Pattern recognition applied to chart analysis. Evidence from intraday international stock markets

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Abstract

Technical analysis as sophisticated form of forecasting technique joins different popularity in the academic and business world. In the past technical trading rules and their performance were seen skeptical. This is substantiated by the acceptance of the efficient market hypothesis and mixed empirical findings about technical analysis in widely cited studies.

The flag pattern is seen as one of the most significant spread chart patterns among the stock market charting analysts. The present research validates a trading rule based on the further development of flag pattern recognition. The research question concentrates on whether technical analysis applying the flag pattern can outperform an index focusing international stock markets. The markets observed are represented by the corresponding indices DAX (Germany), S&P and DJIA (United States) and IBEX (Spain).

The design of the trading rule presents several changes with respect to previous academic works: The wide sample used when considering intra-day data together with the configuration of some of the variables and the consideration of risk allows concluding that the trading rule provides greater positive risk-adjusted returns than the buy and holding strategy which is used as benchmark. The reported positive results strengthen the robustness of the conclusions reached by other researchers.

Keywords: trading rule, pattern recognition, technical analysis, bull flag.

Introduction

Chart pattern studies examine the forecasting probability of visual chart patterns commonly used by technical analysis. In the academic literature different markets are analyzed with pattern recognition, e.g. stock markets and foreign exchange markets. Besides varying markets to be analyzed, pattern recognition and the profitability of pattern recognition differ depending on the methodology applied.


Lo et al. (2000) test the usefulness of 10 chart patterns on a large number of NYSE/AMEX and NASDAQ (Nasdaq Composite Index) stocks from 1962-1996. Applying smoothing techniques such as nonparametric kernel regression, their methods suggest that technical analysis can be improved by using automated algorithms. Further they detected that traditional patterns such as head-and-shoulders and rectangles do not have to be optimal. Lo et al. obtain positive results and conclude that technical analysis can add value to the investment process.
Caginalp and Laurent (1998) provide a study about S&P 500 stocks over 1992-1996. The found out that candlestick reversal patterns generate substantial profits in stock markets compared to a buy-and-hold strategy.


Leigh, Paz et al. (2002) test the bull flag charting heuristic for trading the NYSE Composite Index for 4,817 trading days in a test period from 1980-1999 applying various time hori- zons. Statistical results fail to confirm the null hypothesis that the markets are efficient respectively to the weak form of the efficient markets hypothesis. The results are supplied for a long time period. Thus, parameter optimization and out-of-sample tests are conducted and data snooping problems addressed.

Leigh, Purvis et al. (2002) conduct four experiments combining pattern recognition, neural network, and genetic algorithm techniques to forecast price changes for the NYSE Compo- site Index. The first experiment focuses on recognizing the bull flag with pattern recognition and underlies the same methodology as in Leigh, Paz et al. (2002). Within their exper- iments Leigh, Purvis et al. detect the decision support potential of the new soft computing tools respectively the application of multiple tools and the power in multiple classifier sys- tems. The results of their work support the effectiveness of the technical analysis approach through use of the bull flag price and volume pattern heuristic.

Wang and Chan (2007) analyze the potential profit of bull flag technical trading rules for the NASDAQ and the TWI (Taiwan Weighted Index). They use a template matching tech- nique based on pattern recognition and obtain positive results: All technical trading rules correctly predict the direction of changes in the NASDAQ and TWI. These studies show that charting patterns can predict stock prices.

There are also studies which obtain negative results with regard to the profitability of pat- tern recognition as Cucio et al. (1997), Guillaume (2000) and Lucke (2003) which focus on foreign exchange markets.

To summarize, the success of pattern recognition techniques is strongly dependent on mar- kets observed, sample periods tested and patterns applied. Previous studies have shown that the forecasting probability of technical analysis can be improved by conducting parameter optimization, out-of-sample-testing and addressing of data snooping problems.

**Hypothesis and goals**

The present research builds on empirical findings of previous research following the objective to prove that flag pattern recognition is a profitable forecasting method for different international stock markets. This objective will be achieved mainly by quantitative research, supplemented by a qualitative literature review.

In the course of qualitative investigations, previous technical analysis studies will be examined. This theory-driven part should serve as overview of today's reputation of technical trading strategies pointing out whether technical trading rules are able to outperform a chosen benchmark. In this sense, a research gap will be identified which is to be closed within the practical part of the research.

The practical part will be implemented by quantitative research. In the foreground is the further development and optimization of existing pattern recognition methods with regard to the flag pattern. Thus, returns provided by trading rules based on pattern recognition will be analyzed in depth. Some
relevant changes will be realized in a way that the results, analyzed as a whole, allow to validate the flag pattern in a more consistent and robust way.

**Methodology**

The introductory part of the present research project is descriptive since an analysis of previous research will be done to get an overview about studies done so far in this area. The focus will be set on the profitability of pattern recognition on stock markets. The general idea is to find out in which direction the trend goes. A systematic literature review of analyzed studies will be created and relevant criteria implemented.

The practical part of the work is quantitative. It concentrates on pattern recognition applying the bull flag template for figuring out buy and sell signals. Inspired by previous publications of Leigh, Modani et al. (2002), Leigh, Paz et al. (2002), Leigh, Purvis et al. (2002) and Wang and Chan (2007) a 10x10 grid matrix with weights ranging from -5 to 0 will be implement. Since the selection of weights within this matrix is essential, an alternative definition of weights and an alternative grid matrix are proposed. Further the matrix contains an IF-THEN rule what differs from academic research in this area done before.

In a next step the trading rule specification is implemented. Based on daily and intraday returns for the DAX, S&P, DJIA and IBEX statistical analysis will be performed and algorithms programmed to forecast future markets prices on these stock markets. The focus will be on the bullish and the bearish flag likewise taking into consideration an important modification of the bullish flag. Further, not only daily returns, but also HFT will be considered and not only closing prices, but also the body of each candlestick will be taken into account. Finally, more than 120,000 candlesticks will be included for each index.

**Conclusions**

All previous chart pattern studies analyzed so far have in common that daily returns are used by the researches. In this context the question arises which return to chose (opening, closing, highest, lowest). Some studies work with candlesticks to include the development of prices within a trading day (e.g. Marshall, Young and Rose (2006), Horton (2009)). The present research goes one step further and analyses intra-day data applying candlesticks. This ensures that a trading day is displayed in a high degree of detail.

When implementing the flag pattern approach, researchers build a 10x10 grid matrix allocating weights into the cells. So far, the idea of the weight allocation is to construct a consolidation phase which is followed by a break out. Following the definition of Downes and Goodman (1998) a more accurate reflection would be achieved by assuming the break out first and the consolidation afterwards. In the present research, this is put into practice by allocating the weights in a different way than done in previous research.

Further, in previous research a lack of dynamic approach can be observed. Therefore the idea is to implement stop loss and take profit thresholds. In this way, the whole approach is IF-THEN rule related which is closer to investor’s behaviour.

The last aspect which is subject to further development is the consideration of risk. In the past the approach was often not risk-adjusted. Mostly it was reasoned in using a broad based market average which made the adjustment for risk of individual securities unnecessary (as Leigh, Modani and
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Hightowera (2004)). Some authors conducted out-of-sample- tests (as Charlebois and Sapp (2007)). The present research intends considering the risk component by using the maximum drawdown.

References


