

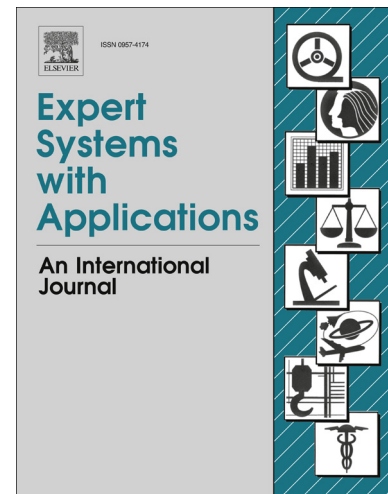
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A Hybrid Approach to Portfolio Composition based on Fundamental and Technical Indicators

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Abstract

This paper describes a new approach to portfolio management using stocks. The investment models tested incorporate a fundamental and technical approach using financial ratios and technical indicators. A Multi-Objective Evolutionary Algorithms (MOEA) with two objectives, the return and the risk, are used to optimize the models. Three different chromosomes are used for representing different investment models with real constraints equivalent to the ones faced by portfolio managers. To validate the present solution three case studies are presented for the S&P 500 for the period June 2010 until 2014. Simulations demonstrate that the stock selection based on financial ratios can be used to choose the best companies in operational terms, obtaining returns above the market average with low variances in their returns. The increase of fundamental indicators enhances the quality of the chromosomes found by the MOEA, and the results of real simulations become more precise. Some of the best chromosomes found by the algorithms invest in stocks with high return on equity (ROE), in conjunction with high rate of growth of the net income and a high profit margin. To obtain stocks with high valuation potential, it is necessary to choose companies with a lower or average market capitalization, low PER, high rates of revenue growth and high operating leverage.

Keywords

Evolutionary algorithms, fundamental analysis, technical analysis, stock investments

1. Introduction

There are several ways to invest in the stock market namely technical analysis, value investing and the random walk theory. Technical analysis studies the market patterns, the demand and supply of stocks shares (Achelis, 2000). Value investing studies the financial information of the industries sector where a company operates to find the intrinsic value of a stock. The random walk theory defends that the market discounts all future developments, so the investor cannot expect to outperform the general market (Murphy, 1999).

Capital allocation is the set of investment decisions that an investor takes to divide his capital by a number of assets, to maximize the expected return and minimize the risk to solve the portfolio optimization problem. This is a complex problem, depending on the correlation of the assets, budget constraints and preferable industries by the investor.

This type of problems are practically impossible to solve by deterministically techniques, which is why researchers developed heuristics like local search (LS), Tabu Search (TS), Simulated Annealing (SA), Particle Swarm Optimization (PSO), Ant Colony Optimization (ACO), and Evolutionary Algorithms (EA) to solve them (Fonseca & Fleming, 1993).

EA are based on the process of biologic evolution, where the solutions of the problem are encoded in chromosomes and evaluated using a fitness function to select the best candidates to generate new populations. The repeating of the process of evaluation and reproduction trains the algorithm in finding the closest solutions to the global optimal solution of the problem. The heuristic allows the chromosome encoding of different data structures that is a way of solving the problem with constraints (Streichert, Ulmer & Zell, 2004).

The research done in the field proves that it is a heuristic capable of solving and finding the Pareto set, because it is capable of processing a set of solutions in parallel and finding a good approximation in a single run (Zitzler & Thiele, 1998). It solves high dimensional spaces problems because they combine features from random search and Monte Carlo methods with some powerful heuristics borrowed from natural evolution (Tettamanzi. & Loraschi, 1993).

This paper describes a new approach to portfolio management using stocks. The objective is to find stable companies, with good growth and a reasonable price, which have the potential for higher returns. To achieve this, an innovative approach was developed using Multi-Objective Evolutionary Algorithms with two objectives, the return and the variance of returns. Traditionally, optimization based approaches use either technical or fundamental indicators to find the composition of a portfolio. The proposed approach combines both fundamental and technical indicators. In the literature several fundamental indicators are available to be chosen from macroeconomic indicators, like inflation or unemployment, to industrial sector information, going

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