BY FATIMAH KHAN

The Birth of Modern Finance

New ideas developed in the second half of the 20th century built the financial world around us and remain impactful today

Since the 1950s, a series of theories and models have come to largely define financial and investment practices, transforming a trial-and-error practice into a quantitative academic field. Collectively, these innovations have become known as modern financial theory. If you have ever invested in an index fund or diversified your portfolio, as is the case for many Americans, you have benefited from modern financial theory.

These investment vehicles are often used as part of a passive investment strategy, wherein one buys and holds a diversified mix of assets, usually including both bonds and stocks, over a long period of time with the goal of approximating the average market return. This is a common way to invest savings for retirement and contrasts with active investment, which involves the more frequent purchase and sale of individual securities in pursuit of arbitrage opportunities. A 2021 Gallup survey of U.S. investors found that 71 percent preferred passive investment strategies over active ones to "maximize returns over the long term." In many ways, modern financial theory laid the groundwork for such vehicles and passive strategies through frameworks for portfolio optimization, asset pricing, greater understanding of risk, and pricing options. How did these theories, which are so influential today, come about?

As the world rebuilt and recovered after World War II, private markets in the United States experienced a revitalization. Households, who had been saving diligently to support the war effort by purchasing Treasury war bonds, and institutional investors, such as pension funds, demanded new investment opportunities. At the same time, businesses rebuilding in the booming peace economy needed an influx of capital to expand, make investments, and meet consumer demand. This confluence of factors and the resulting market activity led to questions around how best to navigate both corporate and consumer finance. The consensus among investors at the time was that hiring investment advisors was a reasonably sure way to guarantee high returns. However, those advisors typically didn't rely on scientific processes and models, but rather used rules of thumb to make decisions and manage the needs of their clients. As corporate treasurers and investment managers alike tried to improve their returns, a series of new and innovative economic and financial theories began to take shape.

Perry Mehrling, a historian of financial and economic theory at Boston University, explains that "usually, financial practice comes first, trying to solve a problem," followed by theoretical innovation that aims to improve upon current techniques. When questions outside the scope of existing frameworks arise, new ideas are born of necessity. Mehrling says there were two main questions in this period: How to manage consumer investment, and how to manage corporate finance. Answering these questions would lead to the development of economic and financial theories with far-reaching ramifications.

RISK AND REWARD

In 1952, Harry Markowitz, then a Ph.D. economics student at the University of Chicago, published "Portfolio Selection" in the *Journal of Finance*. Recognizing a gap in current financial theory, he proposed the inclusion of risk in the mathematical analysis of stock prices. His modern portfolio theory (MPT) codified the relationship between risk and return; specifically, that investing in high-risk assets can beget higher returns (or large losses), while investing in low-risk assets produces lower returns. Markowitz proposed an efficient frontier, which defined the most efficient trade-off between risk and reward for investors with any level of risk appetite. Under Markowitz's theory, investors could choose the combination of expected return and risk they desired and allocate their investments to meet those specifications. Markowitz also theorized that the diversification of a portfolio often leads to the most efficient balancing of risk with reward. Markowitz's MPT helped to answer questions surrounding consumer portfolio management and remains highly influential today. The theory allowed for the development of more precise investment strategies to balance portfolio risk across asset classes and reap long-term returns.

As Markowitz's theory provided a scientific foundation for individual investment and consumer portfolio management, Franco Modigliani and Merton Miller, then professors of economics at Carnegie Mellon University, proposed a theory to inform corporate financial decision-making. They recognized shortcomings in current models and developed a standardized method to evaluate the cost of capital under uncertainty. Simply put, how should business owners decide how and whether to finance a new project?

The initial Modigliani-Miller theorem published in 1958 asserted that the capital structure (debt and equity

issued) or financing strategy does not impact the market value of a firm, which is the present value of its future earnings and assets. It also stated that a firm's cost of equity is dependent on and proportional to its leverage ratio; in other words, if a firm is highly leveraged with debt, investors will require a higher return on equity to compensate for the higher risk.

However, as is often the case with economic models, the assumptions underlying this theorem — costless transactions, lack of taxes, and equivalent borrowing rates for firms and individuals — don't reflect the real world. So, in 1963, Modigliani and Miller revised their theorem to account for such limitations. They posited that leveraged firms benefit from debt financing because, unlike dividend payments, interest payments are tax deductible in the United States and lead to a higher firm value. Under this amended theory, the cost of equity remains proportional to leverage, but the weighted average cost of capital decreases as the level of debt financing used increases. Therefore, the optimal capital structure would consist of entirely debt financing. This evolution shows how reevaluating the underlying assumptions of a model can strengthen its conclusions and implications. Under the initial assumptions, a firm's capital structure was irrelevant, but it becomes relevant under the more realistic assumptions of the revised theorem.

