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Portfolio Theory Application and the Contrast with Reality

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Abstract. This study aims to address the issue of portfolio theory, which has been a topic of debate in financial. The main objective of this study is to investigate if the portfolio theory is useful in practical application. This study determines the feasibility of applying portfolio theory in real life through comparison and case studies. The findings of the study indicate that its assumptions about investor behavior often conflict with reality. The study provides insights into financial, which may contribute to future research and practice.

Keywords: Portfolio theory in practice; efficient frontier; mental accounting; loss-averse.

1. Introduction

As a framework, Portfolio Theory is highly useful thanks to its core insights. It has profoundly shaped the mindset of Wall Street and global investors. However, it faces limitations in practical application, and its assumptions about investor behavior often conflict with reality.

2. The Definition of Portfolio Theory

Portfolio Theory, primarily Modern Portfolio Theory (MPT) pioneered by Harry Markowitz in the 1950s, is extremely useful. “Using these concepts, MPT is a prescriptive rather than a descriptive theory which provides a solution for investors by showing what is the best combination of available assets in a portfolio in order to maximize the total expected return for a given amount of risk, or, alternatively, in order to minimize the portfolio risk, for a given level of expected return." [1]

Its value lies not in providing a perfect, foolproof investment formula, but in establishing a foundational framework for analyzing risk and return. The theory introduced key definitions, including expected return, covariance, and the diversification effect. At its core, it argues that a portfolio’s risk depends not only on the individual assets within it but also on the interrelationships between those assets—enabling risk mitigation through the strategic selection of assets to construct the portfolio.

3. Key Usefulness and Applications

3.1. The Power of Diversification

This theory proves most valuable and useful in its practical application. Before MPT’s emergence, diversification was widely regarded as a sound strategy, yet MPT was the first to quantify it. "Diversification-the idea of assembling a variety of assets that perform differently from each other instead of a portfolio of similar performing investments-became the essence of portfolio construction." [2] MPT mathematically demonstrates that when investors combine assets with unsynchronized price fluctuations (for example, nor perfectly correlated), the overall risk of the constructed portfolio will be lower than that of any single asset within it.

Real-World Example: This insight forms the bedrock of the entire index fund and Exchange-Traded Fund (ETF) industry. Purchasing an S&P 500 index fund represents a direct application of MPT: you acquire a diversified portfolio of 500 companies, which eliminates the specific risk of any single company’s failure.

3.2. The Efficient Frontier

MPT is the origin of the "efficient frontier" concept. This frontier represents a set of optimal portfolio construction, each delivering the highest expected return for a given level of identified risk. As such, aligning a portfolio with the efficient frontier has become a clear goal in portfolio construction:

Application: At my firm, Guided Choice, we use a Monte Carlo simulation to demonstrate to clients the probability of meeting their retirement savings and spending goals, depending on the risk of a particular portfolio. “Portfolios that are high on the efficient frontier will have higher return potential, but higher risk." [3]

3.3. Shifting the Focus from Individual Assets to the Entire Portfolio

The MPT provides a novel perspective for analyzing stock volatility. What matters is not the performance of a single stock in isolation, but rather its impact on the portfolio as a whole. The changes in some stocks may complement each other, thereby influencing the overall risk and return. This theory proposes that stock risk is determined by covariance and variance. For instance, when we look at the risk composition of a portfolio that contains two assets, the risk is composed of 2 covariances and 2 variances. Variances measure the volatility of a single asset’s returns, while covariances capture the relationship between the returns of different assets. As the number of assets increases, the number of covariances rises proportionally to the number of assets—but the number of covariance terms grows at a much faster rate. Ultimately, covariances become the dominant driver of portfolio risk.

3.4. Quantifying Risk-Return Trade-off

MPT guides investors to focus not only on returns but also on risk. As a result, the standard of a good investment has changed to the return on per risk rather than the rate of return. “Investors can use the mean-variance model proposed by Markowitz to obtain the existence of effective portfolios when they understand the historical average interest rate of each stock and the covariance matrix." [4] This shift also diminishes the appeal of companies that offer high returns only alongside disproportionately high risk.

3.5. Focus on Variance as Risk

MPT defines risk as the variance (or standard deviation) of returns—a mathematical simplification. For real-world investors, however, risk extends beyond mere volatility; it is more closely tied to the permanent loss of principal or the likelihood of underperforming a benchmark.

4. Investor behavior against the theory

From the preceding analysis, there is no doubt that MPT serves as a crucial, valuable reference for investors navigating investment decision-making. That said, the theory’s inherent limitations inevitably create discrepancies when applied to real life, thereby affecting investors' behavior. We will therefore focus on these limitations and the gaps between MPT’s assumptions and practical reality.

