Construction of currency portfolios by means of an optimized investment strategy

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A R T I C L E   I N F O

A B S T R A C T

This work focuses on the development of a technical breakout trading strategy based on the Donchian Channel approach, aiming to the construction of profitable portfolios. In this direction, the Modified Renko Bars (MRBs) were developed first; that proved to be a useful trading tool that responses more accurately than the normal candle sticks to the nature and characteristics of the FOREX market. Subsequently, the parameters of the trading strategy (or system) are calibrated for eight currency pairs, over a period of four years (2006–2009), by comparing the performance of three global search derivative-free optimization algorithms. Then, the returns of the developed system are tested for the next seven years (2010–2016) for each pair and two types of portfolios are constructed; an equal weighted one and a portfolio based on the Kelly criterion. The ultimate objective of this paper is to create currency portfolios based on a novel optimized trading strategy, which could beat constantly the main investors' benchmarks (i.e. S&P500, Barclay CTA Index).

1. Introduction

The ultimate objective of any investor, trader or manager is to speculate, to generate profits in a consistent basis. Simsek [27] assumed that any financial innovation on portfolio risks is likely to lead to speculation rather than risk sharing due to the motives of the participants in market. An approach that can be implemented in order to maximize profits and simultaneously to minimize the risk of loss, is to define specific rules for buying and selling securities; rules that will be able to predict accurately the future movements of the market. These rules formulate the so-called trading strategy or system. The most common trading strategies are based on fundamental or technical analysis; this work is focused on technical trading strategies that rely on the assumption that historical data can create patterns that repeat themselves in the future.

According to a top technical analyst (Ping [[25], p.2]) the technical analysis is defined as follows: *"The technical approach to investment is essentially a reflection of the idea that prices move in trends that are determined by the changing attitudes of investors toward a variety of economic, monetary, political, and psychological forces. The art of technical analysis, for it is an art, is to identify a trend reversal* at a relatively early stage and ride on that trend until the weight of the evidence shows or proves that the trend has reversed."

The prediction of market's future movements became an important research topic for academicians into a theoretical basis and a challenging task for investors in practical level. One of the earliest empirical studies in this field is the one by Donchian [7] who presented the movement of the market as a channel approach focusing on the breakouts of these channels. Apart from this approach, there is a plethora of technical strategy types. Among others, trading systems that include filters were introduced (Fama and Blume [8]; Sweeney [29]), strategies that focus on the moving averages were presented (Cootner [4]; Dale and Workman [6]) and strategies based on the relative strength were studied (Jensen and Benington [13]). One of the most significant studies on this field was carried out by Brock et al. [3], who strongly supported the efficiency of technical strategies. They tested two simple technical strategies (moving average and range breakout) in Dow Jones Index in their study and using the model-based bootstrap approach they conducted statistical tests on the trading returns. A few years later, Bessembinder and Chan [2] confirmed the research outcomes presented by Brock et al. [3] and provided further support to the technical rules, indicating that they can predict the movement of the market and particularly those of the US Equity Index. In another research, Taylor [30] indicated that technical trading approach and specifically the channel style when applied to currencies can lead

to profits, having also remarkable forecasting ability when the market follows almost random walk. Menkhoff and Taylor [21] tried to explain the continuously rising use of technical analysis and its apparent profitability. Among their arguments, they sustained that technical analysis could fit to the foreign exchange market due to not-fully-rational behaviour of the market and it might provide information on foreign exchange movements that cannot be explained through fundamental analysis. Gehrig and Menkhoff [11] also underlined the importance of technical analysis into the world of investment; especially they mentioned that it is by far the most important tool when dealing with FX and is rated second in the field of fund management. Later, Osler [23] showed that technical trading strategies can represent rational long run balance given the structure of the currency markets and traders' motivations. Relying also on the relationship between technical analysis and the FOReign EXchange (FOREX) market, in a recent study by Smith et al. [28] it was found that during high-sentiment periods, the use of technical analysis provided an edge to the hedge funds that helped them to succeed higher performance with superior market-timing ability and at the same time achieve lower risk to their investments. Another study that focused on FOREX market was by Novotný et al. [22]. They investigated a strategy based on price jump and indicated how price jumps carry a tradable signal for all currencies.

Back to real life, the experiment performed by Richard Dennis is considered as a unique example representative of the obsession related to trading and the feverish effort to generate profits. Covel [5] described in his book entitled "*The Complete Turtle Trader*" that in mid-1983, the famous commodity trader Richard Dennis conducted an experiment aiming to prove that he could teach people how to become great traders. In order to prove his belief, he published an advertisement in Barron's, the Wall Street Journal and The New York Times seeking to recruit and train people (Michael W. Covel, was one of them). According to the experiment Richard Dennis provided the trainee traders with real accounts in order to trade. These trainee traders were called as "*Turtles*" and Dennis taught them a trend-followed system based on a channel approach. The "*Turtles*" succeeded to earn an aggregate sum of over $100 million dollars in the next four years and became the most famous experiment in trading history.

