Gordon Institute of Business Science
University of Pretoria

# Headline differences between sector valuations on the Johannesburg Stock Exchange: Market timing opportunities

Rinay Bhownath
Student Number: 16391472

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# ABSTRACT

Methods to derive cumulative annual returns (CAR), from stock markets, in-excess of passive buy and hold strategies are popularised in modern culture. Market timing is a proven and systematic method applied by investors to achieve significant CAR. This study investigated the performance of market timing strategies on the JSE by quantitatively assessing the performance of headline differences in sector valuations, as an initiator to switch between a risky and risk-free asset classes. Performance was assessed by calculating each portfolio's CAR. Switching triggers were generated using historic daily closing share price data and dual data analysis was completed to determine each portfolio's CAR.

Nine JSE industry indices were investigated for use as equity asset classes (risky asset). Daily closing share price data was collected for seven JSE industry indices (J510, J520, J530, J540, J550, J560 and J590) from 1995-2017, J580 from 1960-2017 and from 2002-2015 for the J500. This study calculated maximum CAR possible for each of the nine indices and were found to be within the range 36.7% to 62.4% with a 100% forecasting accuracy. This was out of reach for normal investors. However, the forecasting accuracy required to outperform the associated buy and hold strategy ranged from 80.5% to 87.45%. The key finding being the sizeable CAR possible with associated forecasting accuracies.

To further expand the applicability of this research to investors, two market timing strategies were investigated using a simple ten-month moving average approach. Two riskless assets were examined, being bond (ALBI) and a conservative money market fixed deposit. After including transaction costs (2% per asset switch), four out of nine equity/bond market timing strategy outperformed the associated buy and hold strategy. An equity/bond market timing strategy for the J590 (24% CAR) portfolio beat the associated buy and hold strategy by 13% CAR. Further sensitivity analysis calculated the detrimental effect of high transaction costs and the enhanced CAR of the equity/money market timing strategy with higher fixed deposit rates.

This study further provides evidence of market predictability specifically, short term predictability using the ten-month moving average approach. It is recommended for an investor to adopt an equity/bond market timing strategy using the J590, which achieved the highest CAR over the investigated period. Limitations of this study include inherent look ahead bias and ignoring of taxation.

# KEYWORDS

Market timing, JSE, stock, return, portfolio.

# DECLARATION

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination at any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

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Rinay Bhownath Date

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# CHAPTER 1: INTRODUCTION TO RESEARCH PROBLEM

Methods to derive cumulative security fund returns to outperform the market benchmark are popularised in modern culture and is the main aim of active fund managers (Cremers and Petajisto, 2009). Jeffrey (1984) argued that the risks of timing stock market movements over a long period outweigh the rewards. However, short term fluctuations can create disparities in the market, such as the South African president appointing two finance ministers in the space of three days (Wright, 2015). Scenarios such as these artificially prop up or undervalue certain sectors such as the financial sector, which may create buying and selling opportunities (market timing).

The aim of this study was to quantitatively determine the effectiveness of market timing strategies, utilizing the JSE sector valuations, with hypothetical stock portfolios, to yield returns in excess of the market benchmark return. The implications of using such a strategy, if successful, provide an analytical risk-adjusted approach to achieve sustained cumulative returns. These returns can be practiced by investors and reduce reliance on active fund managers that charge high administration fees and also reduce reliance on passive buy and hold strategies.

The loom of credit downgrading by US rating agencies of South Africa's economy to junk (C-rated) status shall see South African stock markets plummeting because of the withdrawal of foreign direct investment (FDI). A requirement of large FDI investors such as pension fund predicates BBB-rated investments or higher. Paradoxically, this makes South Africa a particularly attractive investment destination to active investors as the inevitable credit downgrade will necessitate higher risk adjusted returns. The evidence in this study was used to assess the effectiveness of using two market timing strategies and to assess the performance of both, based on JSE sector indices in the given time range. Having identified viable timing strategies, an investor or active fund manager shall benefit by utilizing such a strategy on the JSE to achieve superior returns over the market benchmark.

## 1.1 Background

The allure of trading securities on a stock market was to create portfolio returns greater than the market equity benchmark by employing the traditional philosophy of selling shares at a high price and buying at low prices (Baker and Wurgler, 2002).

The two primary methods of accomplishing excess returns are stock selection or factor timing (Cremers and Petajisto, 2009). Stock picking can be described as a systematic analysis performed to ascertain if a security will yield a superior return, relative to other securities with a comparable level of non-diversifiable risk (Wermers, 2000) and (Ferruz, Muñoz and Vargas, 2010). Factor timing, commonly referred to as market timing, is an attractive method as it removes human judgement or intuition and its performance can be retrospectively assessed quantitatively in each market.

Market timing can be defined as the practice of switching weights of portfolio per expected or predicted market conditions (Ward and Terbanche, 2009). While stock picking and market timing share similarities, the difference between the two strategies is that stock selection is associated with cross section return of securities whereas marketing timing is associated with a predicted security price movement (Wermers, 2002). Stock picking can be decomposed to a market timing strategy with 3 or less securities. The disadvantage of contemporary stock picking methods is the mathematical complexity associated with efficient models and difficulty to critically assess. Whereas market timing hinges on the theoretical premise that historic information is included in the share price of a stock and simpler mathematical models can be created, which leaves less room for error.

Stock picking and market timing essentially exploit the variability in the market, with variability associated with the dissemination of new information. This concept of the dissemination of information into the market is described by the efficient market hypothesis (EMH) and tested throughout the years (Fama, 1970, 1995). This was most recently discussed and tested by Burton and Shah (2017). The core idea being, information is readily available and instantly incorporated into share prices thus leading investors placing a premium for information, driving the EMH (Firer, Ward and Teeuwisse, 1987). The purpose of referring to dated work of Fama (1970) was to trace the theoretical roots of most modern market timing strategies from that seminal work. All historic information is programmed into stocks. Using historic share price information, potential market timing strategies can be assessed quantitatively and is devoid of other contemporary behavioural investment strategies.

Market timing's advantage of simplicity holds itself to a simple thought experiment. All things being equal, investors that keep their assets in market during bullish periods and removes it into safe, risk free investments during bear periods, achieve superior cumulative fund returns. In reality, when including transaction costs, efficiently timing

the market and choice of portfolio can lead to returns well below the market benchmark. These factors and others shall be assessed quantitatively in this study, to determine the viability of the use of headline differences in sector valuations on the JSE, as a market timing strategy.

### 1.2 The research purpose and objectives

This study investigated the performance of market timing strategies on the JSE by quantitatively assessing the performance headline differences in sector valuations, as an initiator to switch between a risky and risk-free investment. The initial literature review shall assess the theoretical basis of market predictability on the JSE. The performance of the created fund shall be based on the identification and quantification of headline differences in sector valuations on the JSE. These differences are used as an initiator to switch between a listed stock index and risk-free investment, to generate cumulative portfolio returns greater than the market benchmark.

The study shall aim to predict future stock movements using past stock price information to estimate future stock prices, as described by original researchers in the field such as Fama (1965), Jaffe and Mandelker (1976) and later by Fama and French (1988). Future stock prices shall be determined using momentum affects, detailed later, which has the benefit of being mathematically rigorous. The purpose of the research was not to investigate momentum effects, but to put forward the evidence to support the argument that a simple mathematical model can be created, using available share price information, to yield returns more than the market benchmark. This shall be achieved using a ten-month moving average technique supplemented by determining the maximum and minimum returns achievable, overlaid against the required timing accuracy.

The period performance of each constructed portfolio shall be measured against the respective buy and hold strategy. This study design supported adoption of research proposition investigating the use of headline differences in sector valuations on the JSE can be used in a market timing portfolio that outperforms the associated buy and hold strategy.

### 1.3 Research scope

This study shall operate within the scope of the JSE and further investigate two types

of market timing strategies as related to headline differences in sector evaluations. A range of portfolios shall be constructed and the accuracy of predication of movement between securities shall be assessed against the market benchmark for the same time, as well as a pure market timing method.

The JSE is a stock market in an emerging economy and has been in existence for over 100 years. This stock market was of interest in the current global financial environment because other developed countries' stock markets yield disappointing returns due to low gross-domestic-product projections. The JSE was chosen because of ease of access to historic share price information and was sufficiently mature, compared to other emerging markets such as Russia. This work has the added business benefit of ease of use by investors and can be supplemented in strategies employed by South African active funds managers.

