, the continued importance of diversification, and his thoughts on the current state of finance and the markets. Joining the discussion were Edward D. Baker III of The Cambridge Strategy, London and San Francisco; Ronald Kahn of Barclays Global Investors, San Francisco; Tony Kao of Promark Global Advisors, New York; and Meir Statman of Santa Clara University, California. This interview is the eighth in the *Journal*'s Masters Series, which presents topical discussions with leading experts and visionaries in finance, economics, and investments.

Ed Baker: Harry, it's nice to talk to you. We've been looking forward to this conversation. Let's start out by asking you about the major factors that shaped your career, helped you evolve your thinking, and contributed to your major achievements.

Harry Markowitz: My first insight into mean-variance portfolio theory happened while I was working toward my

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PhD degree at The University of Chicago. I was reading John Burr Williams' book, *The Theory of Investment Value*.[1] Williams asserts that the value of a stock should be the present value of its future dividends. Where the present value is uncertain, it should be the expected value of future dividends. The thought went through my mind that if you're only interested in the expected value of a security, you must only be interested in the expected value of a portfolio. If you're only interested in the expected value of a portfolio, you maximize that by putting all of your money into whichever security has the greatest expected return. But that didn't make sense, because everybody knows you're not supposed to put all of your eggs into one basket. What Williams' theory was lacking was the impact of risk. I'd also read Wiesenberger's *Investment Companies*,[2] and I saw that investment companies were being paid for diversification. I figured that investors diversified because they were interested in minimizing risk—which I formalized as standard deviation—as well as in earning high expected returns.

So I had two quantities—risk and return—and I was a budding young economist. So I drew a tradeoff curve with expected return on one axis and risk on the other, and thus had the first efficient frontier.[3] At the time I was taking a course in activity analysis at The University of Chicago under Tjalling Koopmans.[4] He distinguished between efficient and inefficient production allocation. I clearly had efficient and inefficient portfolios. Over the course of one afternoon, while reading Williams' book, the basic concepts of efficiency came to me, which I published in my 1952 paper, "Portfolio Selection." This still left the problem of how to compute the efficient frontier, which I worked out and published in 1956. During 1955 and 1956, I spent nine months at the Cowles Foundation.[5] There I thought through the relationship between mean-variance efficiency and the expected utility and personal probability of the theory of rational behavior under uncertainty. By 1959, I had worked out in my mind and put on paper portfolio theory as I viewed it. That was it for me for the time being.

Ed Baker: If you could whittle down your career into one major achievement—I know there are so many—what would you underscore? What makes you feel particularly proud?

Harry Markowitz: I've made contributions in three or four areas of which I'm proud. One is portfolio theory. In the area of linear programming, I developed sparse matrix techniques that are used to solve very huge mathematical optimization equations. In simulation, I created a computer language called Simscript that is still in use.[6] I also have a relationship to behavioral finance in terms of my other 1952 article entitled "Utility of Wealth." There is a recent contribution to the basic problem of the dynamic programming of large systems of which I feel very proud. I'm not one of your one-shot Nobel Laureates who can only work in one field.

Ed Baker: That's a very impressive list. How about your biggest mistake or disappointment? There must have been one along the way that you found educational or valuable.

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Harry Markowitz: My biggest disappointment is that I've never been able to get Simscript II developed as I had planned it, including database entities as well as simulated entities. Mistakes? You make lots of mistakes. I remember my successes and I forget my mistakes.

Ed Baker: That sounds very typical.

Harry Markowitz: It's very behavioral.

Ron Kahn: I'd like to follow up on portfolio theory and ask what you thought the impact of mean-variance analysis might be and how that compares with what you've seen.

Harry Markowitz: At the time I developed the theory, I thought this was something that investors could use. But, at the moment of discovery, I really wasn't thinking about its impact. I had no idea that I would eventually get a Nobel Prize for it. I did think I would get a PhD degree. When I published in 1952, I put forward a proposal I thought people could use, and it never struck me that hundreds of billions of dollars would be invested this way if my idea was taken seriously.

Meir Statman: I don't know if you've seen the January 2009 issue of the *Journal of Financial Planning*, but your name is on the cover page. It's a very short question that asks, "Is Markowitz wrong?" The author of the article says that we know now that diversification is dead. How do you defend yourself?

Harry Markowitz: Usually that's accompanied by a statement that all correlations have gone to one.

Meir Statman: Let me just add that the author says—and you've heard this before, of course—that market timing should be substituted for diversification because there are times when it is obvious that some asset classes are overpriced and you should move out of them. So the article says that strategic asset allocation or diversification is dead and it is time to move on to tactical asset allocation.

Harry Markowitz: It's yet to be shown that anybody has the capability to market time successfully, and it's certainly yet to be shown that billions of dollars worth of pension funds could be successfully market-timed. Let's go back to the basic questions: Do all correlations go to one? Is diversification of no value? The simplest way to describe what's going on would be to pretend as if covariances were subject to the one-factor

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model. Then the return on a security would be its alpha plus its beta times how the underlying factor—let's say the market—does, plus idiosyncratic risk.