Overall, MPT clearly functions as a normative model for investors rather than a descriptive one of actual behavior—meaning it operates under ideal conditions predicated on rational investors. These two conditions are largely unfulfilled in real life. In Noreen et al.'s article, they proposed the Adaptive Market Hypothesis, suggesting that markets may not swiftly adjust to restore equilibrium in certain situations [4]. This underscores that real markets cannot sustain the ideal state MPT requires, leading to frequent failures of the theory’s prerequisite conditions. Similarly, investors face numerous factors that undermine their supposed rationality.

From a theoretical standpoint, the statistics are the decisive factor for investors to make decisions. Portfolio theory systematically quantifies stock risk and return: it uses variance and covariance to

assess the risk composition of stocks, and analyzes stock profitability through returns and return rates. Within this framework, when a risk-free asset is available, the best portfolios combine the risk-free asset with a tangent portfolio of risky assets. A risk-free asset typically refers to government bonds, Treasury bills, or other securities issued by governments or highly reliable institutions—entities that can be consistently trusted. The theoretically optimal portfolio combines such risk-free assets with risky assets. However, in reality, investor decisions are influenced by far more than just data—a topic to be discussed further. It is also important to note that while investors may act rationally under normal circumstances, they often consider additional factors beyond raw data. This leads to decisions that are not always strictly rational or scientific.

One key assumption of MPT is that investors only need to consider asset correlation and return rates. In theory, assets can be adjusted to pursue higher returns with lower risk—this flexibility enables the diversification of investment portfolios. In practice, however, the actual behavior may be when making investment decisions, investors often choose products they are more familiar with and trust. For instance, established stocks or those with strong growth momentum are preferred, while relatively new or volatile stocks are largely avoided. This bias can undermine portfolio diversification. In some cases, investors even accept lower returns to avoid holding assets they are unfamiliar with. Moreover, the degree of familiarity people have with different stocks can affect their sensitivity to stock price fluctuations, which in turn shapes their investment choices. Notably, the familiarity is closely tied to the investors' personal lifestyles and cannot be separated from the media's agitation and publicity.

A core assumption of MPT is that investors focus solely on the overall risk and return of their portfolio. In reality, however, investors exhibit mental accounting. BPT investors do not consider their portfolios as a whole. “Instead, investors consider their portfolios as collections of mental accounting (MA) subportfolios where each subportfolio is associated with a goal and each goal has a threshold level." [5]. Investors' threshold standards for specific goals also vary based on their individual circumstances. Particularly for goals like education, retirement, and inheritance, investors set different thresholds aligned with their unique psychological expectations. This means that when allocating assets, investors do not only rely on risk and return considerations. The truth is that the investors will classify the assets into different accounts from their own perspective, like the return gained from the investment will differ from the original asset. As a result, investors often lack strong awareness of holistic portfolio construction and instead treat different pools of capital in isolation.

Beyond mental accounting, MPT also assumes that investors are consistently risk-averse—a premise that conflicts with real-world behavior, where the disposition effect is prevalent. The disposition effect is a cognitive bias that manifests when individual investors sell more winning assets from their portfolios than underperforming ones (Shefrin & Statman, 1985) [6] More commonly, investors dislike losses more than they avoid risk. Psychologically, the pain of a loss is roughly twice as powerful as the pleasure from an equivalent gain—and this imbalance leads investors to sell profitable assets too early while holding onto loss-making ones for too long. In most cases, investors also enter investments with a certain psychological expectation of losses. This expectation, in turn, leads them to tolerate some short-term losses in the hope of securing greater long-term benefits. This is also the inner activity of investors that the portfolio investment theory has not taken into account.

From the above comparison, we can conclude that investors' behavior often contradicts MPT. The limitation of the theory's consideration determines that it cannot be well applied in real life. The theory does not take into account that in real life, situations are often more complicated, and investors have more concerns beyond the data. If investors rely solely on MPT to make decisions, their investment outcomes may deviate significantly from expectations. While such decisions appear rational from a theoretical standpoint, in the context of complex real-world scenarios and individual circumstances, relying exclusively on the theory is ultimately irrational.

5. Conclusion

Portfolio theory aims to explore the mutual influence among multiple stocks, and identify how to minimize risks through asset combination, while presenting risks and returns in a data-driven manner. This theory has made remarkable contributions across several aspects, providing a novel perspective and a more comprehensive theoretical foundation for investment decisions. From a mathematical perspective, it elevates the investor's analytical focus from individual stocks to specific stock portfolios, using metrics like variance and mean to scientifically assess the rationality of investments. Additionally, its explicit emphasis on risk and return rates offers clear, actionable directions for investors when evaluating potential choices.

However, due to its overly ideal theoretical model and inherent limitations, the portfolio theory often contradicts investment behavior in practical application. What matters is identifying how to apply the theory's insights under different scenarios to make investments more rational and reasonable. Over-reliance on this theory, or conversely, disregarding it and acting arbitrarily, can both lead to poor investment decisions. This process requires not only a deep understanding of the theory itself from investors but also a continuous deepening of their knowledge of the stock market—ensuring they grasp information accurately and form correct, rational judgments about the current market situation.

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