

# **The Profitability of Moving Average Trading Rules in the JSE Top 40 (Research Proposal)**

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# 1 Introduction

A study by Lo (2004) highlighted interesting aspects in testing technical analysis trading rules in emerging markets. The study found that emerging markets have developing financial systems that could result in lower levels of the Efficient Market Hypothesis (EMH) or even market inefficiencies. Sobreiro *et al.* (2016) investigated the results found by Lo (2004) for the main stocks of the BRICS and emerging economies and his findings were that, for some countries, there is a combination of periods of moving average trading rules that generated better outcomes. This study seeks to extrapolate on the findings by Sobreiro *et al.* (2016) to analyse the South African capital market specifically using the Johannesburg Stock Exchange (JSE) Top 40 Index values to determine whether moving average trading rules can be used to produce returns in excess of those achieved from a passive buy-and-hold strategy. Furthermore, the study will examine if there are significant differences in the results if transaction costs are taken into account. Ultimately, inferences on the efficiency of the JSE will be drawn from the overall results of the study.

## 2 Primary Research Question

It is imperative to strictly define the research question so that the results of this study provide useful information to be used for further research. The primary research question of interest in this study is as follows:

*"The Profitability of Moving Average Trading Rules in the JSE Top 40."*

South Africa is one of the BRICS emerging markets and according to a paper by Sobreiro *et al.* (2016), it was found that since emerging markets have fairly developing financial systems, they are likely to exhibit lower levels of market efficiency than countries with developed financial systems. Therefore, the weak

form of the Efficient Market Hypothesis (EMH) or possibly some levels of inefficiencies may apply to these economies. Results from past literature like that of Jefferis and Smith (2005) infer that the JSE closely resembles a weak form efficient market, however, there is still a significant amount of literature that is inconclusive on the efficiency of the JSE for example the study by Thompson and Ward (1995). If there is a possibility that South African stock markets exhibit some level of inefficiencies, this allows technical analysts to form strategies to trade on these market inefficiencies in order to generate excess returns (positive alphas) relative to the market. To assess whether the latter is possible, this study will assess whether different technical trading rules (specifically moving averages in this study) can be used on index values (the JSE Top 40 in this study) to achieve returns in excess of those achieved by holding a market portfolio.

## **2.1 Secondary Research Questions**

Along with the primary research question, there are additional questions to be considered in order to effectively structure and answer the primary research question.

- *Are South African capital markets efficient?*

This will help us determine if there is an opportunity for the effective application of technical analysis in SA capital markets. It would also be worthwhile investigating the efficiency of markets in emerging economies in general. Past literature that has considered the topic will be consulted.

- *What is Technical Analysis in general?*

It will be useful to investigate the history of technical analysis and how it has been used in other markets.

- *What are the different forms of Moving Average (MA) trading rules and their suitability?*

Moving average trading rules are commonly used in practice for technical analysis. For this study, different moving average trading rules will be explored and these will be assessed to determine which are suitable for application in the SA market. However, careful attention must be given for the selection of parameters for the specific trading rules for their optimisation.

- *How is the profitability of Technical Analysis measured?*

Relevant and unbiased profitability measures need to be investigated to contrast the use of moving average trading rules against a passive buy-and-hold strategy.

- *The effect of transaction costs on the profitability of Technical Analysis*

It will be worth assessing if the profitability of moving average trading rules changes after factoring in transaction costs.

- *Why is the JSE Top 40 index being considered and not some other index?*

The Top 40 index represents the forty largest companies which are constituents of the JSE All Share Index, ranked by full market capitalisation. This index can be used as a benchmark to measure the South African stock market. It is a reasonable representation of the movements in the South African stock exchange as it represents approximately 80% of the total market cap of all JSE listed companies (JSE, 2017).

### **3 Literature**

A number of studies have been published on the proposed research question and its components and these will be consulted throughout the development of the research paper.