Another actual example is the one by Professor Josef Lakonishok [18], who supported that value strategies can beat the market. Based on his study, Lakonishok decided to apply his theoretical research in real-world trading practice and turn it to an almost $70 billion dollars practice. His strategy is focused on identifying valued shares before the market recognize them. To succeed that, he proposed a system that uses valuation ratios such as price-to-book or price-to-sales and searches for companies with ratios relatively lower than their peers. Then, his system tries to identify possible entry points based on the price momentum of the last six-month period.

As Pardo [24] indicated in his book "*The Evaluation and Optimization of Trading Strategies*" the first step into trading strategy design process is the formulation of the trading strategy while another extremely crucial step is the optimization of that strategy. Optimizing the trading rules is extremely important, since actual traders are likely to choose the best-performing rules in advance. The work by Jensen and Benington [13] is considered as the forerunner study in this direction, they followed an optimization and out-of-sample validation procedure for improving the performance of relative strength index based strategies. Later, Marshall et al. [20] tried to answer if commodity futures can be traded profitably with quantitative timing strategies and to find the most suitable trading rules for each commodity in order to provide statistically significant profits. Fisher [9] in his book "*The logical trader*" introduced the ACD Rules and Pivot Point System, that provided specific

entry levels for buying and selling based on the opening range of virtually any security. Tian et al. [31] attempted to optimize the rules of ACD system in an intraday basis in order to ameliorate its performance in Chinese future market. Foltice and Langer [10] focused on the creation of a momentum strategy, which could be found appropriate for an individual investor. They developed and calibrated a simple strategy, which succeeded to outperform its benchmark and it required a small initial capital.

The main objective of this study is to develop an empirical technical trading strategy, which could be applicable to the financial markets and lead to the construction of profitable portfolios. This strategy follows a channel breakout approach based on the study by Donchian [7]. The portfolios that are formed in this work are based on the currency market. Barroso and Santa-Clara [1] proved that the exposure to currency can lead to portfolios with significant higher Sharpe ratio. The strategy developed in the current study is combined with the Modified Renko Bars (MRBs); a trading tool which responses more accurately than the normal candle sticks to the nature and characteristics of the FOREX market. Aiming to create an edge to the investor and to develop a profitable portfolio, an optimization problem is formulated and solutions are carried out. The optimization stage focuses on the calibration of the system for eight FOREX pairs (GBP/USD, USD/JPY, NZD/USD, AUD/USD, EUR/USD, USD/CAD, GBP/JPY and EUR/JPY) using three global search derivative-free optimization algorithms; a Swarm Optimization one called Pity Beetle Algorithm (PBA) along with the DIvide a hyperRECTangle (DIRECT) and Multilevel Coordinate Search (MCS) algorithms. Then, optimized strategy is tested to the specific pairs and based on the returns obtained two kinds of portfolios were constructed; an equally weighted portfolio and a portfolio based on Kelly Criterion. Finally, the performance of the portfolios is assessed based on common and widespread evaluation measures (arithmetic mean, geometric return and sharpe ratio) and then they are compared with well-known benchmarks (S&P500, Barclay CTA Index). Thus, the proper question that can be stated is "*how can a profitable currency portfolio be made based on a specific trading system?*" This is the question that is answered in this study.

2. Creation of an adaptable to market conditions strategy

In order to answer the question of how a trading strategy can be mostly profitable, it is required to comprehend what makes a strategy not profitable in the long run. Creating a strategy that would be profitable for a small time horizon is rather easy to implement, if not needless. The objective of this study is to develop a trading tool, which will be proved efficient and reliable in the long run. Through a preliminary research and common trading sense, two are the factors that affect mostly the performance of a trading system. The first one is related to the amount of risk that a specific trade involves. The risk itself cannot be meaningful; however, it can become useful to answer the question of how determining if a strategy or better the trades that a strategy generates are valuable to be followed or not. In order to measure the risk of a trade effectively, it needs to be correlated to the potential reward that this trade can generate. In other words, the first factor that is used in the current study is the so-called Risk/Reward Ratio (RRR) where risk and reward are associated. This ratio is calculated by dividing the amount the trader consents to lose if the market moves in the opposite direction of his position (risk) by the amount the trader expects to earn if the price moves in the same to his position (reward) direction. Thus, if a strategy generally generates trades that risk more units and return less, then the chances are not with the trader. In this specific example, the winning trades should be far more than the losing ones in order for the outcome to be positive. This phenomenon might be easily