A Comprehensive Analysis of The Modern Portfolio Theory

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Abstract. The emergence of the modern portfolio theory in 1952 marked the beginning of a new era in portfolio management. In addition to the con pets forwarded by active and passive portfolio theory, the MPT (modern portfolio theory) outlines the importance of diversification in reducing the risk associated with a portfolio, which is achieved thanks to the credentials of diversification in eliminating specific risk. The importance of contemplating assets as parts of a portfolio instead of individual investments, thus putting the criteria of low risk before high return is also a fundamental concept presented by MPT. This results in changes in investors' behavior, more particularly in the way they evaluate assets and contemplate the financial market. However, despite its extensive use and recognition, the MPT still has alarming pitfalls due to the unrealistic character of its assumptions and its neglect of macroeconomic factors as well as the possible evolution of the companies. This essay will first present the evolution of MPT, its use, its influence on investors' behavior as well as its limits.

Keywords: Modern portfolio theory; Capital asset pricing model; Diversification; rational investors; risk.

1. Introduction

The contemporary financial market offers a considerable variety of investment projects, amongst which figure several well-known securities such as stocks and bonds, which are used by investors as an investment, a tool to gain financial return in the future. Thus, the latter often tend to look at stocks individually and purchase the ones which seem to offer a high rate of return. However, despite their number, stocks are considered as risky securities, rational investors, as risk averse individuals, aim at cutting down risk while maximizing their return.

From the combination of risk aversion and profitability maximizing arose two portfolio theories: one, known as passive portfolio theory, which takes into account the results that the investor looks for and their preference in terms of temperament regarding financial actions. However, neither of these theories allow investors to cut down risk while maximizing their return. The modern portfolio theory, first invented by Professor Markowitz in 1952, offers, in addition to the two theories, a way to minimize risk while having the highest return. This essay will be organized as follows: first the evolution of the portfolio theory, then the reasons why it is useful, before the presentation its limits and alternative models.

2. Literature review

The invention of the Modern Portfolio Theory (CAPM) revolutionized the way people select their assets. It offers a practical and efficient way for individuals to select assets and show that the performance of an individual stock is less important than the performance of the entire portfolio [1]

In the same framework, in the 1960s, William Sharpe, John Lintner, Jack Treynor and Jan Mossin provided a framework to associate the return of an investment with the risk associated with it: The Capital Asset Pricing Model (CAPM). As an idealized portrayal of how financial markets price securities, it allows investors to calculate the expected return on equity according to the assets' price. It also states that in order to earn a higher return, it is necessary for investors to take on more risk [2].

Jan Mossin's research of 1966 was centered around the market properties of risky assets based on the general equilibrium exchange model, where investors seek to maximize preference functions over expected yield and variance on their portfolios [3]. The market risk premium theory is thus outlined and shows that the general equilibrium implies the presence of the "market line", figure which related the expected yield per dollar to the standard deviation and presents the price of risk as the slope of the "market line" [3].

An alternative theory to the MPT was invented in 1976 by Dr. Ross, and is known as the Arbitrage Pricing theory. It used the linear relationship between the expected return of an asset and a certain number of macroeconomic variables that could impact the systematic risk [4].

3. Use of MPT

In accordance with the MPT, investors try to cut down specific risk by selecting a diversified portfolio (Markowitz) which is called an efficient portfolio [5].

The theory follows the following assumptions: a stock is no longer considered alone, but in the light of the existing portfolio and whether its purchase would raise the return of the portfolio without adding on to its risk. The emergence of this theory reduces volatility in a portfolio because stocks are considered together. It also drives investors to think which kind of "risk profile" they have and then determine their portfolio according to it.

In addition, the theory is also used in other disciplines such as psychology and served as one of the foundations of the most important principles of behavioral economics. It is also worth mentioning that the way to design a portfolio is a combination of the clients' risk tolerance and return expectations in order to maximize the expected return for a given level of risk and also helps to choose a stick according to its risk premium, so its marginal contribution to the risk of the portfolio.

4. Insights into investors' behaviour

In modern days, a wide variety of investment projects and securities are available on the financial market. In order to select the most profitable assets, rational investors look at the rate of return, but also at the risk associated with them. This is especially important in the stock market, often referred to as the epitome of risk.