### 1.4 Contribution to literature

Market timing, manipulation and prediction of stock performance for superior gain is extensively researched. Traditionally, industry sectors were used in sector rotation research by switching between non-correlated systems. Limited or no research was found detailing the use of industry sectors in a market timing strategy on the JSE.

This study further aims to extend the field of market timing by investigating the use of headline differences in JSE sector valuations or simply put JSE industry indices (previously unpublished) and assessing the performance of such a strategy against the market benchmark (buy and hold strategy).

An additional objective was to improve the methodology used to assess market timing strategies in literature by employing a parallel method rarely cited in literature. This method calculates the maximum and minimum achievable returns establishing the theoretical parameters; which will be overlaid against a simple market timing strategy that a seasoned investor can utilize. It is analogous to assessing the theoretical fuel efficiency of a light motor vehicle in perfect laboratory conditions and assessing its performance against the real-world terrain it operates in, melding the actual with theoretical assertions.

### 1.5 Applications to investors

Globally, the increase uptake of exchange traded funds (ETF) and the lowering demand for active fund managers signals a shift in investor confidence and endeavour for superior portfolio returns. ETF, a type of passive fund, essentially replicates and index and so provides an investor with a low-cost market related return.

New online low-cost trading platforms such as Satrix online and GT24.com make trading stocks easy and accessible to investors. Thus, further reducing the need for active managers.

The next logical step for an investor, with the advent of lower transaction fees and increased investor maturity, would be undertaking simple market timing strategies to outperform the associated passive investment strategy. This study further aims to provide an investor with an easy to use market timing strategy methodology and a recommended JSE index to utilize.

### 1.6 Study organisation

This research report was structured to provide a logical flow and this section provides an overview of the subsequent chapters. The aim of this study was to assess market timing strategies on the JSE, to achieve cumulative returns in excess of the market benchmark. The succeeding chapters build on prior research in support of the proposition, deriving research propositions, detail methodology, and provide evidence and subsequent discussion to critically assess the evidence against the literature, to draw a meaningful insights and conclusion. A further detailed chapter background is given next.

#### 1.6.1 Chapter breakdown

Chapter two details the literature review conducted. The arguments presented, supported by academic literature, are used to demonstrate the need for the research and refine the research problem as introduced in chapter one.

Chapter three builds on the preceding chapter by precisely defining the purpose of the research, including the research propositions. These propositions will be explored in subsequent chapters.

Chapter four lists the research methodology used in this study. The approach of Saunders and Lewis (2012) was used as a framework. This framework includes the approach, philosophy, strategy, type of research, time horizon, sampling techniques, unit of analysis, data gathering processes and analysis.

The results of data analysis are presented in chapter five. It shall include the sample set, quality of data including validity tests, results of data regression and statistical results.

Chapter six provides a discussion encompassing the data analysis, research propositions and academic literature. Insights shall be explored with in-depth data regression.

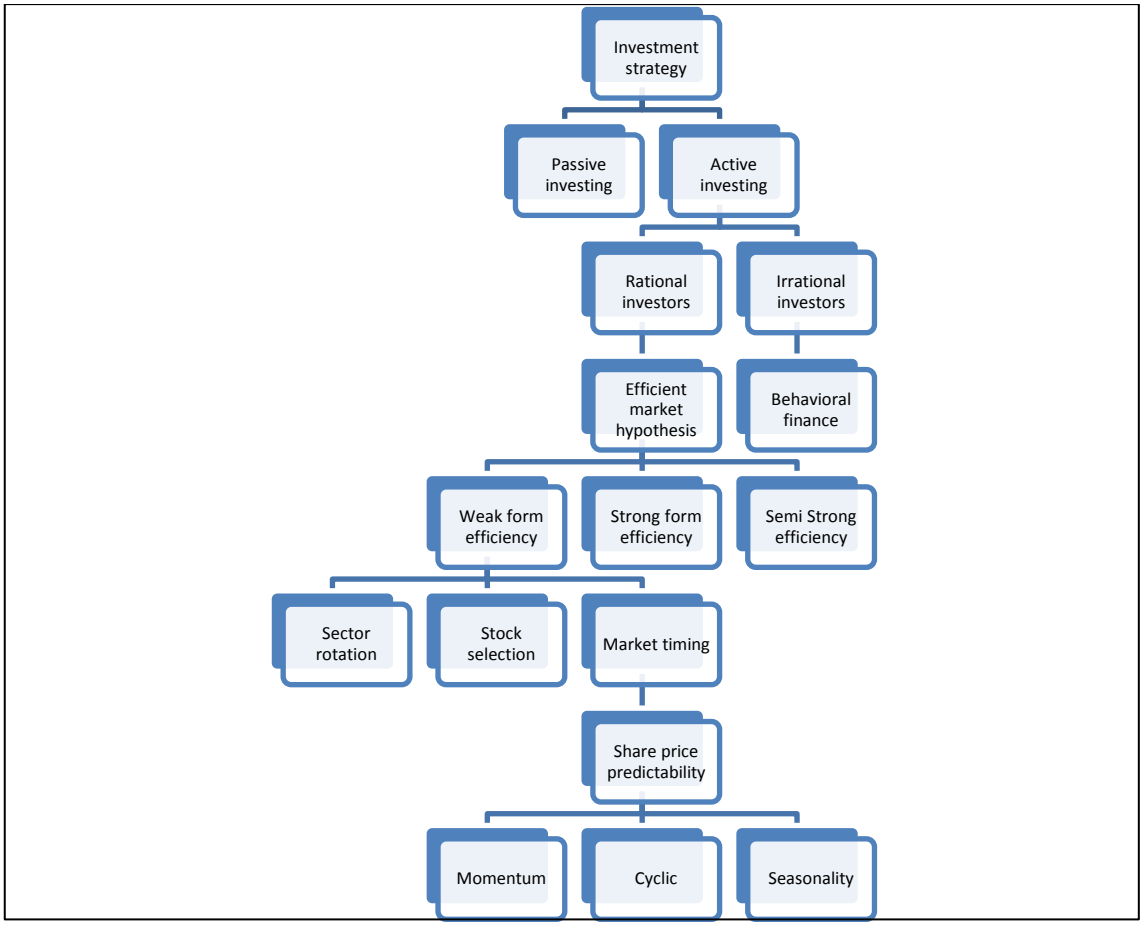
The final conclusions and recommendations of the research are detailed in chapter seven. The main findings of the research are presented, qualified with results presented and tempered with study limitations. Implications for investors are presented in conjunction with recommendations for future research.

# CHAPTER 2: LITERATURE REVIEW

Chapter two provides a detailed literature review of investment strategies with primary focus on market timing. This was used to assess the viability of using headline differences in sector valuations on the JSE as a market timing strategy. A funnel approach, shown in Figure 1, provides the framework followed to hone into final themes which were used as a platform to generate research propositions detailed in Chapter 3.

The subsequent sub-sections offer an overview of the strategies available to investors and further explores the theory underpinning market timing EMH. This chapter culminates with a review of short term market timing strategies with the use of JSE industry sector indices.