In a study by Gunasekarage and Power (2001), the profitability of moving average trading rules in the South Asian stock markets is examined. The study considers if a simple trading rule based on a comparison of average returns over a short and a long period can outperform a passive buy-and-hold strategy. However, it is noted that the latter is not possible under the Efficient Market Hypothesis (EMH) and the study further tests the EMH using data from four emerging equity markets in South Asia. Indices for Bangladesh (DSEALL), India (BSENAT), Pakistan (KSE100) and Sri Lanka (CSEALL) were used over a 10.25 year period from January 1990 to March 2000. The study uses two types of moving average techniques which are the Variable Length MA (VLMA); and the Fixed Length MA (FLMA). The VLMA signals a buy (sell) signal when the short MA is above (below) the long MA by an amount greater than a band under consideration. However, the FLMA signals a buy (sell) when the short MA cuts the long MA. The results of the study revealed clear evidence that the equity returns in the markets under consideration (except India) were predictable and thus the null hypothesis that the average return across different technical rules considered is equal to passive buy-and-hold return was rejected. The study by Gunasekarage and Power (2001) will be helpful for this study since it considers the proposed research question but in a different context. Also, the South Asian markets considered are emerging which is something they share in common with the South African market, however, the level of comparability of the study with South African market needs to be carefully considered.

The second piece of literature considered in this study is that of Sobreiro *et al.* (2016) which assesses the profitability of moving average trading rules in the main stocks of BRICS (Brazil, Russia, India, China and South Africa) and other emerging stock markets for the period 2000 – 2015. The results of the study show that, for some countries, there is a combination of periods for moving averages producing better outcomes. A computational experiment was executed using the closing prices of the BRICS and emerging markets main stocks obtained from Bloomberg and its performance was compared with the buy-and-hold strategy. The study makes use of combinations of the Simple Moving Average (SMA) and the Exponential Moving Average (EMA) to form trading strategies. These moving averages are commonly used in practice to generate buy and sell signals. The SMA and the EMA are defined as follows:

$$SMA_n = \frac{1}{k} \times \sum_{t=n-k+1}^n P_t$$

Where:

$k$  is the number of periods included in the *SMA* calculation;

$n$  is the relative position of the current period observed; and

$P_t$  is the closing price of the stock in the  $t$  period

$$EMA_n = \left( \frac{2}{k+1} \right) \times P_{t-1} + \left( 1 - \left( \frac{2}{k+1} \right) \right) \times EMA_{n-1}$$

Where  $k$  and  $n$  are defined as in the SMA definition and:

$P_{t-1}$  is the closing price in the previous period; and

$EMA_{n-1}$  is the EMA calculated in the previous period.

It is worth noting that the Exponential moving average (EMA) is more useful in identifying markets trends than the SMA.

The Moving average trading signals constructed in the study by Sobreiro *et al.* (2016) are as follows:

*Buy:* when the short MA crosses the long MA from below; and

*Sell:* when the short MA crosses the long MA from above.

All possible combinations between the two identified MAs (SMA-SMA, EMA-EMA, and SMA-EMA) were tested in order to create trading orders.

The performance of each trading technique was assessed by a reward-to-risk ratio using the average return and the standard deviation on each stock. A second measure, relative average deviation (RAD) which represents the distance of each result from the best known value was used to compare the results obtained by the MA rules with the buy-and-hold strategy. The MA rule with the smallest value for RAD was considered to be the best.

The results of the study show that in all countries except Brazil, China, India, and South Africa, combination SMA-SMA generated a better performance. However, using RAD analysis, the combinations EMA-EMA and SMA-EMA had lower performance in the studied stocks. The EMA-EMA performed better in the Indian and South African stock markets whereas the SMA-EMA combination only exceeded the other combinations in the stock markets of Brazil and China. The study reveals a lower level of efficiency of the studied MA strategies compared to the buy-and-hold strategy which stands out in the Jamaican stock market.

However, the MAs generated returns in excess of the buy-and-hold strategy in markets like Argentina and Peru.