Of course, if you take any short period of time when the factor has had an extreme move, then over that short period of time, all of the correlations are indeed very close to one. However, a priori, you have different estimates of the betas for different asset classes. For example, the emerging markets asset class has a higher beta than large-capitalization U.S. equities. In fact, in 2008, emerging markets did move down much more than the Standard & Poor's 500 Stock Composite Index. Now, it is not true that all of the idiosyncratic risks went to zero. It's just that there was a big move in the underlying factor so that, more or less, asset classes and, to a certain extent, stocks moved in proportion to their betas. This swamped their idiosyncratic terms.

If you had put all of your money into one security, like credit default swaps, you could have lost everything. I understand there were municipalities in Australia that put all of their money into credit default swaps—not buying them, but writing them—and they were wiped out. Compare that with a person who put his 401(k) in a 60/40 mix of stocks and bonds. Let's say he had $600,000 in equities and $400,000 in a mix of government and corporate bonds: the $600,000 became $400,000, and the bonds would have stayed at $400,000. So his $1 million became $800,000. He's not happy about that, but he hasn't jumped out of any windows. Certainly putting all of his money into one asset class, or trying to time the market, would have been a foolhardy idea.

Meir Statman: Do you think that mean variance, or really the optimization, is being oversold in the sense that both professors and financial advisors explain it in the language of negative correlations where one asset goes up and the other goes down, rather than in the realistic language of positive correlations where both assets go down but one asset goes down more than the other?

Harry Markowitz: It may be that people say that they can find negatively correlated securities—and perhaps there are some rare negatively correlated securities—but most securities and most asset classes have positive betas. It would be misleading to pretend otherwise.

Meir Statman: So why are people so shocked when both U.S. and international markets go down during the same period? Your explanation is fairly straightforward. Why do people fail to understand it?

Harry Markowitz: That seems to be a behavioral question, so I'd have to ask you for the answer, Meir. It may be that there's a tendency to oversell anything. For example, financial engineers speak of risk control, as if you can control risk, whereas I've never said you can control risk. I say there is a risk–return tradeoff. If you go higher on the frontier, you're exposed to more risk. If you come lower on the frontier, if you want less exposure to risk, you have to be willing to accept less return. It's just part of the mean variance risk–return paradigm that if you stick your neck out and things go badly, you may get your head chopped off.

Ron Kahn: I have a question that's slightly different, but related. When I think of your work on mean-variance optimization, it seems like that was the first time we saw a financial analysis that required more detailed mathematics and computers to perform. You can draw a line—maybe not a straight line—to today, where people are building collateralized debt obligations and very nontransparent investments. Do you see that as a straight line, or perhaps an inevitable path—something that started out fairly simple, but has evolved with many aspects that you wouldn't necessarily have expected?

"So I make a distinction in my mind between, on the one hand, good old-fashioned mean-variance analysis . . . and, on the other hand, these—people would say very sophisticated, but I believe obscure is a better descriptor—analyses, which have been a source of big trouble lately."

Harry Markowitz: I give a talk called "Portfolio Theory versus Financial Engineering, and Their Roles in Financial Crises." It has to do with what I consider fairly straightforward mean-variance analysis—especially supported by a top-down asset-class view that has done reasonably well through these crises, versus analyses that have become very complicated, very obscure, and somehow have encouraged a great deal of leverage. These types of analyses are based on many assumptions. If any one of these fails the whole thing comes tumbling down. So I make a distinction in my mind between, on the one hand, good old-fashioned mean-variance analysis as it has evolved with the Brinson[7] asset class view, Ibbotson[8] data, the use of Monte Carlo simulation[9] to help investors pick out where they should be on the frontier, and so on, and, on the other hand, these—people would say very sophisticated, but I believe obscure is a better descriptor—analyses, which have been a source of big trouble lately.

Ed Baker: How important do you think it is that investors try to understand the time-varying nature of some of these risk relationships? Isn't that really one of the problems with correlations, that is, they do change so much, and what

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you think you might have in terms of diversification in one context differs from what you have in another context? How does one really account for that successfully?

Harry Markowitz: Let me go back to the notion that, ex-ante, you don't know whether you're going to go into a very quiet time or a very wild period. If you look at it in terms of the one-factor model, ex-ante you don't know whether you're going to have a big move in the underlying factor and the idiosyncratic terms are all going to be rather irrelevant, or if you're going to have a small move in the underlying factor and the idiosyncratic moves will be the largest source of variance. During periods when the common factor has large moves, correlations are high. When the common factor has small moves, correlations are low.

Ed Baker: So perhaps one solution to the problem is to always be conservative and force your correlations to be above their historical averages, if it's really the outlier or the ugly periods that you're concerned about?

Harry Markowitz: The simplest way to explain this is in terms of the one-factor model. Shall we be conservative and assume that the average beta is greater than one? I don't think so, because the average beta has to be one. We can up our estimate of the variance of the underlying factor. For example, if you look at the 1930s, the volatility of the market was generally much greater than in the 1950s. While it seems to be very difficult to predict the expected return over the next period, there does seem to be certain persistence in volatility. So it's probably a fair guess that 2009 might be more volatile than the 1950s, but not as volatile as the 1930s. Again, going back to the one-factor model, you should use judgment looking forward, rather than just historical statistics looking backward. It's perfectly reasonable for you to say that, on average, my beta estimates are one and I think my idiosyncratic risks are perhaps right, but my estimate of the volatility of the underlying factor should be greater when I look toward 2009 than it would have been in 2005.

