

# Chapter 1

## Determining Expected Utility and Entropy Ratio in the Expected Utility–Entropy Decision Model for Stock Selection Depending on Capital Market Development

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### **ABSTRACT**

*Appropriate securities selection is an important step in formation of an investment portfolio. The expected utility-entropy (EU-E) decision-making model is one of the models that can be applied to investment portfolio stock selection. The decision-maker subjective preference is reflected by the expected utility, and the objective uncertainty is measured using Shannon entropy. In this model, the measure of risky action is the weighted linear average of expected utility and entropy using a risk tradeoff factor. This chapter tests whether tradeoff coefficient depends on capital market development. With this aim, EU-E model was applied on European Union (EU) capital markets with different development according to FTSE equity country classification. It tests whether the EU-E model applied to the three different capital markets gives the best stock selection results for the same tradeoff coefficient values, or whether tradeoff coefficient depends on capital market development.*

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## **INTRODUCTION**

An investment portfolio is a set of assets that can hold stocks, bonds, cash and other financial or nonfinancial assets. It also refers to a group of investments that an investor mixes in order to earn a profit while making sure that it reflects the investor's risk tolerance and financial goals. In a context of uncertainty but also great opportunities, investors repeatedly have to select investment assets from a wide range of securities listed on worldwide capital markets.

One of the most important components of investment portfolio management called portfolio selection problem refers to the problem of dividing an investor's wealth amongst a set of available securities. Taking into consideration the stock's market complexity, a high level of knowledge on the part of the financial analyst is required in order to obtain strategies that allow risk minimization and/or maximization of the investor's return, thereby achieving both high and low periods (Pinho & Melo, 2018).

Furthermore, investment portfolio management is not possible without strong quantitative support, which is based on the application of appropriate mathematical models for asset valuation, risk management, portfolio optimization and rebalancing and on the development of new models that will allow investors to make better decisions with better investment results in comparison to previous models.

To this date, many mathematical models have been developed to support the decision-making process when selecting an investment portfolio. Most models aim to find a portfolio that maximizes return for a given rate of risk or a portfolio that minimizes risk for a given rate of return, the so-called efficient portfolio. Depending on the characteristics of securities and investment strategies on the one side and those of the capital market on the other, different risk measures can be applied in these models.

In addition, as there are many securities in the capital markets, in the first step of the model the number of securities is often reduced using the criteria chosen by the decision maker, and only then the optimal portfolio from the selected reduced set of securities is chosen. Such a model is also used and presented in this chapter. In the first step, the best stocks are selected using the normalized EU-E measure of risk and in the second step mean-variance efficient portfolios are formed. On the basis of the presented model, an attempt will be made to determine whether the model has the same characteristics and parameters in the markets at different levels of development.

In line with the Financial Time Stock Exchange (FTSE) classification criteria, national capital markets are divided into four categories: developed markets, advanced emerging markets, secondary emerging markets and frontier markets. Emerging markets and frontier markets, which the Croatian market belongs to, are characterized by high returns but also volatility, strong links with developed markets, low liquidity, reduced capitalization, underdevelopment of financial instruments, political instability, exchange rate volatility, and high transaction costs. Despite the limitations of the emerging and frontier markets, such as e.g. insufficient liquidity, weak regulations, they still represent a challenge and provide opportunities for higher returns as compared to developed markets.

Since stock returns in markets at different levels of development do not have the same characteristics, it is interesting to investigate how the EU-E model for stock selection behaves in different markets.

In the analysis, German, Hungarian and Croatian capital markets were taken as representatives of developed market, advanced emerging market and frontier market respectively. Emerging markets are divided into advanced and secondary emerging markets, but no EU country is classified as the secondary emerging market. It will be tested whether the EU-E model applied to the three different capital markets, previously presented, gives the best stock selection results for the same trade-off coefficient values, or whether trade-off coefficient depends on capital market development. The success of the model will be

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