In 1964, William Sharpe, then at the University of Washington, developed the capital asset pricing model (CAPM), furthering the new marriage of mathematical modeling and economic theory with the practice of investing by incorporating systematic risk into asset pricing models. The model proposed that, at market equilibrium, prices will adjust to generate a linear relationship between an asset's return and systematic risk, which cannot be avoided through diversification, unlike other types of risk. This systematic risk is shared throughout the market and entire economic system, referred to by Sharpe as correlation to "swings in economic activity" and known today as business-cycle risk. Sharpe's idea was consistent with existing investment wisdom and built upon Markowitz's framework. In fact, Sharpe was influenced by Markowitz's theories after the two met while conducting research at the RAND Corporation in the late 1950s, and Markowitz served as a pseudo-doctoral advisor for Sharpe during his Ph.D.

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The CAPM gave rise to "beta" — a widely used measure of an asset's volatility and correlation with the market portfolio. The model is used by businesses to evaluate opportunities for investment, capital costs, and asset pricing and, alongside the MPT, continues to inform retail investors today.

"CAPM tells households, 'You don't want to be picking stocks, you want to hold and harvest the market portfolio,'" explains Mehrling. Portfolio asset diversification — balancing the higher risk and the higher reward of investing in stocks with the safety of investing in bonds based on an individual's risk profile — has become the go-to method of minimizing one's risk and maximizing return.

THE RIGHT PRICE

As a student at Tufts University in the late 1950s, Eugene Fama assisted a professor with stock market predictions, formulating rules for projecting future performance and making investment decisions. At the time, technical analysis — predicting future market movement by analyzing historical data — and fundamental analysis — estimating a firm's intrinsic value by evaluating its earnings, balance sheet, cash flow, dividends, growth opportunities, and returns — were prominent prediction methods. However, Fama found that the predictions based on past performance didn't hold up when tested on out-of-sample data, and stock market returns appeared to be unpredictable. This curiosity led to his development of one of the most influential theorems in modern finance.

The efficient markets hypothesis (EMH) posits that, if a market has a free flow of information, costless transactions, and many rational, intelligent actors aiming to predict future prices and firm values, the current price of a security will reflect all available information as well as the intrinsic value of a firm. In essence, in an efficient market, security prices will be "correct."

The three versions of the EMH — weak, semi-strong, and strong — reflect variations in exactly how much information is manifested in market prices. The weak version of the EMH states that all past pricing data is factored into current prices, so technical analysis of historical data will not result in arbitrage opportunities. Fundamental analysis does not inherently contradict the weak version of the EMH. In fact, analysts who identify and act on price discrepancies between market price and intrinsic value contribute to a more efficient market and more accurate prices. Thus, a talented analyst might theoretically be able to outperform the returns from a buy-and-hold strategy. However, given the sophistication needed to achieve this level of analysis in a rapidly changing market, fundamental analysis is not a realistic option for the average retail investor, who is best served by a buy-and-hold strategy. While EMH doesn't completely invalidate fundamental analysis, it challenges the strategy and asserts that it is only of use if an analyst has new information or better insights into a security than is reflected in the current market price. This may be supported by data that show the underperformance of

actively managed funds compared to passive investment benchmarks over three-, five-, and 10-year periods.

The semi-strong version posits that both fundamental and technical analysis are unable to assist investors because all public information is already factored in, although private information unavailable to the public would help investors. Finally, the strong version of the EMH asserts that current stock prices account for private and public information, and there is no information that would give an investor greater insight in making decisions.

In 1992, Fama and Kenneth French, both professors of finance at the University of Chicago's Booth School of Business at the time, developed a statistical model to explain and predict the returns of stock portfolios. At that time, French says, "the received wisdom was that expected returns are described by the CAPM, although there was evidence that it didn't work."

The two researchers endeavored to create a model that built on the CAPM and encapsulated predictive factors in addition to systematic risk. Known as the three-factor Fama-French model, this advancement in empirical finance included variables for systematic risk, firm size (or market capitalization), and book-to-market ratio. A firm's book-to-market ratio is a comparison of its asset values to its market value; stocks with high book-to-market ratios are known as value stocks, which are undervalued and expected to ultimately appreciate. Stocks with low book-to-market ratios are known as growth stocks, potentially overvalued but expected to increase earnings quickly. This model contributed to an institutional shift, standardizing the methods used by large institutional investors to construct portfolios. French explains that, while previously financial advisors used conflicting variables to classify mutual funds, "they started thinking in terms of differences in size and book-to-market."

In 2015, Fama and French extended their work by developing the five-factor Fama-French model, which added two more variables to the previous model. It considered the impact of a firm's profitability and investment strategy — conservative or aggressive — on stock market performance. Therefore, a portfolio's performance can be constructed with reference to an investor's risk profile, and returns can be estimated by the portfolio's sensitivity to the five risk factors. Other researchers have similarly built upon the foundation of CAPM by developing models for stock market returns that incorporate other predictive factors, including sentiment anomalies, industry, currency, and style variables.

"What you'd like are really accurate signals. That's the ideal in an efficient market: That prices are right in the sense that they reflect the true value society places on the assets those securities represent," says French.