Meir Statman: Is it possible that investment managers and advisors are simply pushed to promise too much? It seems that Ed was saying that we need to be able to forecast the future a bit better, and I think clients are pushing toward that. Shouldn't investment managers push back and tell them that it is impossible?

Harry Markowitz: Let me contrast two different people. One I know well; the other I just saw across the room. The first is Roger Gibson,[10] who served on an advisory board with me. One of the things he does is interview prospective clients three or four times before he accepts them as clients. During these interviews he tries to determine the prospect's comfort with various asset classes. He also tries to determine how a large downdraft in their portfolio would cause them to chicken out of the program. If they seem risk-averse, then he suggests putting in a little more fixed income and a little less equity. I spoke to Roger recently and asked him if his clients were sticking with him, and he said that yes, they were sticking with the program. Some have decided not to rebalance just yet, but they are sticking with the program. So that's an example of a person who tells it as he sees it, and his clients are loyal.

The second person is someone I don't know. My wife and I were dining in a small Italian restaurant, and I could see two women conducting business at a table near the window. The woman who was selling said, "Yes, the program you just chose *will* give you a 10-percent return." I thought to myself, "It's misleading to tell a client that she *will* get a 10-percent return." One of the things William Sharpe does at Financial Engines, and we do at Guided Choice, my 401(k) advisory service client, is Monte Carlo analyses to show investors that there is a probability distribution of what can happen. I think people should be taught that there is no certainty about investment.

Meir Statman: So did you go over to the table, introduce yourself, and say you had something to tell them?

Harry Markowitz: No, but I was tempted.

Ed Baker: Let me go down a slightly different path. Many people are arguing that distributions aren't normal, that tails are fatter than for normal distributions and that we should expect to see these bad events more often. In other words people are just misassessing probabilities. Do you think that's true? If it is, what does that mean for portfolio theory?

Harry Markowitz: Nilufer Usmen and I did a Bayesian analysis of the probability distributions of daily moves in the S&P 500. We found that subjective probabilities should shift very heavily away from a normal, or Gaussian, distribution toward a Student's *t*-distribution[11] with between four and five degrees of freedom, which is very fat-tailed. We did this analysis before October 1987 and submitted the article to a finance journal, but it was rejected. The article subsequently was published in the *Journal of Risk and Uncertainty* (1996), but had it been published before October 19, 1987,[12] we could have said, "We told you so." As far as daily moves go, I believe in black swans.[13] However, if you take 250 trading days or so, i.e., a year's worth, of Student's *t*-distributed random samples, and you add those observations together for a year's worth of return, they become very normal looking. So, I believe in black swans on a daily basis, but not on an annual basis.

For example, people who are leveraged and marked-to-market can get wiped out in a day, whereas look at what happened in 2008. The S&P 500 had a little less than a 2.5-standard deviation downward move. If the distribution was normal, then you would expect a more than two standard deviation downward move to happen with 2.5-percent probability. So once in forty years you would expect a move down of more than two standard deviations. You have to be prepared for those. You shouldn't invest in a way that will wipe you out if there's more than a two standard deviation move. So the answer to your question is yes, I believe in fat tails for the day, but not for the year.

Ron Kahn: You were quoted some time ago talking about the advantages of semivariance over variance. What are your current thoughts about that?

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Harry Markowitz: Well, they're both my children, and I hate to pick among my children. Typically I use mean variance, although if someone said that he wanted to use mean semivariance, I certainly would not try to talk them out of it. The reason I personally use mean variance is twofold: One has to do with the disadvantages of moving away from mean variance, and the other is the disadvantages of staying with mean variance. I'm willing, for practical purposes, to go with the view of von Neumann and Morgenstern[14] and Savage[15] that rational decision-making should consist of maximizing expected utility using probability beliefs where there are not objective probabilities. A paper by Haim Levy and me (1979) addresses mean-variance approximations to expected utility. If your probability distributions are not too spread out, say mostly between a 30-percent loss and a 40-percent gain for the period, then if you know the mean and variance of a return distribution, you can guess very closely what its expected utility is. As long as you're talking about diversified portfolios—and portfolios that are not highly leveraged—then mean-variance approximations are quite good, quite robust. A number of experiments subsequent to ours in 1979 have come up with similar conclusions. I don't see much loss in using mean variance. The problem with moving away from it is that the estimation becomes more complex. For example, with mean variance, all we need to estimate are expected returns, variances and covariances, or—maybe better still—we could use a factor model instead of trying to estimate individual covariances. With semivariance, it's not that way. You can't just use one set of statistics, like semi-covariances, and have a relationship between the semivariance on the portfolio as a whole and this one set of statistics. You have to go through historical distributions or maybe Monte Carlo analysis. I don't come out strongly on either side of this issue, although I do use mean variance myself.

Ron Kahn: My personal thought has always been that if semivariance is half the variance plus something else, then in many cases it's very hard to forecast that something else.

Harry Markowitz: Yes, I would go along with that.

Meir Statman: A central prescription of mean-variance portfolio theory is that one should look at a portfolio as a whole because, if you don't, you might end up with a portfolio below the efficient frontier. However, in your recent work and mine, we've divided the portfolios into mental accounts with no loss of mean-variance efficiency.[16] Can you comment on what you've observed from your own experience about how people think about their portfolios? To what extent do they think about their portfolios as a whole and to what extent as a collection of mental accounts?