**Figure 1: Literature overview**

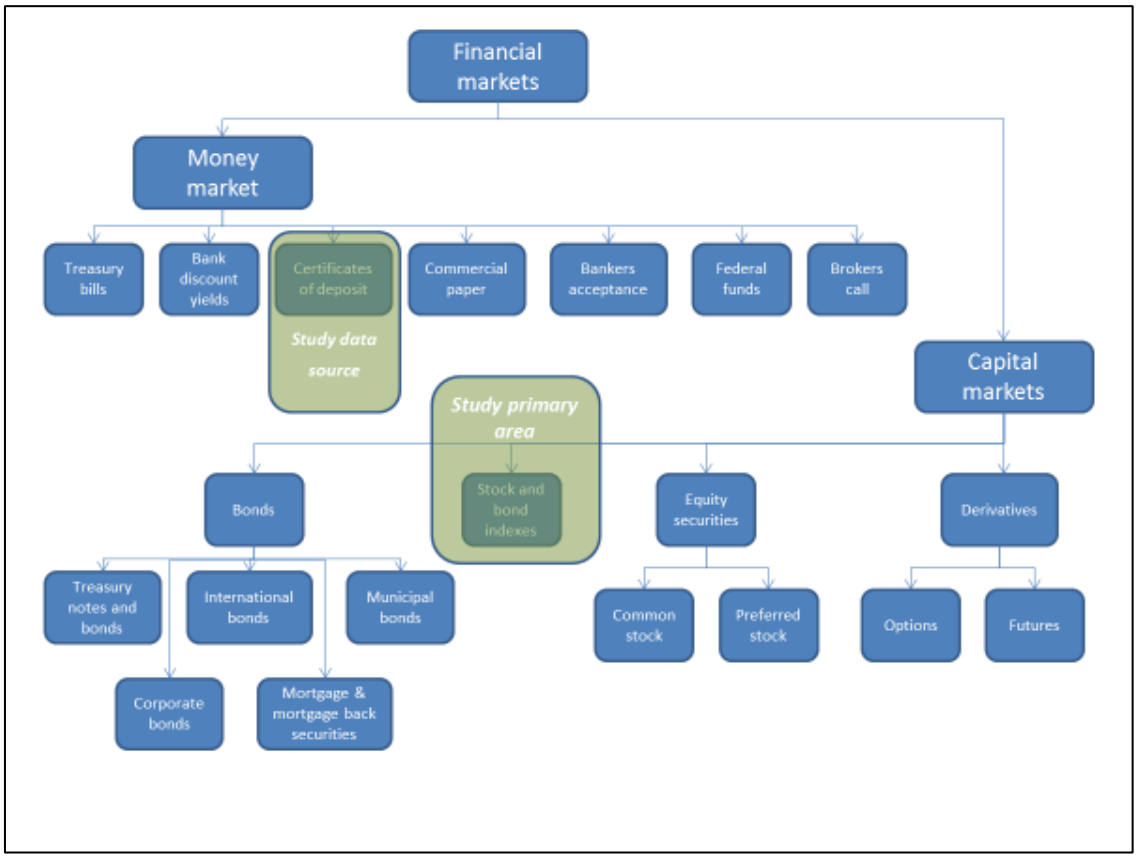


### 2.1. Overview of stock market investing

Investors have a myriad of options available to grow capital. Chee and Fok (2008) have categorised capital investment into three primary types namely stocks (or equities), bonds and money market investments. Bodie, Kane and Marcus (2011) positioned the split between capital and money markets within financial markets with associated instruments, shown in Figure 2.

Money market investments are typically short term, less risky debt securities and are referred to as cash equivalents (Bodie et al., 2011). Conversely, capital markets can be described as long term and more risky investments (Bodie et al., 2011). A seasoned investor with a diversified portfolio, including such options as physical art and venture capital avenues, would have a portion of that in the stock market. Mature stock portfolios generally portion a share to active management with a market timing component attached. Market timing is rarely an exclusive investment instrument of an investor and the degree of proportionality depends on factors such as appetite for risk, required returns and other behavioural traits.

**Figure 2: Financial markets categorized (Bodie et al., 2011)**



Investors participate in securities markets using two primary methods, active and passive investment strategies. The next section details these strategies and the following details the underlying theoretical aspects.

### 2.2 Investment strategies

Two primary methods of investing occur within security markets; passive and active investment. The debate between exclusive use between either can be categorized into two themes, the increased value of active versus passive investing and the relatively higher cost of active investment (Cremers, Ferreira, Matos and Starks, 2016).

Passive invest funds were created to allow new investors access to equity markets through such platforms as the Satrix top 40 fund. These funds provided a low-cost alternative to traditional active management funds, ease of access and minimal input from the investor. The following section details evidence of disadvantages with the increase of passive investing.

#### 2.2.1 Passive investing

A passive investment can be described as a financial instrument or product used to mimic the performance of a financial benchmark, such as the S&P 500 Index fund, or adheres to a set of investment rules regardless of the stock market conditions (Levy and Lieberman, 2016). These instruments are also referred to as index tracker funds. In recent times, passive investing has grown with the percentage share of mutual funds held in passive funds having increased by 33.5% in the period 1998-2014 (Appel, Gormley and Keim, 2016). The JSE has seen a decline in the percentage active fund management from 50% to 15% in the last 20 years (Muller and Ward, 2011). The allure of passive investing are the lower costs but, with ease of investing, passive investing has opened to new, less savvy investors.

Less savvy investors typically strive to outperform traditional cash deposit interest rates of the bank (brick-and-mortar) which form part of their long-term investment portfolios. Proponents of active fund management argue that passive investors lack the motivation and leverage to monitor their diverse portfolios. Fund managers create an increasingly large base of lazy investors and weaken the governance of firms (Appel et al., 2016). Passive investing inherently cannot beat the market as it aims to replicate it and during bearish periods the investor loses alongside the market. Passive investors

ignore market signals and display the ostrich effect (ignoring bad market news) and conversely miss opportunities for good investments. The performance of an actively managed fund, using a market timing strategy, is generally assessed relative to a passive buy and hold strategy.

The performance of an active fund is generally assessed against a suitable buy and hold strategy (passive fund). There are a variety of benchmarks such as the JSE all share index (J203), which is a market weight index, but for purposes of this study, the benchmark chosen per sector will be the market sector index. This provides a better comparison to assess the market timing strategy employed.

### 2.2.2 Active investment

On average, a passively managed fund outperforms an actively managed fund after deducting all fees (Petajisto, 2013). Hunter, Kandel, Kandel and Wermers (2014) propose that an increasing number of portfolio managers associate part of their funds to passive investment strategies. A tactic such as this can supplement an active mangers' portfolio of products to blend the higher administration fees for the actively managed funds with lower passive funds. Cremers and Petajisto (2009) introduced a new measure to describe active fund management, defined as the portion of a fund that is different to the associated benchmark index call active share. While this measure has been used to assess the degree of active management, most managed funds have incorporated large capitalised funds, albeit not in the same proportion as the associated benchmark index. Such a measure can be used to assess if active mangers take positions contrary to popular stock market indices.

Active fund management does not suffer from the same pitfalls as passive management. The increased demand of passive management has resulted in lower fees charged for active funds and portfolio managers forced to take a more active approach (Cremers et al., 2016). Using the econometric view of supply and demand, as lower cost competitive yield passive funds emerge, force active fund managers to trim excess fat and make their products more cost effective and tailored to investors' needs. Active management further stimulates value creation in the market and provides necessary liquidity.

Muller and Ward (2011) showed that low active share funds, over a five-year period, surpassed returns of over 70% of unit trust funds and as the level of active share

increased so did the variance of returns, meaning that a combination of active fund management can yield superior performance to pure passively invested funds. Petajisto (2013) concluded that the most active funds could beat the benchmark indexes by 1.26% after deducting all fees, with the average actively managed funds being outperformed by the benchmark index by 0.41%. Both studies highlight the superior performance of active share, the wide variation of percentage of active share between Muller and Ward (2011) and Petajisto (2013), can be explained by the definition of active share (portion of portfolio differing from the market benchmark). This strengthens the argument that passive investors cannot inherently beat the market benchmark.

Muller and Ward (2011) performed tests on the JSE which, between SAB Miller and Naspers, compromised over 20% of the JSE market cap and meant that few active funds would have a significant component of each company, whereas Petajisto (2013) performed his study on the New York Stock Exchange (NYSE). Both studies imply that a component of active share in a portfolio provide returns in excess of returns for a purely passive fund.

Cremers and Petajisto (2009) list two broad methods taken by active fund managers, stock picking or market timing (factor timing). Bhattacharya and Gaplin (2005) examined the active share investment pattern for 43 countries and observed that stock picking is in decline. As argued previously, the resurgence of passive funds has caused active fund managers to provide more cost effective and superior returns. Market timing strategies that rely on quantitative methodology can theoretically improve returns at lower administration costs.

The previous section described the merits and pitfalls of active and passive investment strategies and highlights the importance of an active investment strategy's potential to outperform a passive strategy. The aim of this study was to assess the performance of market timing strategies (active management) against a passive buy and hold strategy and calculate the levels of accuracy required to achieve maximum and minimum returns.

### 2.3 Theory of rational and irrational investors

Investors trading securities on stock markets are primarily focused on the ability to predict future securities movement. The literature associated with predicting future

stock price movements can be divided by two underlying assumptions; rational and irrational investors. The first describes investors as rational that seek to maximise capital returns. This assumption forms the basis of the EMH which ascribes to the instantaneous dissemination of information which is fully reflecting share prices.

The second category describes investors as irrational and prone to heuristic-driven biases. Behavioural finance aims to describe the decision-making processes of these investors using cognitive psychology (Ramiah, Zhao, Moosa, and Graham, 2016).