BEHAVIORAL ECONOMICS AND FINANCE

Conventional financial theories and models, such as the EMH, assume that investors and other market actors are rational agents making carefully considered decisions to weigh costs and benefits while pursuing their self-interest — *homo economicus*. While a very useful basis for economic models, most people don't usually make all decisions with perfect rationality. Behavioral finance uses a mix of psychology and economics to account for the shortcomings of modern financial theory to explain some investor behavior.

Psychologists Amos Tversky and Daniel Kahneman, often cited as the founders of behavioral economics, described decision-making models and common behavioral fallacies relevant to investment and financial management, such as overreliance on knee-jerk intuition, experience, and instinct. They classified these as "System 1 thinking," as opposed to the slower, deliberate, well-reasoned, and logical analysis they called "System 2 thinking." Tversky and Kahneman also developed a theory of loss aversion — the idea that individuals apply greater weight to expected losses than potential gains — as an alternative to neoclassical expected utility theory. In other words, investors are more emotionally sensitive to failure than success. When rash System 1 thinking is combined with loss aversion, investors are much more vulnerable to intervening and prematurely selling assets that are experiencing a drop in value. As such, a noise trader is one who relies on emotion to make investment decisions, often overreacting to news or changes in public sentiment.

Behavioral economist Richard Thaler built upon this psychological work by highlighting the ramifications of such less-than-rational actors on the market. His work challenged the theoretical conclusion that incorrect prices will be quickly corrected by rational actors seeking arbitrage opportunities, arguing that mispricing due to systemic bias by irrational actors can be "risky and costly" to correct, which effectively disincentives rational actors from correcting mispricing and maintaining efficiency. Under this view, the actions of many noise traders can worsen mispricing and cause rational traders looking for arbitrage opportunities to cut their losses and leave the market. The transaction costs associated with identifying a mispriced asset and the resources needed to correct the discrepancy can also act as a deterrent and perpetuate mispricing. Behavioral finance posits that, due to psychological biases inherent to human nature, systematic irrationality among market actors has the potential to create distortions not captured in traditional financial models but nonetheless significant.

Active investment strategies are more likely to fall prey to behavioral biases — loss aversion, System 1 decision-making, panics, early intervention — than are passive investment strategies. Behavioral finance suggests ways to mitigate the behavioral biases that threaten sound decision-making in active investment, such as relying on data-based strategies and prediction

algorithms and considering one's appetite for risk when constructing portfolios.

TODAY'S IMPACT AND TOMORROW'S POTENTIAL

The theories at the heart of modern finance — CAPM, MPT, and EMH — not only laid the groundwork for the ever-evolving world of highly complex investment management, but also for seemingly simpler financial portfolios. Passive investment vehicles such as index funds, exchange-traded funds (ETFs), and mutual funds, which help investors diversify their risk and protect average expected returns, are based on the principles of modern financial theory.

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Today, assets in passive funds outnumber those in active funds in the United States, and passive investment accounts for over 50 percent of funds in global equity mutual funds and ETFs. But Fama explains that, prior to "the asset pricing models we developed, the passive investment industry didn't exist." Such advancements "turned the financial industry on its head," he adds.

The increasing and widespread popularity of passive investment has given rise to questions about the impact of passive investors in the marketplace, including the ramifications for the EMH. A March 2025 paper by Hao Jiang of Michigan State University, Dimitri Vayanos of the London School of Economics, and Lu Zheng of the University of California, Irvine found that an influx of funds into passive investment, as opposed to active management, may put upward pressures on the prices, volatility, and illiquidity of large firms in popular indices like the S&P 500. Given that passive investors take long positions, short positions will be more likely to be squeezed out, which would increase the volatility and, in turn, the price of large firm stocks. Further, demand for large firm stocks would be greater and more inelastic, which means that mispricing may be more widespread and slower to be corrected by fewer active investors, leading to potential inefficiencies and higher market concentrations.

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Of the roles played by active and passive investors in the market, French explains that "the active investors are gathering information, trading on it, and pushing prices closer in line," while passive investors use buy-and-hold strategies. Active investment is essentially a bet, with one actor predicting a particular outcome and another taking the opposite position — in other words, it takes two to tango. Markets might be less efficient if all investors decided to switch from active to passive strategies, leaving no one for active investors to trade against, but French does not predict a significant shortage of active investors willing to place bets anytime soon.

"There are still lots of people who think they can beat the market," concurs Fama.

The impact of modern financial theory can perhaps be most clearly seen in its influence on saving and investing for retirement. Investors and financial managers tailor portfolios to personal risk profile and retirement date over time as opposed to one-size-fits-all techniques. Through this approach, workers saving for retirement transform their knowledge, career, and resources — sources of "undiversified, idiosyncratic risk" — into a reliable "diversified, liquid portfolio" from which to consume during retirement, Mehrling says. Investing resources for the future while hedging against the risk of loss is made possible by modern financial theory.

The existing framework continues to evolve, as researchers search for the next innovation using ever-expanding datasets.

"We'll see what comes along next," muses Fama. "If I could predict it, I would have already done it." **EF**

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