Harry Markowitz: It's your observation, Meir—not mine—that they think about their portfolios in terms of mental accounts. There's an article that you can probably cite that says if you go about things properly, you can talk to people in terms of their mental accounts, their aspirations for their mental accounts, and how well you've met those aspirations.[17] Nevertheless, the portfolio as a whole will be near mean-variance efficient. That's the lesson I learned from you, Meir.

Meir Statman: But is there something from your own experience that would suggest people do or do not feel comfortable thinking about their portfolios as a whole? For example, does a question about risk aversion make sense to investors when applied to their overall portfolios, or do you have to ask them about risk aversion in specific mental accounts? That is, do you have to specify whether you are referring to their retirement money or their lottery money?

Harry Markowitz: The way I come at the world, I never see it the way you're verbalizing it. Let's take the way we do it for clients at Guided Choice. We don't just come out and ask them where they want to be on the mean-variance frontier. We make a suggestion, but we allow them to override it and try alternatives. We let them select which of seven risk classes they want, essentially where on the frontier they want to be, and at what rate they want to save. We take into account their company's matching funds, we let them tell us when they want to retire, and so on. Then we do a Monte Carlo analysis to show them what the median is, what the one-third point is, and so on, for the probability distribution of how much they can consume at retirement time. We do not do a questionnaire and tell them how they should invest. We do not ask them about mental accounts and then recommend how they should invest. We show them a probability distribution of what could happen given their decisions, of what it will be like when they retire. We allow them to fiddle with the parameters and choose among probability distributions. Coming at it that way, I never see a mental account. I never saw a mental account until I met you, Meir.

Meir Statman: Doesn't this mean that the language of mean variance is foreign to investors, such that you need to translate it? Are you sure that the translation from mean variance into points in the seven risk classes, as you call them, and the Monte Carlo simulation is indeed the way to go?

Harry Markowitz: You're correct that just showing investors a mean-variance frontier and asking them to choose is foreign to them. What they will do is just go high on the frontier. You have to show them the consequences of their decisions. I lean toward doing Monte Carlo analyses. Again, I go to the experience and practice of Guided Choice, where we've had more opportunity to try out this view, as compared with a firm such as Bellatore, where you and I serve on the investment committee, at which we're trying out the behavioral view. I think some people would prefer one and some the other. The more interesting analysis is a new product called Guided Spending. Previously, I was talking about Guided Savings, a product that helps clients figure out how to save until retirement. Guided Spending also has to do with the rate at which they can spend after retirement. There are assorted decision variables, including how much to annuitize, how fast they can spend, how to invest after retirement, and so on. We simulate a client's time pattern of consumption, or how much

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he can consume at various points in his future retirement life, which is a random variable that depends on how the market performs, among other things. Trying to characterize the most important features of this consumption pattern, after retirement—that is, deciding the best way to characterize and present this information to the users so they can make reasonable decisions—I guess that may be behavioral, although we didn't think of it in terms of mental accounts. I do think that both the mental accounts and the Monte Carlo way of spelling out what your decisions mean to you are worth pursuing.

Ed Baker: Do you think investors are really more loss averse than they might confess to being when you're describing a probability distribution? When we're in a world such as we are now, and losses are rather acute, do you think the pain and regret are much greater than people anticipated?

> "I think if you just simply say that here's the mean and here's the standard deviation and you don't really spell it out somehow, investors will underestimate the pain."

Harry Markowitz: Yes, I've heard from more than one source that when it is explained to investors how much a two standard deviation move is and that they can have even more than a two standard deviation move one year out of forty—I've been told by investment managers and financial advisors who level with their clients about this, that when this happens, the clients are not happy, but they want to stick with the program. I think if you just simply say that here's the mean and here's the standard deviation and you don't really spell it out somehow, investors will underestimate the pain. You have to be conscientious about spelling out what would happen, for example, if the market went down 30 percent or 40 percent and asking if they want a 50/50 mix so their portfolio moves down 15 percent to 20 percent, or do they want to be in 100-percent equities and move down 30 percent to 40 percent, understanding that if they have 50-percent stocks and 50-percent bonds then over twenty or thirty years, they won't do as well as if they were in 100-percent equities. It is an effort to try to make people understand what it means to be exposed to that much standard deviation, but I think investment managers who make that effort are rewarded in the long run in terms of keeping their clients.

Ed Baker: Is there an important message there for financial advisors and consultants who are trying to help individuals put together their portfolios?

Harry Markowitz: Yes, they should look at histograms of the S&P 500 and realize that 2008 was not unique. If I remember correctly 1937, 1932, 1907—those are some of the other years when you had those kinds of moves. You have to educate your clients so that they understand they have to establish a mix of stocks and bonds that they can live with.

Meir Statman: Does this also imply that, at a time like this when people are scared, advisors should try to cheer them up, pointing out that this is an especially bad period, as opposed to back in 1999, when they had to tamp down investors' enthusiasm?

Harry Markowitz: That's certainly true. There are good years, and there are bad years. It's like in the Bible. You have to save during the seven good years so you'll have the money for the seven lean years.