### 2.3.1 Rational Investors: efficient market hypothesis (EMH)

A stock market can be described as a capital generation and allocation mechanism. Securities are traded daily on the stock market, based on a host of factors such as public perceptions and perceived outlook but these factors can be distilled down to the concept of information. In one of the original works on the EMH, Fama (1970) reviewed the theoretical and empirical work of efficient markets and described an efficient market as one in which all the information is fully reflected in the share prices. Extensive work following Fama (1970) further supported this theory, showing strong evidence favour for the efficient market model. Rossi (2015) provided a comprehensive literature review of the EMH works from 1970 to 2015 and piled evidence refuting the EMH and showed the predictability in stock markets. Much evidence is provided in support of the work of Rossi (2015), which can be argued in principal that instantaneous dissemination of information is not realistically possible and mechanisms to deliver this information is itself inefficient.

Malkiel (2005) performed a review of the performance of 139 surviving actively managed funds from 1970 to 2003 to assess the viability of EMH. Results showed that, when compared to passive investment strategies over the same period, only 14.4% of active funds outperformed a passive investment strategy. Malkiel (2005) provides a biased view on the matter as a 30-year proponent of the EMH. Evidence presented uncovered sustained periods of nearly ten years where certain active funds doubled the returns of passive index funds. The main argument against the EMH was the instantaneous dissemination of information and the non-predictability of future stock prices. Malkiel (2005) quotes investment guru Warren Buffets who claims that index driven funds are the far superior to active funds. Yet, his fund Berkshire Hathaway was an active market fund that grew to such a market cap that it now mimics the market benchmark, which is an example of active share driving value creation.

Degutis and Novickyte (2014) further reviewed literature and the significance of the EMH in the light of the current dynamic nature of stock markets, as it relates to the Baltic stock market. The arguments presented advocates for further research into information efficiency. While the authors do not refute the EMH, they discuss the limitations of the model to described abnormal events such as seasonality of stock prices.

Seasonality and cyclic periods have a measure of predictability and these can be exploited, which should exist in markets conforming to the EMH. Such evidence of seasonality was described by Matallín-Sáez (2006). They extended the methods to assess weak form hypothesis by accounting for market size and liquidity. Westerlund and Narayan (2013) further provided evidence of the limited capacity of the EMH to predict the future commodity prices particularly prone to high volatility, as it relates to the unit slope conditions.

Gilson and Kraakman (2014) stressed tested the EMH against mispricing of stocks during the 2008-2010 economic recession. They argued that EMH should be thought of using the concept of relative efficiency rather than the instantaneous dissemination of information. Gilson and Kraakman (2014) provided evidence of informational in-efficiency particularly the high cost and slow dissemination of information relating to the state of mortgage backed securities. Their work supports the EMH accounting for information dissemination.

The premise of the EMH was that information, being readily available and instantly incorporated into share prices, lead investors to placing a premium for information, driving the EMH (Firer et al., 1987). There exists overwhelming evidence in support of the EMH. It was not the intention to disprove the hypothesis but to highlight levels of efficiency in the EMH when applied to actual stock markets.

The original EMH, presented by Fama (1970), was based on the classification of information using a hierarchy of three categories; strong form hypothesis in which information is held privately within closed investor circles, semi-strong hypothesis as it relates to the dissemination of public information and weak form which deals with historic price information. The theoretical work presented supports inefficiencies in the EMH, specifically within the level of efficiency specifically relating to weak form efficiency where there may exist arbitrage opportunities.

A key presumption of market timing strategies investigated in this study, using headline differences in sector valuations in the JSE, was that future stock prices can be predicted based on historic information. If weak form efficiency is incontestable in emerging markets, then this assumption is null and consequently the market timing strategy will not yield superior returns over the market benchmark. The following sections detail evidence refuting weak form efficiency in emerging markets.

### 2.3.2 Irrational investors: Behavioural finance

A key disposition of the market timing strategies investigated in this study, using headline differences in sector valuations in the JSE, was that future stock prices can be predicted based on historical information. Classical economics, models an investor as rational. Behavioural finance assumes an investor is irrational and their financial decision-making processes are influenced by psychological biases (Kubilay and Bayrakdaroglu 2016). Such psychological biases or personal preferences result in financial decisions opposed to rational investors. An example could be the unwillingness of a lung cancer survivor to purchase shares of British American Tobacco. Various types of psychological biases have been documented such as over confidence, the anchoring effect and optimum bias (Sahi, Arora and Dhameja, 2013).

In an efficient theoretical stock market, where only rational investors participate, a single stock price fully reflects all information and oscillates around an inherent value. If irrational investors are introduced, their innate biases can disregard available information and cause the share price to move. This can result in long term mean reversion of the share price. It is the effect of these biases on share prices, specifically with short term momentum affects and mean reversion, which can create arbitrage opportunities exploitable in a market timing strategy. Hence, those behavioural traits are ignored

## 2.4 Share price predictability: weak form efficiency in emerging markets

The previous section discussed literature linking share prices to available information. Evidence presented identifies a link, but a more useful result to investors is the predictability of this association. The following section reviews actual evidence of share price predictability.

Weak form efficiency is one of three legs of the EMH which relies on the premise that historic share price information does not predict future share prices (Kumar and Kamaiah, 2014; Fama, 1970). A successful market timing strategy is theoretically not consistent in a stock market exhibiting weak form efficiency. The purpose of this section was to detail research conducted in emerging markets, to test weak form efficiency. As described previously, if markets conform to the EMH, share prices will fully and instantaneously reflect all available information into the share price and no short-term effects will be exploitable by an investor for gain. South Africa is classified as an emerging market and investigating evidence of weak form efficiency in these categories of stock markets are of significance to this report.

Kumar and Kamaiah (2014) examined whether weak form efficiency occurred in the stock markets of nine eastern European stock markets during the period 1994-2013. The authors determined that the stock markets of Hungary, Slovakia, Romania, Poland, Russia and Slovenia did not display weak form efficiency. In particular, the forex markets in these areas displayed weak information dissemination. Kumar and Kamaiah (2014) noted that these eastern European stock markets had not become information efficient even after roughly 20-years of free open trade with outside global markets. Table 1 details the evidence of weak form efficiency within developing countries stock markets.

**Table 1: Weak form efficiency effects in developing country's stock markets**

| No. | Stock market | Period | Weak form efficient | Data | Comment | Source |
|---|---|---|---|---|---|---|
| 1 | China | 1992-2003 | Tentatively | Market value equity index | Serial correlation confirms weak form efficiency; variance ratio test denies weak form efficiency | Worthington and Higgs (2005) |
| 2 | India | 1992-2003 | Tentatively | Market value equity index | | Worthington and Higgs (2005) |
| 3 | Indonesia | 1987-2003 | Tentatively | Market value equity index | | Worthington and Higgs (2005) |
| 4 | Korea | 1987-2003 | Tentatively | Market value equity index | | Worthington and Higgs (2005) |
| 5 | Malaysia | 1987-2003 | Tentatively | Market value equity index | | Worthington and Higgs (2005) |
| 6 | Pakistan | 1995-2003 | Tentatively | Market value equity index | | Worthington and Higgs (2005) |
| 7 | Philippines | 1987-2003 | Tentatively | Market value equity index | | Worthington and Higgs (2005) |
| 8 | Sri-Lanka | 1992-2003 | Tentatively | Market value equity index | | Worthington and Higgs (2005) |
| 9 | Taiwan | 1987-2003 | Tentatively | Market value equity index | | Worthington and Higgs (2005) |
| 10 | Thailand | 1987-2003 | Tentatively | Market value equity index | | Worthington and Higgs (2005) |
| 11 | India | 1987-1994 | No | Bombay stock index (SENSEX), Economic times ordinary share price index (ET) and Bombay stock exchange national index (BSENI) | Use of non-parametric tests, frequency tests and tests for serial dependence. | Poshakwale (1996) |
| 12 | China | 1993-1996 | Tentatively | Weak form efficiency not apparent with international investor shares but apparent in locally traded shares. | | Laurence, Cai and Qian (1997) |
| 13 | UAE | 2001-2003 | Yes | Emirates market index | 40 out of 43 stocks in Emirates index are weak form efficient | Moustafa (2004) |
| 14 | Nigeria | 1981-1992 | Yes | 59 randomly selected securities | Calculated based on the autocorrelations based on lag. | Olowe (1999) |
| 15 | Dhaka | 1992-2001 | Tentatively | Market indices | Weak form efficient pre-1996, no evidence of weak form efficiency from 1996. | Islam and Khaled (2005) |
| 16 | Turkey | 1992-1999 | Tentatively | Three test show evidence of weak form efficiency, non-parametric tests show no evidence of weak form hypothesis | | Buguk and Brorsen (2003) |
| 17 | South Africa | 1993-2001 | Tentatively | 7 indices | 4/7 show weak form efficient, 3 out of 7 do not | Jefferis and Smith (2004) |
| 18 | Egypt | 1996-2000 | Tentatively | Indices | All tests reject, unit root test confirms | Omran and Farrar (2006) |
| 19 | Jordan | 1996-2000 | Tentatively | Indices | Weak evidence to support based on serial correlation tests, others reject | Omran and Farrar (2006) |

