

## Chapter 9

# International Diversified Portfolio Optimization With Artificial Neural Networks: An Application With Foreign Companies Listed on NYSE

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### ABSTRACT

*Investing in developed markets offers investors the opportunity to diversify internationally by investing in foreign firms. In other words, it provides the possibility of reducing systematic risk. For this reason, investors are very interested in developed markets. However, developed are more efficient than emerging markets, so the risk and return can be low in these markets. For this reason, developed market investors often use machine learning techniques to increase their gains while reducing their risks. In this chapter, artificial neural networks which is one of the machine learning techniques have been tested to improve internationally diversified portfolio performance. Also, the results of ANNs were compared with the performances of traditional portfolios and the benchmark portfolio. The portfolios are derived from the data of 16 foreign companies quoted on NYSE by ANNs, and they are invested for 30 trading days. According to the results, portfolio derived by ANNs gained 10.30% return, while traditional portfolios gained 5.98% return.*

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## **INTRODUCTION**

Risk aversion tendency of the investors rises together with the return expectations of the financial assets with the limited amount of resources. Restricted with an inadequate level of resources, investors expect to have a high rate of return under a lower level of risk. A limited amount of financial resources and the expectation of high returns with these resources requires financial asset diversification. Asset composition emerging from these decisions is defined as a portfolio. Derived from the definition, portfolio is a new financial asset with its return and risk consisting from more than one financial asset (Korkmaz & Ceylan, 2006: 504)

A new financial asset emerges from the portfolio diversification. Nevertheless, this process consists of two factors. First of all, financial assets to be included in the portfolio must be determined. Selection of the financial assets has a major importance at this point. Together with the selection of financial assets composition, the behavior of these financial assets during the investment period is also distinctive. Secondly, participation ratio of each financial asset in the portfolio is a determinant factor of portfolio selection. In other words, investment amount of each financial asset must be specified.

While Portfolio diversification is the design of a portfolio with investing in assets with different risk and return levels at different amounts, portfolio maximization is the determination of a portfolio with the maximum level of gain at a certain level of risk or rate of return (Markowitz, 1959: 277). In other words, diversification emphasizes the distribution of a limited amount of resources among different assets within the scope of risk diversification; optimization underlines the efficient distribution of these resources among different assets under the same principle. Investors expect high levels of return under low levels of risk. Risk diversification can achieve this. Investing in an individual asset extends the risk. In such a case, it is important to diversify the risk to increase the rate of return. Therefore, investors especially investing in developing countries come up against a high level of volatility. These investors diversify their portfolio in the international markets to lower the risk and to have a more stable return. In this process, different country indices having negative covariance to each other and investments in different international companies in these countries enable the diversification of risk in modern portfolio theory as stated by Markowitz.

When the resources are invested in different companies in the same market, these invested assets are affected by the same incidents in this country, and eventually, the tendency of co-movement is possible for the returns of risks of these assets.

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