Application of the theory of Markowitz for structure portfolio investment in the Colombian stock market

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Abstract

Since its appearance in 1952, Harry Markowitz model has been a major theoretical reference in structuring investment portfolios, leading to multiple developments and referrals. The present work is aimed to apply the model of Markowitz in the Colombian stock market and through an empirical study will verify whether the model is able to provide investment portfolios to meet the risk and return preferences for a Colombian investor. To do the daily closing prices for the period January 2005 to December 2014 from a sample of 12 shares of Colombian stock exchange will be used.

Keywords: diversification, efficient frontier, profitability and risk.

Introduction

To venture into the field of finance, investment decision becomes a challenge for those who are willing to take advantage of the great opportunities and alternatives offered by the stock market. The decision to invest in a market like Colombia is subject to uncertainty, which leads to consider important variables from the economic, political and social environment that affect the expected cash flows and change the course of the results, which defines the presence of risk in investments.

Modern Portfolio Theory is composed of the Theory of Portfolio Selection of Harry Markowitz (1952) and William Sharpe contributions to the theory of price formation in financial assets (1964) known as the Capital Asset Pricing Model (CAPM). Basically, the Modern Portfolio Theory is an investment framework for the selection and construction of investment portfolios based on maximizing the expected return of the portfolio and the simultaneous minimization of investment risk.

Since its emergence, the theory of Markowitz Portfolio Selection has been a fundamental theoretical reference in selecting portfolios, leading to multiple developments and referrals.

The remainder of the paper is structured as follows. First, we will present the methodology and the database. Then the main results of the application will be described. Finally, the last section will conclude.

Methodology

The aim of this research is to apply the model of Harry Markowitz in the Colombian stock market, to find the solution to the problem faced by an investor to create an investment portfolio with an optimum composition of shares that confer the lowest risk for a maximum return.

The model of Markowitz is applied using daily closing prices for the period January 2005 to December 2014 of the following 12 companies: Banco de Bogota SA (Bogota), Bancolombia SA (BCOLOMBA, PBFCOLOM), Celsia SA E.S.P. (Celsia), Cementos Argos SA (Cemargos), Corporación Financiera Colombiana SA (Corficolet), ETB SA (ETB), Argos Group (Grupoargos), Grupo Aval SA (Grupoaval), Sura Group Inc. (Gruposura), Interconexión eléctrica SA (ISA) and Nutresa Group (Nutresa). Most of the
selected companies belong to the financial sector (Bogotá, Bcolombia, PFCOLOM, Corficolf, Grupoaval and Gruposura), two belong to the energy sector (Celcia, ISA), the remaining four are Cemargos, within the cement industry; ETB, in the telecommunications sector; the food sector is represented by Nutresa, and Grupoargos is a holding company with investments in cement, energy, urban and real estate development and ports. These 12 companies are the only ones for which enough information is available for the requested period.

Historical information from January 2005 to December 2014, daily prices of the 12 actions mentioned above were used.

Results

Applying the model of Markowitz, the minimum variance portfolio at a desired level of profitability is calculated (Table 1).

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>Pesos</th>
<th>σp</th>
<th>E [Rp]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bogotá</td>
<td>32.07%</td>
<td>0.086%</td>
<td></td>
</tr>
<tr>
<td>Pfbcolom</td>
<td>10.84%</td>
<td>0.086%</td>
<td></td>
</tr>
<tr>
<td>Corficolf</td>
<td>7.10%</td>
<td>0.086%</td>
<td></td>
</tr>
<tr>
<td>ETB</td>
<td>6.55%</td>
<td>0.086%</td>
<td></td>
</tr>
<tr>
<td>Grupoaval</td>
<td>7.69%</td>
<td>0.086%</td>
<td></td>
</tr>
<tr>
<td>ISA</td>
<td>7.74%</td>
<td>0.086%</td>
<td></td>
</tr>
<tr>
<td>Nutresa</td>
<td>26.00%</td>
<td>0.086%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100.00%</td>
<td>0.086%</td>
<td></td>
</tr>
</tbody>
</table>

Source: The authors

In the minimum variance portfolio, Bogotá has the highest weight (32.07%), as it is less risky share among the 12 stocks selected. Regarding the portfolio of maximum profitability, only Corficolf is included, because it is share with the highest expected return between 12 stocks selected (Table 2).

Table 2 shows the construction of the Efficient Frontier line, that is, of the combinations of the stocks that offer the highest return for a given level of risk. Then suitable combinations (wi) of the shares in the different portfolios according to the desired risk and subject to the restrictions previously indicated are calculated.

Table 2 shows that from the portfolio 11 only three companies are used to obtain the efficient frontier: Bogotá, Corficolf and Grupo Aval. This is one of the criticisms stated by Michaud (1989), who suggests to limit the weight of each companie in the portfolio.
For a conservative investor, the minimum variance portfolio is a good choice. However, according to Markowitz, rational selection of the investor and risk aversion lead him to seek different possibilities of portfolio geared for generating good returns at a given level of risk, and create the so-called indifference curves on the efficient frontier line.

It is worth highlighting that an investor who wants to invest in shares comprising the Colombian stock market can maximize profitability by investing in any of the portfolios located on the efficient frontier line, depending on the level of risk he/she wants to assume.

Conclusions

In this paper the application of the Markowitz model in the Colombian stock market in the period January 2005 to December 2014.

The main conclusion to be drawn from this research is the difficulty faced by Colombian investors in order to implement the model of Markowitz. In fact, only 12 companies present complete information regarding share prices for a time period which is not very long. This lack on information and on companies available to build the portfolio has a very important impact on the portfolios that can be created by the model. Many of the efficient portfolios are composed just by two companies. For this reason, investors seeking a higher and more reasonable degree of diversification cannot construct their portfolios only using Colombian shares. Therefore future research should be directed to find other investment alternatives, for example, investing in other stock markets in the region and creating a pan-american portfolio applying the model of Markowitz.

References