| | | | | | | |
|---|---|---|---|---|---|---|
| 20 | Morocco | 1996-2000 | Tentatively | Indices | All tests reject, unit root test confirms | Omran and Farrar (2006) |
| 21 | Turkey | 1996-2000 | Tentatively | Indices | Weak evidence to support based on serial correlation tests, others reject | Omran and Farrar (2006) |
| 22 | Israel | 1996-2000 | Yes | Tel Aviv 100 | Confirmed by serial correlation tests | Omran and Farrar (2006) |
| 23 | Bangladesh | 2006-2015 | No | 3 Indices | Rejected by parametric and non-parametric tests | Rahman, Simon and Hossain (2016) |
| 24 | Brazil | 1995-2010 | Tentatively | Benchmark index | Barrage of tests used, tests show increased efficiency over time but tests were not conclusive to confirm weak form efficiency | Mobarek and Fiorante (2014) |
| 25 | Russia | 1995-2010 | Tentatively | Benchmark index | | Mobarek and Fiorante (2014) |
| 26 | India | 1995-2010 | Tentatively | Benchmark index | | Mobarek and Fiorante (2014) |
| 27 | China | 1995-2010 | Tentatively | Benchmark index | | Mobarek and Fiorante (2014) |

Numerous studies have been published detailing the effects of weak form efficiency while studies in developing markets are less consistent, with some refuting the weak form efficiency. Generally, developing countries display weak form efficiency when weak tests are performed, but refute the weak form hypothesis when more rigorous tests are performed.

The inconclusive evidence points to inefficiencies with the dissemination of information in the stock markets of developing markets that has the potential to be exploited with a market timing strategy. The evidence provided in Table 1, points to the potential benefits of active management, inefficiencies in the EMH and poor evidence of weak form efficiency in emerging markets. This provides the platform for a successful market timing strategy in an emerging market such as the JSE.

### 2.5 Market timing

The evidence presented in emerging markets, as depicted in Table 1, show that arbitrage opportunities are present in a number of developing country's stock markets. Hence weak form efficiency was not fully subscribed by all developing stock markets. The following section provides a landscape view of the field of market timing.

Empirical research papers focusing on market timing dates as far back as the 1960's, with works of Jensen (1968), and Treynor and Mazuy (1966). Table 2 summarises the contemporary definitions of market timing, which has broad definitions in open literature.

**Table 2: Market timing definitions**

| Definition | Source |
|---|---|
| Market timing can be defined as swapping between assets classes for adjusting the beta (systematic risk) of a fund in anticipation of a change in capital markets. | Firer, Sandler and Ward (1992) |
| Switching an equity fund between a risky and riskless asset. | Li and Lam (2002) |
| Market timing simply put is the variation in the equity allocation with the equity premium | Brennan and Xia (2010) |
| Entails buying stocks post large price falls and selling of stocks after substantial prices increases to achieve a higher absolute return. | Dimson, Marsh and Staunton (2011) |
| An investor strategy whereby a fund is invested into a risky asset when a risk-free asset is expected to decrease in value and vice versa. | Bowler (2012) |
| Market timing is referred to as the allocation between the aggregate market portfolio and the risk-free asset. | Jagannathan and Korajczyk (2014) |
| Market timing is an active fund management strategy aiming to exceed returns of passive index funds by predicting future changes of a stock market. | Zakamulin (2014) |

Jeffrey (1984) investigated the accuracy required for successful market timing on the NYSE for the period 1926-1982 and concluded that the potential upside gains were half the potential losses using the “football approach”. However, work by Firer et al., (1992) noted that market timing upside gains increased with a reduction in downside risk for shorter intervals. To assess the viability of a market timing strategy, an investor must control for a variety of factors such as; future stock prediction, efficient switching indication, construction of funds and absolute transaction. The method to determine the level of accuracy correlated to returns, as a yard stick to assess active funds, is a prudent method. However, this “football approach” has not been adopted past the 1980’s and it was determined to supplement this with a contemporary market timing strategy, described in Chapter four.

Waksman, Sandler, Ward and Firer (1997) investigated use of a market timing strategy using derivative instruments with a market timing strategy on the JSE and concluded that, with accuracy levels in excess of 80%, an investor can generate abnormally high returns. Davies (2013) investigated the predictability of macroeconomic variables with stocks prices on the JSE. Davies (2013) results showed that accurately forecasting bull markets led to superior returns for fund managers. Davies (2013) determined that macroeconomic variables have a forecasting ability. De Chassart and Firer (2001), in their study, investigated three market timing strategies; traditional, bull and bear market timing on the JSE and concluded that market timing can be a favourable strategy if the correct strategy was used in the appropriate market conditions.

For a market timing strategy to be successful it relies on a level of predictability in historic share price data. Evidence of various successful market timing strategies relying on predictability of futures are; seasonality, conducted on the JSE by Miller and Ward (2015), market demand shifts induced by demographics, conducted by Dellavigna and Pollet (2013) and the “January effect”, first noted by Rozeff and Kinney (1976). Bowler (2012) investigated market timing strategies using predictor variables such as the Rand/US dollar exchange rate and the 90-Day banker’s discount rate, to outperform the JSE All Share Index (JSE ALSI). Pesaran and Timmermann (1995) investigated the ability to forecast US stocks prices and found that this could be exploited during periods of volatility in the 1970’s. De Kock (2016) investigated market timing on the JSE with the South African volatility index as a market timer and concluded that such a market timing strategy outperformed a passive strategy in the long term.

While it can be argued that differing market timing strategies, such as seasonality, cannot be used in an argument for day of the week effects, yet, in principle these rely on a level of predictability in future stock prices. It is paramount to this study to dissect the various market timing strategies to classify methods and to provide a platform to investigate the use of headline differences in sector valuations on the JSE.

### 2.6 Market timing strategies

A market timing strategy is an investment strategy used to predict the future capital market positions to achieve maximum cumulate share portfolio return by considering associated risk and transaction fees. The following section details recent market timing strategies investigated in the recent years.

The potential upside gain of market timing was the subject of interest for Shilling (1992) and presented the strategy of being in the stock market during bull runs and out of it during bear runs. Shilling (1992) calculated an increased return of 11.2% to 19.0% for a fund invested in the Dow Jones Industrial average's strongest 50 months during the period 1947-1991. The premise behind this strategy was that profits were not steadily increasing and that correctly timing the profitable months shall yield superior returns but that the converse is true when incorrectly timing the market.

A study by Chen and Liang (2007) included a sample of 221 market timing hedge funds in the period 1994-2005 and concluded that US hedge portfolio managers displayed market timing abilities. Results show significant market timing ability during periods of high market volatility and bear markets. A bootstrap analysis was used to discount pure luck or randomness.

Neuhierl and Schlusche (2011) examined the portfolio returns using market timing rules adjusted against data snooping and concluded that the highest performing strategy, slightly but not significantly, generated returns in excess of the market benchmark, during the sample period from 1995-2007. However, within the period 1981-1994, the highest performing market timing rules made statistical superior performance even after adjusting for data snooping.

Pfau (2011) revisited and updated the 132-year study (1871-2002) of Fischer and Statman (2006) by extending the period from 2002 to 2010 to include the bull market of 2002, included risk adjustment, extending the test portfolios and included additional PE-10 decision rules. Pfau (2011) concluded that the investigated market timer yielded favourable returns as compared to a pure passive (buy and hold) strategy and a 50% asset allocation strategy (50% passive strategy). Pfau (2011) further concluded that, adjusting for risk, a value based market timing strategy has the potential to yield better returns for risk adverse, long term investors.

