Dimensional

PERSPECTIVES

Celebrating Groundbreaking Research with Giants of Finance: Robert C. Merton

Savina Rizova, PhD
Global Head of Research

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KEY TAKEAWAYS

- This year marks the anniversaries of research that laid the foundation for a new way to invest.
- Merton's Intertemporal Capital Asset Pricing Model (ICAPM) (1973), the Fama/French three-factor model (1993), and Novy-Marx's profitability research (2013) underpin Dimensional strategies.
- In our first conversation, Bob Merton discusses ICAPM, which provided the theoretical framework for multifactor investing.

How many investors appreciate the role financial science has had in the way we invest today? Before financial science emerged in the middle of the 20th century, there was only one way of investing—the traditional active way. People would research individual stocks and bonds and buy a few that they thought were underpriced.

That changed when Harry Markowitz, a PhD candidate at the University of Chicago, introduced the idea of Modern Portfolio Theory in his 1952 paper "Portfolio Selection." This theoretical paper suggests the steps an investor can take to build a portfolio that balances efficiently the tradeoff between expected return and volatility. It was the first big breakthrough in financial science and is still taught today as one of the cornerstones of financial theory. Markowitz later became a Nobel laureate for this work.

Traditional active stock picking, however, remained about the only investment approach until the early 1970s, when indexing emerged. This new approach offered broad diversification, low cost, and transparency by holding all securities in a market index. These characteristics appealed to investors who were familiar with the research of Michael Jensen, another PhD student at Chicago, who in 1968 illustrated how few fund managers outperformed the market, especially after their fees and costs were deducted.

The year 2023 marks the anniversaries of several other breakthroughs in financial science, which launched a third way of investing—factor investing—that combines the low cost, transparency, and diversification of index investing with a systematic pursuit of higher expected returns:

- Fifty years since the publication of Robert C. Merton's Intertemporal Capital Asset Pricing Model (ICAPM), which provided the theoretical framework for multifactor investing.
- Thirty years since the development of the three-factor model of Eugene Fama and Kenneth R. French, which paved the way for the implementation of multifactor systematic investing.
- Ten years since the publication of the profitability research of Robert Novy-Marx, which added the profitability premium to the ranks of size and value as an important long-term driver of expected stock returns.

These three milestones have truly changed the way we invest. They have opened the door for investment strategies that pursue higher expected returns in a systematic, diversified, and low-cost manner. When combined with a sound, lifelong financial plan and the patience and discipline to stick to it, such strategies can transform people's long-term investment outcomes.

As a firm at the frontier of financial science, Dimensional has been a pioneer and a leader in multifactor investing, transforming this rigorous theoretical and empirical research into value-added, systematic investment solutions. We launched our first value funds in 1993—a dozen years after our founding—and started incorporating profitability systematically in 2013.[1]

In honor of these 50-, 30-, and 10-year anniversaries, I had the great fortune to interview the pioneers themselves on their findings. In this series of three articles, I asked Bob, Ken, Gene, and Robert about the impact and continuing relevance of their groundbreaking work.

You might wonder how I managed to get ahold of all those luminaries. All four financial economists have close ties with Dimensional. Bob Merton is our Resident Scientist. Ken and Gene are consultants to Dimensional, as well as board members and shareholders. Robert Novy-Marx is also a longtime consultant to the firm. All of them also sit on our Investment Research Committee. As Global Head of Research at Dimensional and Co-Chair of the Investment Research Committee (along with Ken), I feel privileged to work closely with these brilliant minds on many innovative research and implementation projects.

My first conversation was with Nobel laureate Bob Merton.

50 YEARS OF THE INTERTEMPORAL CAPITAL ASSET PRICING MODEL

In 1973, Merton, an academic at the Massachusetts Institute of Technology and future Nobel laureate, published a theoretical paper that opened the door to a third way of investing, one that offered some of the benefits of both active investing and indexing (then still in its infancy): multifactor systematic investing. The paper showed that investors generally demand compensation not only for holding assets that expose them to market risk but also for assets that expose them to other sources of systematic risk. Since the paper was theoretical and did not pinpoint what those other sources of risk were, it would be a while before multifactor investing took off and became a trillion-dollar industry.

A decade earlier, among the key breakthroughs in financial science in the 1960s was the Capital Asset Pricing Model, or CAPM, developed by William F. Sharpe, John Lintner, and others. It provided us with a framework for how to think about asset allocation and about expected returns. It said that, in equilibrium, all investors should hold some combination of the market portfolio and a risk-free asset. The model also implied that expected return on any investment is driven solely by its exposure to systematic market risk.

