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# Markowitz and Implementation of a Multi-Objective Evolutionary Technique Applied to the Colombia Stock Exchange (2009-2015)

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**Abstract :** There modeling component selection financial investment (Portfolio) a variety of problems that can be addressed with optimization techniques under evolutionary schemes. For his feature, the problem of selection of investment components of a dichotomous relationship between two elements that are opposed: The Portfolio Performance and Risk presented by choosing it. This relationship was modeled by Markowitz through a media problem (Performance) - variance (risk), ie must Maximize Performance and Minimize Risk. This research included the study and implementation of multi-objective evolutionary techniques to solve these problems, taking as experimental framework financial market equities Colombia Stock Exchange between 2009-2015. Comparisons three multiobjective evolutionary algorithms, namely the Nondominated Sorting Genetic Algorithm II (NSGA-II), the Strength Pareto Evolutionary Algorithm 2 (SPEA2) and Indicator-Based Selection in Multiobjective Search (IBEA) were performed using two measures well known performance: The Hypervolume indicator and R_2 indicator, also it became a nonparametric statistical analysis and the Wilcoxon rank-sum test. The comparative analysis also includes an evaluation of the financial efficiency of the investment portfolio chosen by the implementation of various algorithms through the Sharpe ratio. It is shown that the portfolio provided by the implementation of the algorithms mentioned above is very well located between the different stock indices provided by the Colombia Stock Exchange.

**Keywords :** finance, optimization, portfolio, Markowitz, evolutionary algorithms
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