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Mean-variance investment strategy applied in emerging financial markets: Evidence from the Colombian stock market

Fernando García[a,*], Jairo Alexander González-Bueno[b], Javier Oliver[c]

[a] *Universitat Politècnica de València, Camino de Vera s/n, 46022, Valencia, Spain*
[b] *Universidad Pontificia Bolivariana, Spain*
[c] *Universitat Politècnica de València, Spain*

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Abstract

In any investment, an analysis of the expected return and the assumed risk constitutes a fundamental step. Investing in financial assets is no exception. Since the portfolio selection theory was proposed by Markowitz in 1952, this methodology has become the benchmark in portfolio management. However, it is not always possible to apply it, especially when investing in emerging financial markets, which are characterised by a scant variety of available stocks and very low liquidity. In this paper, using the Colombian case, we will examine the challenges found by investors who want to create a portfolio using only stocks listed on a scarcely developed stock market.

JEL classification: G11; G12

Keywords: Diversification; Efficient frontier; Mean-variance; Profitability; Risk.

1. Introduction

The creation and management of investment portfolios is a major challenge in the financial arena. Indeed, many agents such as individual investors (Jacobs, Müller, & Weber, 2014) and pension funds or life insurance companies (Jablonskienė, 2013) seek to efficiently manage their investment portfolios instead of using other alternatives such as passive management (García, Guijarro, & Moya, 2013). Furthermore, alongside the traditional variables of risk and return, investors sometimes include other criteria in the selection of values as ethical criteria (Belghitar, Clark, & Deshmukh, 2014; Slapikaite & Tamosiuniene, 2013).

Modern portfolio theory was first introduced by Markowitz (1952) and later developed by Sharpe (1964). Modern portfolio theory establishes an investment framework for the selection and construction of portfolios based on maximising expected return and simultaneously minimising investment risk.

* Corresponding author.
E-mail addresses: fergarga@esp.upv.es (F. García), jairoa.gonzalez@upb.edu.co (J.A. González-Bueno), jaomun@hotmail.com (J. Oliver).

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Since its publication, the mean-variance portfolio selection model has been a fundamental theoretical reference in portfolio selection, leading to multiple developments and referrals.

Researchers, applying neural networks, have further analysed some problems in portfolio building, because neural networks can incorporate uncertainty related to stock returns in the models (Nazemi, Abbasi, & Omidi, 2015). This methodology can also improve the algorithm in the selection of stocks, generating a previous selection of the inputs to be used in models (Chen, Huang, Hong, & Chang, 2015).

Another problem studied is rebalancing the portfolio. Becker, Gürtler, & Hibbeln, 2013 analyse the effects of portfolio rebalancing with and without restrictions on the weights of stocks included in the portfolio.

Other studies incorporate new variables into the model. For example, Xia, Min, & Deng, 2015 include the consensus temporary earnings forecasting (CTEF) variable that is nothing more than a prediction of the different types of earnings in the market (e.g. one-/two-year forecasts of earning per stock).

Using algorithms such as particle swarm optimisation (PSO) and multi-objective particle swarm optimisers (MOPSOs) makes it possible to build multi-objective models. Mushakhian and Abbas (2015) apply these algorithms to the problem of selecting stocks that incorporate transaction costs.

Support vector machines (SVMs) can also be applied in selecting the assets to be included in the portfolio. SVMs select stocks that are more profitable (Barak & Modarres, 2015; Loukeris & Eleftheriadis, 2015), with the ability to extract complex and relevant information from accounting statements to help in the selection process (Hsu, 2014).

Other studies examine how to build index tracking models as efficiently as possible, avoiding high transaction costs (Chen & Kwon, 2012; Edirisinghe, 2013; García, Guijarro, & Moya, 2011).

The remainder of the paper is structured as follows: in the section following this introduction, the mean-variance model by Markowitz is presented; Section 2 is devoted to a description of the database of stocks listed in the Colombian stock market. In Section 3, Markowitz's model is applied and the main results are described. Finally, the last section draws conclusions.

2. Methodology

The expected return from a portfolio is the weighted average of the expected returns of individual stocks, which are frequently calculated using the historical behaviour of returns, and is calculated by the expression formed by the following components:

$$\mathrm{E}(R_p) = \sum_{i=1}^{n} \mathrm{w}_i E(R_i) \tag{1}$$

$$\sum_{i=1}^{n} w_i = 100\% \tag{2}$$

where:

$\mathrm{E}(R_p) =$ Expected return on the portfolio

$n =$ Number of stocks included in the portfolio

$w_i =$ Weighting of the stock "i" in the portfolio.

$E(R_i) =$ Expected return of the stock "i"

Risk can be defined as the possibility that the actual performance of an investment differs from what is expected.

The overall risk of a stock can be divided into two basic components: systematic risk (also called non-diversifiable risk, market risk or common risk) and unsystematic risk (also called diversifiable risk, specific risk or idiosyncratic risk). Portfolio selection theory assumes that these two types of risk are common to all portfolios. The risk of a diversified portfolio, measured by the standard deviation of performance, is:

$$\sigma^2{}_p = \sum_{i=1}^{n} . \sum_{j=1}^{n} w_i w_j \sigma_{ij} \tag{3}$$

$$\sigma_p = \sqrt{\sigma^2{}_p} \tag{4}$$