For all stocks, risks come from two factors: the specific factor associated with the stock because of its nature, and risk associated with the financial market. For example, the risk of a stock issued by Nestle has a specific risk, associated with its sector, such as drought, and a market risk, which is inevitable. While the market risk, given its empirical aspect, cannot be avoided, specific risk, thanks to modern portfolio theory, can. According to Markowitz, this can be done through diversification [6]. "Diversifying sufficiently among un correlated risks can reduce portfolio risk toward zero »[6]. In this sense, the MPT encourages investors to not assess stocks as individual assets and pick the one offering the highest return, but to have a global view of their portfolio and choose the asset which allows them to have more return while adding the least risk possible to their portfolio. Thus, the MPT encourages the investors to value stability over high return [7].

In addition, as shown above, MPT shows diversification in order to reduce risk. Therefore, investors are encouraged to contemplate the market at a national level and purchase assets from different sectors in order to reduce covariance.

In this context, the MPT alters investors' behavior and, more particularly, the way they select their assets and their perception of the financial market [8].

Table 1. annual return

	Bond A	Bond B
annual return	10%	10%
highest return possible	25%	13%
lowest return possible	-5%	7%
maturity	4 years	4 years

5. Limitation of MPT

Despite its extensive use, the portfolio theory has a certain number of limitations. This is before all due to the assumptions it makes, which are not always true in reality. For instance, portfolio theory assumes that markets are transparent, which isn't always the case [9]. The example of Tyson in 2016 shows that despite the stock market and the bond market being relatively transparent, some companies can refuse to provide information and thus make the market not completely transparent. The portfolio theory also assumes that all investors are rational and are risk - averse. In real life, many investors aren't rational and don't always give priority to loss minimization before return. For example, between the two bonds shown in table 1, the first one has the highest possible return of 25% but also has a higher volatility, and the second one has a higher lowest possible return but its highest possible return is lower than that of bond A, which represents a lower volatility. According to the portfolio theory, investors should choose the second bond because it has a lower variance, therefore lower risk. In reality, many investors could be tempted by the high return offered by bond A and purchase it despite the fact that its risk is higher. The assumption of an equal distribution of return is also seldom seen in reality [10].

Therefore, it is evident that the portfolio theory has limits due to the fact that some of its assumptions are unrealistic.

Moreover, the portfolio theory remains theoretical. While it attempts to predict the future, its theoretical nature forbids it to do so. The asset considered as the best one by the portfolio theory does not always turn out to be the most profitable one. For example, using the two stocks from table 1, the portfolio theory would suggest choosing the second one. However, it might occur, given the unpredictable character of the future, that bond A ends up offering a 25 % return. In this case, the investor who chose bond A ends up winning more money and the portfolio theory is proven wrong.

Thus, portfolio theory remains theoretical and is sometimes unable to predict the future accurately.

The portfolio theory uses correlation in order to eliminate specific risk. However, correlation between assets may vary over the course of time [11]. Indeed, if in the last the value of a certain stock was negatively correlated to the value of another one, it is not guaranteed that this will remain the case in the future, especially if important macroeconomic changes occur, such as the oil crisis or the merger and acquisition of two important companies.

Macro-economic factors such as exchange rates and inflation play an important role in variation of financial assets' prices. However, they are not taken into account by the portfolio theory despite their importance. This constitutes an alarming pitfall for the portfolio theory since it misses out on an important factor which determines the performance of companies and other institutions and thus their assets' prices. These factors are however taken into account in the arbitrage pricing theory. It also neglects to have the investors collect information about how the company is doing, which is likely to determine the variation of the assets' price in the future.

6. Conclusion

The MPT constitutes a pioneer in modern portfolio management research. This research has shown that it enables investors to choose the best portfolio with a predefined risk, reduce their assets' risk by diversification and that investors can use diversification to optimize their portfolios. This reveals the need to contemplate the financial market at a national level and the necessity of privileging little risk to high return. However, due to its unrealistic assumptions and its disregard towards macroeconomic factor and the performance of the companies involved, the theory contains several alarming pitfalls. It is nonetheless important to bear in mind that this paper does not lay its emphasis on alternative uses of the portfolio theory besides finding the efficient portfolio and choosing the best asset with a given portfolio.

The underlying assumptions of the theory have therefore been extensively challenged by behavioral economics in recent years. Despite its limits, it is still widely used in the financial sector due to its practical credentials and remains the most recognized theory for portfolio management. In order to maximize the accuracy of the result, it recommended to take into account all information that could potentially impact the value of the assets prior to purchase and combine them with the results offered by the MPT.

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