Cao, Chen, Liang and lo (2013) investigated whether portfolio managers could time market liquidity changes and measured the timing abilities by changes in the funds' market exposure. Results presented, using a sample of 5298 equity funds from 1994-2009, showed compelling evidence for market timing. The best fund managers outperformed worst fund managers by adjusting for risk, by a maximum of 5.5% per year.

Zakamulin (2014) investigated the use of moving averages and time series momentum parameters and technical trading rules, as market timing strategies. The study sample included data from the Down Jones Industrial Average index and Standard and Poor's Composite stock and two bonds indices for the period 1926-2012 (87 years, 1044 months). Results showed a marginal better risk adjusted return over the period of the study but this does not imply that this market timing strategy shall yield the same result in the future. Additional, during the medium term, passive strategies are empirically shown to produce higher returns than active strategy, which was attributed to market timing performance being confined to shorter time frames or historical episodes.

### 2.7 Forecasting indices returns

The ability to predict the movement of stock indices is an invaluable tool to an investor and has become a popular investing instrument with the decline of active investing. An accurate forecasting model is central to a successful market timing strategy. The following section details an overview of previous forecasting techniques along with efficacy of each model, where applicable.

Leung, Daouk, and Chen (2000) investigated the use of a group of classification models to predict the direction of stock movements and compared it to traditional level estimations models which estimate the actual return. Leung et al. (2000) used a sample set that included 348 months of data, from January 1967 to December 1995, of the S&P 500, FTSE 100 (UK) and the Nikkei 225 (Japan). They present empirical evidence that the group of classification models had a higher predicted direction rate and was able to outperform portfolio returns from level estimation models.

The review of soft computing techniques (neutral networks and neuro-fuzzy models) to predict the stock market, including indices, was conducted by Atsalakis and Valavanis (2009), by surveying more than 100 related published articles. They concluded that soft computing techniques were an acceptable approach to model and predict the nonlinear stock market movements and produced returns in excess of conventional models. Majhi, Panda, Majhi, and Sahoo (2009), introduced a new adaptive bacterial foraging (ABF) model to better predict various stock market indices and present evidence of better efficiency and prediction accuracy of the ABF model, as compared to other contemporary evolutionary models.

The day of the week effect was examined by Zhang, Lai and Lin (2017), which simply

proposes that more stocks are traded, or a predisposition to positive market performance on Friday rather than on Monday. The study investigated this effect using 28 stock market indices across 25 countries (13 emerging and 12 developed countries) by using a calendar effect ratio to measure significant day of the week effects for each stock market index. Results presented by Zhang et al. (2017) showed significant affects for each day of the week, a respective index such as the Monday effect, for the Dow Jones Index.

Mensi, Tiwari and Yoon (2017) tested the weak form efficiency, which stipulates that historic share price data are the best predictors of present share price data of Islamic stock markets, using ten stock indices over a 17-year period (November 1998 to March 2015). A multifractal de-trended fluctuation analysis was used to test market efficiency which showed that levels of market efficiency varying over time is more efficient in the long term than the short term and market efficiency being lower since the onset of the 2008 global financial crisis.

Gao and Yang (2017) investigated the ability of the mixed-frequency stock index futures sentiment and mixed-frequency stock index sentiment to predict stock index future returns within the Chinese stock market. Their results show that mixed frequency stock index sentiment factors were the best predictors and out sample forecasts provide evidence that sentiment trading strategy yields greater positive portfolio returns than time series momentum or passive buy and hold strategies.

### 2.8 Forecasting short term returns

In the EMH, described in section 2.3, there should be no effects of weak form efficiency in the short term. Available research does agree with that finding but other work presented points to the existence of short term momentum effects. The following section provides evidence of short term momentum effects and methods which link into this study's research methodology.

Short term momentum effects were investigated by Poterba and Summers (1988), by using market return for 18 countries during the period 1957-1985 and they found steady evidence of security returns being statistically significantly correlated during short periods. Evidence of mean reversion, which was explained by two primary factors, time varying returns and price fads, was presented.

Muller and Ward (2010) scrutinized the country indices of seventy countries during a 39-year period, from 1970-2009, investigating mean inversion, including momentum effects. Results presented show consistent short-term momentum effects. They further demonstrated the effect of this result by showing superior returns of a portfolio of the four best performing indices, by applying a simple moving average (SMA) approach, over 11 months and calculated a 10% excess return over an equally weighted benchmark.

The first examination of the effect of index momentum factors on global and international equity portfolios was conducted by Breloer, Scholz and Wilkens (2014). This examination was accomplished by constructing multiple country and sector momentum factors used to evaluate global/international portfolio performance during the period 1996- 2009. The outcome of the study was that 53% of global funds and 54% of international funds displayed significant association to both country and sector momentum effects.

Evidence for the momentum profit was presented by Wang and Xu (2015) by investigating the relationship between the Chicago Board Options Exchange Volatility Index (VIX) and momentum return. The sample set included data from 1990- 2010 and the results show the ability of the VIX to predict momentum profit.

Jegadeesh and Titman (2001), as an extension of earlier paper by Jegadeesh and Titman (1993), provide additional explanatory evidence for the superior returns possible with marketing timing strategies using momentum. Jegadeesh and Titman (1993) provided evidence of superior portfolio returns by buying stocks with high returns within a 12-month period and selling stocks with meagre returns in the same momentum period. Jegadeesh and Titman (2001) concluded that data snooping was not a factor and there was a positive association with delayed overreaction by investors.

Faber (2007) presented a ten-month moving average (momentum) strategy for managing risk in a market timing strategy. This strategy was applied to a market timing strategy on a portfolio consisting of the S&P 500 from 1900-2000. Results showed that the market timing portfolio outperformed the buy and hold strategy (S&P 500) by 0.91% and had a better average return, 11.72%, as compared to 11.65% (S&P500).

Momentum takes advantage of heuristic biases of investors and has shown to be successful in select environments. Various research points to different historic periods exploitable by momentum effects from 3 to 24 months. This study will exploit momentum affects by adopting the approach of Faber (2007) using 10 month moving average approach.

### 2.9 Market timing strategies on the JSE

Various market timing strategies using stocks listed on the JSE have been published in open literature dating as far back as the 1970's. The following section chronicles previous market timing strategies investigated on the JSE. The various approaches if successful point to further evidence of weak form efficiency and potential success of market timing strategies investigated in this study.

Gilbertson and Roux (1977) investigated the EMH using share price data from 1971-1976 on the JSE. The evidence presented showed the effect of the EMH, yet a deeper diagnosis could reveal effects of weak form efficiency. In the next year, a subsequent follow-up paper by Gilbertson and Roux (1978), provided reasons for the findings that the EMH thesis applies to approximately 50% of shares listed on the JSE.

Firer et al. (1992) revisited the work of Firer et al. (1987), which looked at share price data from 1967-1986, by extending the data set from 1987-1989, which critically includes the crash of late 1987. Their data set included the gold share index and the all share index and results presented support earlier work that a high level of accuracy is required to outperform the benchmark index. Due to the volatile nature of the gold index, investors with a low degree of risk faced much lower returns and required a level of accuracy in excess of 90%. Follow-up works add credence to the market timing results presented on the JSE.

Equity style investments on the JSE were empirically tested by Mutooni, and Muller (2007). These types of strategies, such as value or growth investing, are used by investors to achieve superior portfolio returns. While no transaction costs were included in their data set of a 20-year period from 1986-2006, their findings support the conclusion that equity timing strategies provided superior returns when compared to the market benchmark.

Muller and Ward (2013) researched a myriad of investment strategies on the JSE over a 27-year period from 1985-2011 using such strategies as momentum, price to net-asset-value (NAV), dividend yield, size effects, industry, earnings yield and liquidity. Their results showed that these investment styles, both pure style and in various combinations, produced superior returns over the JSE all share index over the same period while momentum based strategies yielded returns in excess of 9% per year. Various market timing strategy operates better depending on specific conditions each rely on the in-efficient dissemination of information.

South African law requires directors (Insiders trading act of 1999) to disclose their share trading with companies in which they fulfil the role of director. Director dealings were used as a predictor in a market timing strategy investigated by Moodley, Muller and Ward (2016). The sample set included 13840 trades over an 11-year period from 2002-2013 and followed a director's selling and purchasing strategy. Their results were statically significant yet lacked consistency; specifically post the 2008 financial crisis. The authors did not recommend either strategy as directors' motivation for buying and selling does not extend wholly to negative expectations.

Gallagher (2016) researched the use of director led market timing strategies (director purchasing and selling strategies) on the JSE for 314 companies (1026 directors) over a nine-year period from 2004-2013. The author finds persistent evidence of directors successfully timing the market, as they are likely privy to information not available and market negating the EMH.