The study identifies that for some countries, there are distinguishable differences in patterns depending on the parameters used for long and short MAs which can lead to better outcomes. Therefore, strategies that fit the data under consideration

more precisely have a larger quantity of higher returns as they eliminate more excess market noise. Ultimately, the study finds that emerging markets can have unique levels of efficiency and technical indicators for the application of moving averages in trading strategies to produce excess returns in these markets. As an overall conclusion, the study finds that moving averages are still beaten by the passive buy-and-hold strategy in most markets, with a few exceptions like Brazil, Russia and Argentina.

This study seeks to extrapolate on the findings of Sobreiro *et al.* (2016) to solely consider the South African market. A bigger set of moving average methods (including those used in Sobreiro *et al.* (2016)) and their combinations will be considered to generate more complex trading rules specific to the South African market. Different time periods may also be considered to assess how the technical indicators behave in different economic conditions (see Section 4). Also, something of interest to this study that was not considered in the study by Sobreiro *et al.* (2016) is the effect of transaction costs on the performance of the trading rules against the passive buy-and-hold strategy.

### **3.1 Additional Literature to be consulted**

In addition to the preceding literature, the following literature is going to be consulted for the formal literature review:

A study by **Jefferis and Smith (2005)** will be consulted to investigate the changing efficiency of African stock markets. The foundations of Technical analysis will be investigated in **Lo, Mamaysky, Wang (2000)**. A paper by **Hatgioannides and Mesomeris (2007)** investigates the returns generating process and the profitability of trading rules in emerging capital markets in Latin America and Asia. **Appiah-Kusi and Menyah (2003)** assesses the return predictability in African stock markets which will be useful for this study.



## 4 Methodology and Data

This study is going to make use of the daily JSE Top 40 index values from 2000 – 2017 which will be obtained from the University of Cape Town Libraries Bloomberg terminal. The motivation for using the period 2000 – 2017 is from the study done by Sobreiro *et al.* (2016) which used the period 2000 - 2015 for its analysis. An important consideration worth exploring is splitting the data into two time frames to assess the possible variation in our results before and after the 2007/2008 Financial Crisis to assess the effect of different economic conditions.

The methodology of this study is going to be based on constructing a number of trading rules using the combination of different types of moving averages identified in consulted literature. These are then going to be applied on the JSE Top 40 to compare their performance against a passive buy-and-hold strategy for the index. The Simple Moving Average and the Exponential Moving Average are of particular interest to this study since these are commonly used in practice for buy and sell indicators. However, more moving averages are going to be considered in this study for specific application in the South African market. The length of the period for the moving averages that are going to be used is also important, therefore, the parameters for short and long moving averages will be carefully considered in order to optimise the performance of the moving average trading rules.

This study will make use of risk-adjusted returns to compare the performance of the different trading rules with a passive buy-and-hold strategy. One example of a risk-adjusted return is the Sharpe ratio, which measures the average return earned in excess of the risk-free rate per unit of risk with a greater ratio meaning a better risk-adjusted return. Another example is Alpha, which is the active return earned on an investment and measures the excess return of an investment relative to the return on a benchmark (usually the overall market).

Furthermore, this study will assess the variability in the performance of these trading rules when transaction costs are taken into account.

## 5 Final Paper Structure

The proposed outline of the paper is as follows:

- 5.1 Abstract**
- 5.2 Introduction**
- 5.3 Background or Theory**
- 5.4 Methodology and Data**
- 5.5 Results**
- 5.6 Discussion and Conclusions**
- 5.7 References**
- 5.8 Appendices**

## 6 Timeline

In addition to meetings with the supervisor which are arranged by appointment, these are the proposed deadlines to ensure the research project develops smoothly.

<b>22 May 2017</b>	Write up basic literature review outline
<b>29 May 2017</b>	Hand in first draft of literature review to supervisor
<b>05 June 2017</b>	Second draft of literature review
<b>12 June 2017</b>	Submission of Literature review
<b>July/August Vacation</b>	Start working on draft paper
<b>11 September 2017</b>	Submission of Draft paper
<b>16 October 2017</b>	Draft paper feedback from supervisor
<b>06 November 2017</b>	Submission of Final paper

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