Savina Rizova

: Bob, how did the Intertemporal Capital Asset Pricing Model, or ICAPM, change the CAPM framework?

Bob Merton

: The ICAPM reflects that investors can revise their portfolios periodically during their overall planning horizon, and so they not only care about current investment conditions but future ones as well. Consequently, investors face additional systematic [nondiversifiable] risks caused by stochastic [unpredictable] changes in the future investment opportunity set, including interest rates, expected returns, and volatilities not reflected in the one-period CAPM.

Savina

: So there might be unfavorable shifts in the future investment opportunity set, and long-term investors would demand compensation for assets that expose them to those additional sources of risk?

Bob

: Yes, and as a result, instead of an asset allocation with only one risky portfolio [in equilibrium, the market portfolio], the optimal portfolio for each investor can be expressed as an asset allocation among the market portfolio and “hedging” portfolios for the nondiversifiable risks of investment opportunity set changes—collectively, the “factors.”

Savina

: By taking a long-term perspective, the ICAPM transformed the single dimension of risk in the original CAPM into multiple dimensions. So the straight line between risk and return in the CAPM, known as the Security Market Line, becomes the Security Market Hyperplane in your model. What is the significance of this?

Bob

: The CAPM Security Market Line that expresses each asset’s equilibrium expected excess return as proportional to its beta with respect to a single factor, the market, is replaced in the ICAPM by the Security Market Hyperplane, in which each asset's expected excess return equals the sum of its (multiple-regression) beta with respect to each factor times the expected excess return on that factor, creating multiple risk dimensions that cause differences in equilibrium expected returns across securities.

Savina

: Back in 1973, the CAPM said that there was only one driver of differences in expected returns: the market factor. Your theory suggested there should be more factors. And this is because investors worry not only about today's investment opportunities but also about those in the future. When you developed your multifactor theory, did you expect that it would lead to a proliferation of factors?

Bob

: Yes, because once it is demonstrated that investors will optimally hold different risky portfolios, the equilibrium market-cap-weighted portfolio will no longer be mean-variance efficient; the CAPM will thus fail, and therefore, "alphas" will exist relative to that benchmark, even in a frictionless perfect-market, informationally efficient equilibrium world.

I anticipated that just as the ICAPM generalized the CAPM, opening the door to a richer set of financial science developments, so the ICAPM demonstration that differences in optimal risky asset allocation were not exclusively the result of market "mispricing" would stimulate finance practice to materially expand factor strategies and products offered, even for those investors who believe in market informational efficiency.

Savina

: The result of the competition to find new factors has led to more than 400 being proposed and this collection of work being described as a "factor zoo." This proliferation of ideas is not necessarily helpful to investors and could be motivated by things other than the pure pursuit of scientific reason. What's your take on that?

Bob

: I did not envision the large size of the factor "zoo" as it has evolved. I had thought the practical search for the additional dimensions of risk premiums beyond total-market risk would be guided by theoretical specifications, such as stochastic changes in the investment opportunity set—interest rates, volatilities, and expected returns—in much the same spirit as the CAPM theory identified a cap-weighted market portfolio as the benchmark portfolio to be tested.

Instead of such structural specifications, risk-premium factor identification has evolved primarily as a reduced-form empirical process, exemplified by the ubiquitous classic Fama-French three-factor model. In the absence of a priori structural constraints on factor choices, the number of candidate factors that can produce seemingly statistically significant risk premiums from the data is predictably much larger.

Savina

: Where do you see financial science and investing evolving?

Bob

: It is always a challenge to forecast the future, and just so for the directions of financial science and practice, since the arrival of new breakthrough discoveries are rarely predictable. Nevertheless, I mention a few: There are only three ways to manage risk: diversification, hedging (risk-free asset), and insuring (options). Currently the bulk of both retail and institutional investing relies principally on the first two. I believe that goal-based investing—the customization/tailoring of products and strategies to better serve customer-specific objectives—will be a major trend in improving performance. Options have a particularly important role to play in implementing goal-based investing. Improving risk-forecasting using information extraction from the expanding number of markets, particularly derivative markets, and lowering of dynamic trading costs to use those markets, will improve performance through better control of realized volatility.

Savina

: What might be needed to make this type of innovation broadly adopted?

Bob

: I hope to see a trend in financial-service products which follow the philosophy that the product design should be based on what its users already know. Thus, to use it does not require further financial education. This is already a competitive requirement in automobile and mobile phone designs. It absolutely can be done in financial services as well.

Whatever the future brings in terms of challenges and opportunities, I am confident that financial science will play a significant part in their solution.

1. Dimensional Fund Advisors LP launched 41 years ago.

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