Meir Statman: Should advisors listen to clients' answers about risk tolerance and just take them as they are offered, or should they try to modify the answers depending on the environment? I wouldn't be surprised to find that people are more risk averse in this scary time than they were in 1999 when exuberance reigned.

Harry Markowitz: I think that you behaviorists probably would tell us that, in forming their subjective probabilities, people tend to overweight the recent past. Also, there's this whole business of "if all of my friends are getting rich by putting all of their money in high-tech stocks, I want to get just as rich just as fast as they do." It's certainly true that people become very bullish in bull markets and bearish in bear markets.

Meir Statman: You raise a very important point, which says that people are concerned not just about their own portfolios but also about the portfolios of their friends and neighbors. To what extent does that play a role in the advice that should be given? In good times, people care not just about getting rich but also about getting richer than their friends. So they may feel good about getting rich but bad about not getting as rich as their friends. Is that something you thought of incorporating into a formal model?

Harry Markowitz: Presumably their friends are getting rich in proportion to how fast the market is rising.

Meir Statman: Of course, the friends might have different allocations. If it's 1999, and I have all my money in stocks and the others have a 50/50 mix of stocks and bonds, I'm getting richer faster. That also would mean that the others would have an inclination to follow me in overloading on stocks.

Harry Markowitz: You can do a mean-variance analysis in which risk is not a total variability, but variability as compared with some benchmark. For example, if you have as your mandate to outperform a specific benchmark, say small-cap stocks or large-cap stocks or the Tokyo Price Index, then risk to you is to underperform that benchmark, and you should use tracking error as your measure of risk. Conceivably somebody could try to make a client happy by using tracking error vis-à-vis "the neighbors" as a benchmark. I find that people want to track the market when the market is going up, and

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they want absolute return when the market is going down. I think the best thing for both the advisor and the client in the long run is to try to educate the client that there are good times and bad times. Just because there are good times now does not mean there will be good times forever.

Ed Baker: Should people be using hedging strategies more than they do? In general, what's your opinion about derivatives and their role in the investment process?

Harry Markowitz: One of the results of Black-Scholes (1973) is that puts and calls are redundant, that you could do the same thing by shifting back and forth between cash and a security. That was the idea behind portfolio insurance,[18] which was popular until October 1987. In that, you're essentially moving up and down the frontier, with the aim of trying to guarantee that you could not lose more than a certain amount. There are two problems with that. One, let's suppose that you have a portfolio strategy where, depending on anything, you spend half the time in cash and half the time in stock. On average you are 50/50. Compare that with a strategy where you periodically rebalance to a 50/50 mixture. It can be shown that the expected return for a given level of variance is less with this going back and forth and back and forth than just rebalancing to the 50/50 point. I used to consult for a man named Richard Brignoli.[19] Before 1987, Richard would debate Mark Rubinstein of Leland O'Brien Rubinstein Associates about the wisdom of their portfolio insurance strategy. One argument against it was that you have greater expected utility, or greater geometric mean for a given variance, if you just rebalance to a certain point rather than go back and forth. The other argument was that it was causing positive feedback that would eventually wreck the market.

As far as puts and calls go, I was in the convertible arbitrage business for three years, and I made a modest but rather steady return for my clients. You could make a decent return when things were properly priced. If you're writing covered calls and you get a decent return on your money, that can juice up the return on your portfolio. If you're buying calls and the guy on the other side is making money, then on average you're losing money. Buying calls is a way to borrow and leverage and satisfy a desire to have a small chance at a very large gain, because your utility function is like that. But on the average, over the long run, that's not going to make you money. The problem is that it's very hard to value puts and calls. You need a computer and a model, and if you buy them at the wrong time at the wrong price, on average you're going to lose.

Meir Statman: What about a product like an immediate annuity, where you put in $100,000 and you receive a promise of getting, say, $8,000 a year for life, however long you live?

Harry Markowitz: You are insuring against your longevity. That seems a reasonable bet. It's very hard to evaluate the combination of annuities, fixed income, equities, and consumption rate (as a function of how well the market is doing) that is best for you. I can't do it, but with Monte Carlo I can help. Immediate annuities certainly should be considered as part of your spending strategy post-retirement.

Meir Statman: So this has the characteristics of a structured product with characteristics resembling a put option?

Harry Markowitz: Well, it's a life insurance policy, but it's not one that pays off if you die. It's one that pays off if you live. Since one of your concerns is to not become a bag-lady before you die, it's certainly a reasonable thing to consider for your portfolio. That's different than wondering if you should be buying puts on your portfolio.

Meir Statman: But why not buy a put? Let's say you have a 60/40 portfolio. Why not buy puts on the equity portion of your portfolio?

Harry Markowitz: That's certainly a possibility. However, if the puts are overpriced, you'd be better off just going with a 50/50 or a 40/60 mix.

Ed Baker: Certainly, though, there are costs of transacting to get there, so that one always has to trade off one set of costs relative to another, which is another somewhat tricky thing to do.

Harry Markowitz: There are costs to turning over the puts, and there are costs to moving once from the 60/40 mix to the 40/60 mix. So if you're going to be at that 40/60 mix for a long time, you can, perhaps gradually, move toward the place on the frontier where you feel more comfortable. If the market falls, and the value of your portfolio goes down, then maybe again you want to shift down the frontier, just because now the motivation of protecting yourself from further declines outweighs the motivation of having returns over the long run. Again, it depends on prices.