Seasonality effects using dual-listed stocks on the JSE were investigated by Naidoo (2016). In his work JSE stocks were tested for seasonality using econometric tests over a nine-year period from 2003-2012 and results presented support these effects and the use of it in a market timing strategy.

Research presented demonstrates a level of inefficient information dissemination on the JSE which provides a basis for further investigation into the use of indices as a proxy to a market timing strategy. It can result in arbitrage opportunities exploitable a suitable market timing strategy.

## 2.10 JSE industry sectors

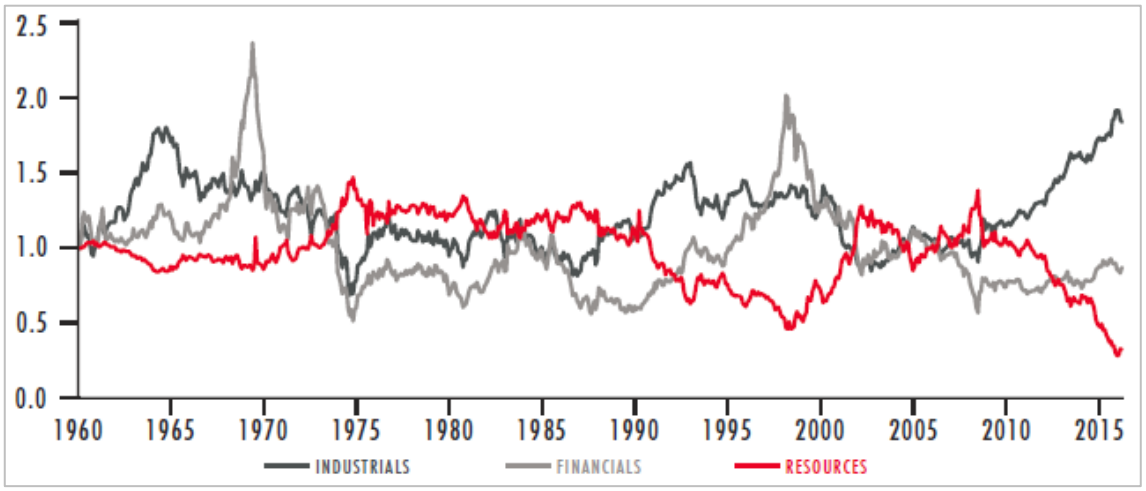
Various indices are created on a stock market to act as proxies for a sector or benchmark. To adequately represent the JSE the index classification method of the International classification benchmark (ICB) was adopted. Companies listed on the JSE are classified per the ICB, as shown in Appendix A. The entire population of companies listed on the JSE are logically split into ten industries, 114 subsectors, 19 super sectors, and 41 sectors (ICB, 2012). The ten industry categories (Oil & gas, basic materials, industrials, consumer goods, health care, consumer services, telecommunications, utilities, financials and technologies) on the JSE, were used to create ten equity portfolios used in market timing strategies for this study.

The ICB classification framework is an established method of classifying companies, applied to over 145 000 companies and securities worldwide. This classification method is unrivalled and is a definitive system which is continually updated by the FTSE Group.

Other industry classifications can group further shares by market capitalisation such as the J200 (JH-ALSI40) or the JSE/FTSE top 40 (Sharenet, 2017). Investment firms, as part of their value offering, include passive index tracking funds such as the Stanlib ALSI40 tracker, designed to track the J200 with minimal error (Stanlib, 2007). These index funds are constructed from shares of those companies compromising the tracked fund.

The use of sector valuations in market timing strategy was alluded to in the periodic stakeholder communiqué from the investment firm, AllanGray, which discusses the significance of headline differences in stock sectors. The key finding being factors outside the control of companies can affect their stock price, thereby creating buying and selling opportunities (AllanGray 2016). Figure 3 shows the relative movement of sectors of the JSE across, with noticeable periodic movements.

**Figure 3: JSE sector relative performance AllanGray (2016)**




## 2.11 Market timing using sectors indices on the JSE

The literature presented provides evidence of short term predictability of share prices and the successful market timing strategies on the JSE. Evidence of market timing was found on the NYSE when forecasting index returns for the S&P 500 (Marquering and Verbeek, 2004). This implies a level of predictability in developed mature stock markets. It was crucial to the validity of this study to find previous studies utilizing market timing strategies with indices on the JSE. To this end the ensuing section discusses previous market timings strategies based on indices used on the JSE.

The day of the week effect was investigated on the JSE by Ioffe (2015). The study utilized a time series method with the JSE/Actuaries all share index (CI01) and the JSE All share index (J203) for a seven-year period from 1995-2012. Results showed no significant presence of the day of the week effect. Ioffe (2015) postulated that this was due to the JSE being opened to foreign investment post 1994 elections, causing the South African stock market to be closely linked to international markets in terms of daily performance and efficiency. This study had a limited sample set and did not include any of the other myriad of indices such as the JSE Financial or All Gold Index.

Mbululu and Chipeta (2012) conducted a comprehensive investigation of the day of the week effect on the JSE during a similar period, from 1995-2011, but used nine JSE indices (J500 Oil & Gas (OILGAS), J510 Basic Materials (BMATS), J520 Industrials (INDI), J530 Consumer Goods (CGDS), J540 Health Care (HC), J550 Consumer Services (CSVS), J560 Telecom (TELEC), J580 Financials (FINI) and J590 Technology (TECH)). Mbululu and Chipeta (2012) showed the presence of the day of

the week was noticed for the Basic Materials index and further provided evidence of weak-form efficiency of the JSE, in which arbitrage opportunities are possible.

Sectors or indices on the JSE are essentially financial instruments used to describe the stock market and are constructed by weighted average portfolio of stocks from companies comprising that sector. However, the stock market is not static and firms come into and out of the market, as the case of de-listing of SAB Miller from the JSE in 2016, as reported by Moneyweb (2016), which has the effect of affecting the performance of an index on a stock exchange. Miller and Ward (2015) examined the effect of share price of firms joining and leaving an index. This was accomplished by studying four indices on the JSE (FTSE/JSE Top 40, Resources 20 Index, Financial and Industrial 20 Index and RAFI Index) for nine years, from 2002-2011. The researchers showed that the share price of a firm joining an index increased, which can be explained by increased awareness and knowledge of that firm to investors and concluded that there are long term price effects for indices on the JSE, indicating a level of market inefficiency. Such effects can be exploited by a market timing strategy.

Darrat and Chung (2013) examined seasonality effects on the JSE, including the beginning of the month and month of the year effects. These effects were tested by using the daily total JSE return index of the JSE (compromising of 70 equity stocks) during a period of 39 years, from 1973-2012. Their results showed seasonal effects such as beginning of the month pre-2008, but no significant evidence of these or other seasonal effects post 2008 crisis.

### 2.12 Sector rotation

Sector rotation involves switching a portfolio between different sectors in response to business and economic cycles. The ability to identify each sector's response to each cycle and switching between sectors to achieve superior portfolio returns, is central to sector rotation strategy, as described by Chong and Phillips (2015), and includes more than two sectors. These methods introduce optimisation techniques to balance the requirement of each portfolio. This study does not investigate sector rotation effects but it was vital to review previous work to avoid any overlaps in this study.

Sassetti and Tani (2006) provided evidence of the varying responses of sectors to economic cycles. Market responses can be explained by behavioural and cognitive factors such as the perception of poor JSE resources performance during periods

when the South African economy is in recession. Conover, Jensen, Johnson and Mercer (2008) quantify the effect of the Fed monetary policy shift and the effect per sector such as expansive policies on the US consumer sector.

Sector rotation relies on independent movement of asset classes and correlation between economic or business cycles and is therefore different to pure market timing strategies switching between risky and riskless asset classes. They share commonality in their switching rules, such as various momentum strategies.

Sassetti and Tani (2006) argues against market timing due to its heretic nature. Sector rotation requires greater predictive ability, introduces further complexity in the form of optimisation and requires a deep understanding of each sector's response to the cyclic factors. Sector rotation is a promising field but is excluded from the scope of this study.

### 2.13 Transaction costs

Transaction costs are administrative costs incurred during the movements between different asset classes or securities. Transaction costs vary per the buying selling mechanism and with the value of the transaction, ranging from 2% for small values and down to 0.5% for higher value transactions using derivative instruments (Ward and Terblanche, 2009).

