

## Chapter 2

# Application of Markowitz Portfolio Theory by Building Optimal Portfolio on the US Stock Market

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### **ABSTRACT**

*This chapter is focused on building investment portfolios by using the Markowitz Portfolio Theory (MPT). Derivation based on the Capital Asset Pricing Model (CAPM) is used to calculate the weights of individual securities in portfolios. The calculated portfolios include a portfolio copying the benchmark made using the CAPM model, portfolio with low and high beta coefficients, and a random portfolio. Only stocks were selected for the examined sample from all the asset classes. Stocks in each portfolio are put together according to predefined criteria. All stocks were selected from Dow Jones Industrial Average (DJIA) index which serves as a benchmark, too. Portfolios were compared based on their risk and return profiles. The results of this work will provide general recommendations on the optimal approach to choose securities for an investor's portfolio.*

### **INTRODUCTION**

Investing in capital markets is one of the main activities of large number of economic subjects. This activity was particularly driven by development of information technology as well as deregulation and globalization, which is typical of the current financial markets. The development of information technology has enabled even small retail investors, who generally do not have the appropriate knowledge and experience, to take advantage of the direct purchase or sale of securities on the capital market. Driven by different motives, investors allocate their available resources to the assets and through selected invest-

DOI: 10.4018/978-1-5225-0959-2.ch002

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ment strategies they seek to derive maximum value from invested funds and at the same time eliminate the threat of losses.

Different models for assets valuation describing the relationship between risk and return on the given investment can be used as a tool to support investment decision-making.

One of the most common methods in designing strategies and building portfolios is the Modern Portfolio Theory (MPT). Although it is based on simplifying assumptions, it can be successfully used in portfolio analysis for explaining the relationship between the return and risk of individual portfolio components. The Capital Market Theory, which is closely related to the MPT, then came up with the Capital Asset Pricing Model (CAPM), which extended the existing theory by an equilibrium view of the asset market. In spite of the fact that the capital asset pricing model rests on simplifying assumptions and has been tested many times since its inception in the 60s, but its general applicability was not confirmed, it is currently among the most widely used models and can be used to manage investment strategies and build investment portfolios. The model is based on the equilibrium between the risk and return, or more precisely the risk (represented by beta coefficient) of a specific title is directly proportional to the return achieved on the given investment.

It is these findings about this approach and the model, or its principle (i.e. the idea of equilibrium of return or loss stemming from the risk of a specific investment) that are the reasons for examining its functionality on real data and are used to achieve the objectives of this paper.

The aim of the present paper is to define, on a selected sample of US stocks, the most suitable method for optimal portfolio compilation using the Markowitz Portfolio Theory. That is meaning whether it is appropriate to favour stocks with high or low beta coefficient or whether it is preferable to use a random selection of each stock.

Therefore, the aim of this paper is to verify or answer the research question whether the optimal portfolio compiled in accordance with the Portfolio Theory brings investor an optimal ratio of return to the given risk. Within this basic research question, following research sub-questions can be set out regarding the assumptions and the basic idea of the CAPM model:

- High values of beta coefficient guarantee higher returns on stock titles.
- Random selection of securities in the portfolio provides satisfactory return at an acceptable level of risk.

Defined research questions or empirical analysis of functionality of the CAPM model is based upon knowledge as well as criticism of this issue, which is given in the following chapter. Achieved results of this paper support the arguments against the model and provide investors with recommendation on how to properly compile portfolio regarding its profitability and risk, and whether higher values of beta indicator actually “guarantee” higher valuation.

## **LITERATURE REVIEW**

Just like other areas of economics, the theory of financial markets has a rich history. The firm foundation theory is an approach better known as the determination of the intrinsic value of stock, which is an output of fundamental analysis (Malkiel, 2012). Williams (1938) developed this technique and, thanks to the work by Graham & Dodd (2008), it founded its way even among investors on Wall Street. Although

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