Meir Statman: When we spoke with Eugene Fama,[20] we asked him about the state of finance. He suggested that the peak in our sense that we had it all figured out was sometime around 1975, when we had portfolio theory, a capital asset pricing model (CAPM) that seemed to work, and market efficiency. Nowadays, he said, we have an empirical asset pricing model that we don't really fully understand. How would you assess the state of finance?

Harry Markowitz: I would say that the highlight, the peak of our understanding—and I'm being only slightly facetious—was somewhere around March 1959…. Now, you know I don't really believe that. Let's distinguish between portfolio theory as advice to a single individual investor or institutional investor and the capital asset pricing model or the Black-Scholes model as hypotheses about the world. So we have Markowitz (1959) versus Sharpe (1964). In the area of more recent developments in portfolio theory as applied to one investor, we have the notion of asset classes, top-down strategy, and Ibbotson data. There's certainly been a filling out of the Markowitz view by many other people besides Markowitz. That's one train of thought. The other is the Sharpe-Lintner-Mossin Capital Asset Pricing Model,[21] which became the Black-Scholes model in continuous time. Those have had two different histories. With the CAPM, if it were true, expected returns would be a linear function of

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betas. Fama-French (1993) says those returns are functions of everything except betas—well, a couple of things other than betas. The more sophisticated calculations that have been based on Black-Scholes have become increasingly obscure and troublesome.

Meir Statman: What you described can be called 'micro,' while I'm referring to the 'macro.' I find myself shocked and embarrassed, quite frankly, when people ask me if I, as a professor of finance, couldn't see what was coming, or whether I understood the systemic risks that we are facing. My own confidence in my ability to understand the world and explain it—let alone predict it—has gone down. How do you feel about this?

Harry Markowitz: As I've said over the years, once a year nature pulls a random variable from a bushel basket labeled S&P 500, and—as a rough working hypothesis—that bushel basket has been the same since 1926, the start date for Ibbotson's data, or since 1900, the point where Elroy Dimson (2002) went back and collected data. The draw that we got for 2008 was not any worse than draws we got before. It wasn't that many standard deviations away.

Meir Statman: I'm not just talking about returns. I'm talking about a financial crisis way beyond returns, about investment banks collapsing, about markets freezing, about a global recession. Is this something that financial economists should be able to explain as a physician explains heart bypass surgery? I find myself dumbfounded by it. Am I the only one who is dumbfounded?

Harry Markowitz: I certainly did not anticipate—well, actually I did anticipate somewhat. When the collapse of a couple of Bear Stearns hedge funds revealed the tip of the iceberg in July 2007, I moved out of my Standard and Poor's Depositary Receipts (SPDRs) and other exchange-traded funds (ETFs). I didn't get rid of equities completely because I had College Retirement Equities Fund (CREF). I put the money from that move into a money market account. That wasn't because I predicted the markets would go down; it was just because my uncertainty went up. I didn't predict 2008, but my subjective estimate of the volatility of the underlying factor went up. Then, when the Federal Reserve began a series of interest rate cuts in September 2007, I took the money and put it into a commodity ETF. By sheer dumb luck, I took that money out at the height of the commodity bubble and bought a condo overlooking San Diego harbor whose price has held up. I usually say to forget about market timing but this time it turned out well.

As to the source of the current crisis, my view is that derivative securities have become so obscure that nobody knows the direct and indirect exposure of any piece of paper. My article in the January–February 2009 *Financial Analysts Journal* identifies two sources of the present crisis. Since I didn't see the crisis coming, this is all in retrospect. The first source is one that the *Wall Street Journal* pounded on over and over and over through the years, and that was the

"By sheer dumb luck, I took that money out at the height of the commodity bubble and bought a condo overlooking San Diego harbor whose price has held up. I usually say to forget about market timing but this time it turned out well."

insistence of Congress that the Federal National Mortgage Association (Fannie Mae) finance low-cost housing, come hell or high water. The *Journal* warned that this was a danger to the banking system, and it was. Now Barney Frank[22] is trying to find out who did it. Some day he should look in the mirror and say: "Oh, it was me. Sorry about that." The most decisive thing I say in the *FAJ* article is that Congress and President Obama should decide that when it comes to banking safety versus the financing of low-cost housing, banking safety should come first. The most dramatic way to do that would be to repeal the Community Reinvestment Act[23]—period—bang!

The second source, as I said earlier, is the fact that nobody knows the direct and indirect exposure to subprime loans of these pieces of paper. I have a proposal for how the government could spend a relatively small amount—a few million dollars now as opposed to billions of dollars eventually—to determine this exposure by doing a survey and analysis. The survey would have to be mandated by the federal government; that is, everyone must disclose what pieces of paper they hold and the rules for them. Then, with some analysis, we could figure out the direct and indirect exposures. It seems that, with a little research, one could greatly clarify the current situation. I think that would be a good expenditure of money.

Ed Baker: In an answer to a previous question, you talked at length about the high points in the history of financial market theory and investment theory. What do you think might happen in the future? Have all of the great and/or useful ideas already been discovered and played out, or is there something new that you think could come in the future?

