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An improved moving average technical trading rule☆

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HIGHLIGHTS

- The suggested approach uses a threshold which acts as a dynamic trailing stop.
- This modification increases the cumulative return and Sharpe ratio of the investor.
- It results in smaller maximum drawdown and drawdown duration.

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ABSTRACT

This paper proposes a modified version of the widely used price and moving average cross-over trading strategies. The suggested approach (presented in its 'long only' version) is a combination of cross-over 'buy' signals and a dynamic threshold value which acts as a dynamic trailing stop. The trading behaviour and performance from this modified strategy are different from the standard approach with results showing that, on average, the proposed modification increases the cumulative return and the Sharpe ratio of the investor while exhibiting smaller maximum drawdown and smaller drawdown duration than the standard strategy.

1. Introduction

The use of averages underlies all attempts of empirical modelling and the use of moving averages, in particular, has a long and distinguished history in smoothing and forecasting at least from the time of the publication of the book of Brown [1]. Moving averages form the simplest statistical construct that is widely used in trading the financial markets of all types, foreign exchange and equities more than others, in a variety of different interpretations of trading strategies (or rules). The purpose of this paper is to propose a modification to the standard cross-over strategy, based on prices & moving averages, that enhances its performance along all evaluation measures, providing (on average) higher cumulative returns, higher Sharpe ratios and lower drawdowns.

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Moving averages are a staple in the arsenal of tools in technical analysis trading and their properties and efficacy have been considered in many previous academic studies[2] some of which we discuss below. Brown and Jennings [2] is an early reference from economists on technical analysis. Brock et al. [3] examine some simple technical trading rules and associate them with the properties of stock returns while Neely [4] provides a review of technical analysis (with emphasis on moving average rules) in foreign exchange markets and LeBaron [5] examines the profitability of technical trading rules and foreign exchange intervention. Neely and Weller [6] provide further discussion on Neely's earlier paper. Lo et al. [7] have a comprehensive review of technical analysis, that includes the use of moving averages, where they try to provide some underlying statistical foundations to technical analysis trading rules. Vandewally et al. [8] analyse the use of moving averages from a physicist perspective and more recently, Okunev and White [9], Nicolau [10], Faber [11], Friesen et al. [12], Harris and Yilmaz [13], and Zhu and Zhou [14] have interesting theory and applications that are based on moving average technical trading rules. Okunev and White [9] examine the profitability of moving average-type rules, and the reasons behind it, in currency markets. Nicolau [10] and Zhu and Zhou [14] develop continuous time models that are used to explain various aspects of behaviour of moving averages; the latter paper is particularly interesting since it shows how to optimize a moving average approach for asset allocation. The same underlying intuition, with the application but without the theory, underlies the work of Faber [11] which is concerned with the use of moving averages as 'market timing' instruments. His main concern, from a practitioner's perspective, is whether a simple, 200-day moving average, price cross-over strategy can be used to avoid the pitfalls and large drawdowns of the buy & hold strategy—and subsequently be used in an asset allocation framework. Friesen et al. [12] discuss reasons and explanations behind trading rule profitability, including 'confirmation bias' and show how certain price patterns arise and lead to certain autocorrelation structure. Finally, Harris and Yilmaz [13] examine whether a smoothing approach can be used profitably in foreign exchange trading, by comparing moving average rules with the use of the Hodrick–Prescott [15] filter and kernel smoothing. There are many more academic references on the use and profitability of technical trading rules, beyond moving averages, whereas the above short list is mainly aimed on some papers that used smoothing methods for trading.

The modification that we propose in this paper is simple, intuitive, has a probabilistic explanation (based on the notion of 'return to the origin' in random walk parlance) and can easily be implemented for actual applications. It consists of a rule that relates the current price of an asset with the price of the last 'buy' signal issued by a moving average strategy (making this latter price a dynamic threshold) and it works as a dynamic trailing stop. We present a 'long only' version of the strategy but the adaptation to both long-and-short trading is immediate. We further discuss this modification in the next section. We present comparative results on the performance of the modified strategy on the Dow Jones index, the S&P500 index and the EUR/USD exchange rate. We use the latter currency in order to show the wide applicability of the strategy. Our results support the proposed modified strategy and show that considerable performance improvements can be effected to the standard cross-over rules.

The rest of the paper is organized as follows: in Section 2 we present our methodology; in Section 3 we discuss our data; in Section 4 we have the main discussion of our empirical results while in Sections 4.1 and 4.2 we comment on a variety of secondary series; in Section 5 we have a brief discussion on the choice of moving average type, length of the moving average and other implementation issues; Section 6 has some concluding remarks and prospects for further work.

2. Methodology

2.1. Trading strategies

Consider the (closing) price $\{P_t\}_{t\in\mathbb{N}_+}$ of an asset and let $M_t(k)$ denote the kth period[3] backward moving average, that is:

$$M_t(k) \stackrel{\text{def}}{=} \frac{1}{k}\sum_{j=0}^{k-1} P_{t-j}. \tag{1}$$

The moving average is one of the most frequently used indicators in trading strategies. Two of the easiest and most popular such strategies are based on a price cross-over and on moving averages cross-over. The first strategy issues a 'buy' signal when the price of the asset crosses above the moving average while the second strategy issues a 'buy' signal when a faster moving average crosses above a slower moving average; 'sell' signals are defined in the opposite direction. If the strategies are 'long only' ones then an 'exit' signal (usually reverting to a risk-free asset) is issued. We are going to be concerned with such 'long only' strategies so that the signals are binary.[4] The signal variable based on a price cross-over is defined as follows:

$$S^P_{t+\tau}(k) \stackrel{\text{def}}{=} \begin{Bmatrix} 1 & \text{while} & P_{t-1+\tau} \geq M_{t-1+\tau}(k) \\ 0 & \text{while} & P_{t-1+\tau} < M_{t-1+\tau}(k) \end{Bmatrix} \tag{2}$$

2 The literature on technical analysis from the practitioners' perspective is huge and cannot possibly be reviewed here.

3 Sometimes called the 'look-back' period.

4 It is straightforward to use all material that follows with sell signals as well but, as in Ref. [11], we assume that the investor exits the market and stays with a risk-free asset; in the present analysis we focus on the differential performance among strategies and we assume that the risk-free rate is zero.