Harry Markowitz: I don't see much hope in our actually being able to develop financial models that can predict future market moves very well. Hopefully we can develop financial models that will help us understand what is going on, but not to the point where we can say that this stock will go up and that asset class will go down. Naturally the areas where I expect progress are the areas where I'm working, because obviously I wouldn't work in areas where I don't expect progress. Let me tell you about two areas that I think can be

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of value. First, one of the problems on the portfolio management side is what to do about illiquid assets and changing probability distributions. If assets are perfectly liquid, it's easier to figure out the optimum move to make now, because we don't have to worry about potentially incurring more costs than it was worth if we move now and then want to move back. There's a paper by Erik Van Dijk and myself (2003), and a more recent one by Kritzman, Myrgren, and Page (2009) that have heuristics for how to handle this that seem to work out very well. The problem of illiquidity and changing probability distributions always has been a sticky one for portfolio management, and I think we have a handle on it. The second area I'm working on is the problem that our models—our hypotheses about the world—tend to be very simplistic. Economists' models tend to consist of a few equations and a few unknowns, and that's supposed to model the world. I think there should be more use of asynchronous, discrete-event simulation models of financial markets. A couple of colleagues—Bruce Jacobs and Ken Levy—and I have done some work about that, some of which we have already published, and there's a forthcoming book where we show our experimentation with asynchronous discrete-event simulation of financial markets. I think those are two areas where we should see progress.

Ed Baker: What sort of applications do you see for that latter area?

Harry Markowitz: There are at least two kinds of applications: One has to do with government policies, for example, does the uptick rule[24] help markets. The second has to do with investment policies and trading strategies. For example, when should one use market versus limit orders. Such asynchronous simulation is used, for example, in manufacturing simulations, where the world is too complicated to figure out analytically, as well as in transportation and computer simulations and war games. The financial markets are certainly at least as complicated as a war game, and I think we could use these techniques as well.

Ed Baker: Those are certainly very interesting ideas.

Harry Markowitz: Now here's one question I was waiting for you to ask me. In Jason Zweig's book, *Your Money and Your Brain*, I'm quoted as saying that I split my retirement money 50/50 between stocks and bonds. Just to clarify, that is what I did in 1952, when the RAND Corporation asked how I wanted to split my contributions between TIAA and CREF. Like most people, I split it 50/50. Now I don't do that. I've seen many efficient frontiers, and I know typically people like me are higher on the frontier. I am older than I was in 1952, but I'm also a little wealthier now, so I'm willing to go up the frontier. I split my money among asset classes, like efficient portfolios I have seen. I know I should overweight small-cap stocks as compared with large-caps and perhaps overweight emerging markets as compared with more established international markets and then get a comfortable balance between stocks and bonds.

Meir Statman: The second half of Jason Zweig's story is that you did what you did in 1952 because you were anticipating the regret that you would feel if one of the funds went up and it was not the one you had chosen. Does regret play a role in your portfolio when you construct it now?

Harry Markowitz: The question is, how do you pick a point off the efficient frontier? We do invest in a large number of municipal bonds, which provide enough money so that we can just live. I don't know whether that makes our portfolio on the frontier or off the frontier. Meir, you caught me red-handed—I guess I'm just behavioral. I tell myself that if worse comes to worst, we can live.

Meir Statman: You've been wise before, and you're wise now.

Ed Baker: I'm impressed also that a lot of your conclusions seem to be judgmental and reasoned, rather than purely based on running an optimization.

Harry Markowitz: It's a back-and-forth process. For example, one of the things everybody does in using an optimizer is put in constraints, and they'll say: "Well, we don't necessarily believe that input. We've tried very hard, but if the answer comes out more than 10-percent emerging markets, don't buy it. Put in a constraint." So there is a back-and-forth between intuition and calculation. I have absolutely no idea to what extent someone who is not quite as comfortably fixed as I am ought to put money into annuities and where they ought to be on the frontier and how fast they can consume. I think that Monte Carlo analyses really add to your intuition. If they don't add to your intuition, then they are of no value.

Ed Baker: That's a very important message for our readers to take away. It was also interesting to hear your perspective on how you actually build your own portfolio. We knew it wasn't just 50/50 based on what you did in 2008.

Harry Markowitz: That brings to mind another question that I've often been asked: Isn't equal weighting better? There's a standard answer to that. Suppose somebody is given the choice of stocks versus bonds, then equal weighting would be 50/50. Now suppose somebody is given the choice among large cap, small cap, EAFE, emerging markets, and bonds. Then equal-weighted would be an allocation of 20 percent to each of those, so that ends up being 80-percent equities and 20-percent bonds. Which is right? I think if you push it, equal weighting doesn't work.

Ed Baker: Thank you, Harry. It's been a very interesting interview, and we really appreciate your time.

Harry Markowitz: It's been a lot of fun. JIC

Endnotes

1 John Burr Williams (1899–1989), a pioneer in fundamental equity analysis, is best known for his 1938 book *The Theory of Investment Value*. This book, which was based on Williams' Harvard doctoral thesis on intrinsic value, was among the first to delineate the theory of dividend-based valuation.

2 *Investment Companies* (now issued as *Investment Companies Yearbook*), an annual compendium of information on investment

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companies and mutual funds, has been published by Wiesenberger Financial Services since 1944.

[3] The efficient frontier, which was first defined by Dr. Markowitz in his 1952 paper that launched portfolio theory, examines a universe of potential asset combinations and the expected risk and return for each mix. The efficient frontier is a collection of such portfolios, each of which represents the highest return for a given level of risk. This group forms a convex line in a plot of the portfolios' returns versus their risks, graphically depicting the efficient frontier.

[4] Tjalling C. Koopmans (1910–1985) was awarded the Nobel Memorial Prize in Economic Sciences in 1975 for his work in resource allocation, specifically the theory of optimal use of resources. This work focused on activity analysis, the study of interactions between the inputs and outputs of production, and their relationship to economic efficiency and prices.

[5] The Cowles Foundation for Research in Economics, founded in 1932, was established to foster the development and application of rigorous logical, mathematical, and statistical methods of analysis. The foundation was based at The University of Chicago from 1939 to 1955, when it moved to Yale University, its current home.

[6] Simscript, perhaps the first simulation programming language, was developed by Dr. Markowitz, Bernard Hauser, and Herb Karr at RAND Corporation in 1962.

[7] A study of major pension funds by Brinson et al. (1986) concluded that asset allocation accounted for more than 90 percent of the variation in a portfolio's quarterly returns, leading to increased focus on allocation among asset classes as the most important consideration in portfolio construction.

[8] Roger Ibbotson, professor of finance at the Yale School of Management, together with Rex Sinquefield, authored *Stocks, Bonds, Bills, and Inflation*, which serves as a standard reference for information on investment market returns dating back to 1926.

[9] A Monte Carlo analysis is a sampling method that uses random numbers and probability to compute results, often used when a model is complex, nonlinear, or involves more than a few uncertain parameters. Monte Carlo simulations use inputs randomly generated from probability distributions to simulate the process of sampling from an actual population. The term is a reference to the games of chance popular in Monte Carlo.

[10] Roger C. Gibson is founder and chief investment officer of Gibson Capital Management and author of *Asset Allocation: Balancing Financial Risk*.

[11] In probability and statistics, Student's *t*-distribution is a probability distribution that occurs in estimating the mean of a normally distributed population when the sample size is small. It forms the basis for Student's *t*-tests for the statistical significance of the difference between two sample means and for confidence intervals for the difference between two population means.

[12] On October 19, 1987, or Black Monday, stock markets around the world plummeted and the Dow Jones Industrial Average lost 22.6 percent, which remains the largest one-day percentage decline in U.S. stock market history. Potential causes of the crash—including program trading, overvaluation, illiquidity, market psychology, foreign exchange, and inflation—continue to be debated.

[13] The black swan theory describes rare, unpredictable, and high-impact events. In his 2007 book *The Black Swan: The Impact of the Highly Improbable*, Nassim Nicholas Taleb applied the term to events such as the rise of the Internet and the September 11, 2001, attacks on the United States. He also argued that banks and brokerage firms were very exposed to black swan events and major losses. The term comes from the fact that it was commonly assumed that all swans were white until black swans were discovered in Australia in the seventeenth century.

[14] John von Neumann (1903–1957) and Oskar Morgenstern (1902–1977) authored *Theory of Games and Economic Behavior* (1944), which, in addition to creating the field of game theory, introduced important concepts such as utility theory and choice under uncertainty.

[15] Leonard J. Savage (1917–1971) was an American mathematician and statistician whose 1954 book *Foundations of Statistics* proposed a theory of subjective and personal probability and statistics that forms a basis for Bayesian statistics.

[16] Mental accounting is a term used to describe a framework in which people think of their overall portfolios in terms of a number of nonfungible mental accounts such as current income, current wealth, and future income or, more practically, entertainment, household bills, charity, etc. This framework has behavioral implications for investing and spending, because an individual's attitude toward risk may vary according to the type of account.

[17] See Das et al., Portfolio Optimization with Mental Accounts, forthcoming in the *Journal of Financial and Quantitative Analysis*.

[18] Portfolio insurance involves hedging an equity portfolio against market risk by selling equity index futures short or buying equity index put options. This strategy was developed by University of California/Berkeley academics Mark Rubinstein and Hayne Leland and marketed by Leland O'Brien Rubinstein Associates.

[19] Richard Brignoli of Brignoli Models Inc. was one of the pension industry's earliest users of derivatives.

[20] See "Ideas That Changed the Theory and Practice of Investing: A Conversation with Eugene F. Fama, Ph.D.," *Journal of Investment Consulting* 9, no. 1 (fall 2008): 6–14.

[21] Working independently, William F. Sharpe, John Lintner, and Jan Mossin developed a theoretical equilibrium model of market prices called the capital asset pricing model in the mid-1960s.

[22] U.S. Representative Barney Frank (D-Mass.) has served as chairman of the House Financial Services Committee since 2007.

[23] The Community Reinvestment Act was enacted in 1977 to encourage financial institutions to help meet the credit and borrowing needs of the communities in which they operate, including low-income and moderate-income neighborhoods.

[24] The uptick rule, introduced in the Securities Exchange Act of 1934 as rule 10a-1, was designed to regulate short selling in the financial markets by preventing short sellers from contributing to the downward momentum of a stock already in sharp decline. The rule required all short-sell transactions to be entered at a higher price than the previous trade. The SEC eliminated the uptick rule in July 2007 but may consider proposing a new version of the uptick rule as a step to help stabilize financial markets.

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