In the debate of active versus passive investment strategy, by including the effect of transactions cost can sway the argument towards a passive buy-and-hold strategy. Walden (2015), in his investigation of active versus passive investment strategies for management of state pension fund, argues that, if transactions cost outweighs predicted market gains, then such changes should not be made.

The estimated level of transaction cost in this study has the potential of look-ahead bias by choosing a transaction cost to support a pre-determined view. It additionally has the effect of diminishing the frequency of movement or extending the holding period. These factors can be minimized by reviewing and incorporating common transaction cost levels and following proven market timing strategies, as discussed previously and detailed in subsequent chapters.

Strugnell, Gilbert and Kruger (2011) investigated adjusting beta, size and value effects on the JSE during the period 1994-2007, found strong evidence of positive trading

strategies. Those results could have been negated if transactions costs were accounted for. It can be argued that the allure of publishing impactful articles can be a greater motivator than including pertinent factors, to bring the result closer to reality.

In the pursuit of an optimal market timing strategy, with the presence of transactional costs, Gârleanu, and Pedersen (2013) put forward the minimal adverse effect of transaction costs on a stock fund. They further proposed the benefits of investors trading on persistent signals over faster mean reverting signals, considering transaction costs. While their methods of optimal holding periods were biased to their data set, it distils down to a basic methodology of investigating historic share price data. It tests various holding periods and assessing against cumulative average returns. These effects can be viewed on various indexed tracked funds on the JSE, such as the Satrix top 40 index tracked funds (tracking the J203 All share index), which has built in lags to reduce transaction cost.

The effect is clear, that frequent switching is a quick way to reduce the capital value of a portfolio, with general transaction costs per total portfolio switch ranging from 0.5% to 2% of portfolio size. To control this effect of frequent switching, the transaction cost will be a flat rate, independent of the number or size of switches or destination of switch.

Ward and Terblanche (2009) calculated a reduction in return on investment on an investigated stock portfolio from 75% to 64% with a low transaction cost of 0.98%. Bowler (2012) investigated the effects of transactions costs of 0.5% to 1.5% on market timing strategies and found a significant impact when including transaction costs. The author determined that market timing strategies with low transactions costs outperformed the market by 0.9%-1.8% and with medium to high transactional costs only one trading strategy outperformed the market with 0.8% excess return. These results follow logic interpretation, the more frequent or higher transaction cost incurred, the smaller the chance of outperforming the benchmark or a buy and hold strategy.

The effect of transaction costs on cumulative portfolio return will be investigated in this study. Firer et al. (1987) utilised transactional costs of 1.38%, later used by Waksman et al. (1997). Transactions costs within the absolute constant value of 2.0% per switch shall be used in this study, exceeding the range investigated by De Kock (2016) which was 0.0% to 1.0%.

## 2.14 Conclusion

The research available presents inconsistencies with the EMH and weak form efficiency on the JSE resulting in inefficiencies in information disseminations. It results in a level of predictability of share prices using historic information, which can be taken advantage of with a suitable market timing strategy. It further illustrates the various types of market timing strategies and methods to predict short term share prices on the JSE. These strategies have been shown to be exploitable by investors.

Within literature there exists a chasm of research regarding the use of momentum market timing strategies incorporating JSE industry indices. This report will aim to further the field of market timing by investigating the performance of market timing strategies using the JSE industry indices.

# CHAPTER 3: PROPOSITIONS

The main objective of this study was to determine if the use of headline differences in sector valuations on the JSE, in market timing strategies, can produce returns in excess of the market benchmark. This chapter defines the testable propositions used to achieve this objective. Following on from Chapter two, it was evident that numerous market timing strategies, used on the JSE within the last 30 years, have yielded returns in excess of the market benchmark return. Market timing researchers have utilised two primary methods to gauge performance of a strategy; determining the accuracy required to achieve respective returns and retrospectively calculating the performance of a market timing strategy. Both methods assess calculated returns against the generally accepted market benchmark.

The approach of calculating the accuracy required to achieve desired returns, while theoretically sound, only provides the investor forecasting accuracy required. The results are difficult to compare to real portfolios which do not consider the impact of transactions costs on a myriad of portfolio switching, efficiency of various switching indicators and various types of market strategies will have on a given portfolio. These pitfalls can be attributed in part to the low uptake of this method post the 1980-2000 period. Jeffrey (1984) was one of the first proponents of the methods followed with use on the JSE by Firer et al. (1987), Firer et al. (1992) and most recently by Ward and Terblanche (2009).

While the football method provides a landscape of returns possible, a single market timing strategy calculates a point or a range of estimates rather than the full spectrum of yields. A particular market timing strategy accounts for a select set of study variables such as seasonal effects and does not yield additional information into the full range between maximum and minimum returns achievable. Certain market timing strategies can be mathematically complex, difficult to reproduce and have built in assumptions, making it difficult for the investor to replicate or infer into their personal portfolio.

This study's approach was to utilize a hybrid approach by determining the effect of a single market timing strategy and to calculate the accuracy required to achieve desired returns. The intention of the approach was to reduce the disadvantages of both methods, to yield greater insights from exclusively utilizing a single method. To that

end two research propositions were investigated in this study:

### 3.1 Research proposition one

A market timing strategy, of switching an investment portfolio between a risk-free investment and a portfolio of shares matching the relative weightings of a single sector index on the JSE will not yield cumulative returns in excess of the associated buy-and-hold strategy with a reasonable level of market timing ability.

### 3.2 Research proposition two

A market timing strategy, of switching an investment portfolio between a less risky investment and a portfolio of shares matching the relative weightings of a single sector index on the JSE will not produce cumulative returns more than the associated buy-and-hold strategy during the same period, after accounting for transaction costs.

# CHAPTER 4: RESEARCH METHODOLOGY

The aim of this study was to investigate use of headline differences in JSE industry indices in market timing strategies to generate returns in excess of a buy and hold strategy. Terblanche (2010) explored market timing strategies with exchange rate movements on the JSE and described two methods of assessing market timing ability by either focusing on the accuracy of the marketing timing indicator or calculating the accuracy levels required to achieve associated portfolio returns. This study uses both methods.

The following section details the research methodology used to achieve this study deliverables which utilized the research design approach described by Saunders and Lewis (2012). In the investigation of the South African Volatility Index as a marketing timing strategy, De Kock (2016) utilized the research approach of Saunders and Lewis (2012).

## 4.1 Philosophy

The overarching philosophy adopted for this research proposal was positivism as described by Saunders and Lewis (2012). Positivism can be defined as a research approach used by natural scientists utilizing empirical and quantitative methods to develop or build a formal theory or relation, which may be then tested with further research (Saunders and Lewis, 2012). The sector trends shall be based on quantitative historic share price data and the results presented can be replicated by following the data methods described next. The secondary share price data collected in this study was used to assess the performance of market timing strategies and correlate a positive relation. These positive relations were recommended to an investor for use in a market timing strategy.

## 4.2 Approach

A deductive approach can be described as testing an existing theory (Saunders and Lewis, 2012). A deductive approach shall be utilized in this research proposal as the hypothetical portfolios were generated and tested using market timing strategies against the associated buy and hold strategy. De Kock (2016) further adopted the deductive approach. This approach was prudent as the market timing approach of Faber (2007) was accepted and found to be successful. Robson (2002) described the

five-stage approach which was deemed acceptable and followed in this study:

- Developing a testable research proposition.
- Expressing the proposition with operational terms.
- Testing the proposition.
- Examining the outcomes.
- Conclude or modify the theory as required.

This approach was apt and follows the research methodology of previous researchers such as Terblanche (2010), Bowler (2012) and De Kock (2016). This agnostic approach provides reliability, validity and can be reproduced if required.

### 4.3 Research strategy

An explorative research strategy shall be employed in this study as the method of testing accuracy of prediction was adopted. Explorative research studies seek to find new insights and assess topics in a new light (Saunders and Lewis, 2012). While explorative studies are commonly associated with qualitative studies, explorative studies can also be linked to the quantitative studies which were undertaken by Terblanche (2010).

In this study, the share price movements will be used as an initiator to switch the share portfolio, linking it to a time dependent approach. The use of market timing as an investment strategy was widely researched. This study aims to further the field by investigating the use of industry sectors as proxies in market timing strategies.

### 4.4 Choice of methodology

A mono-method, quantitative research was used. It was supported using cumulative annual return as a research unit. This was an important metric for active investors and employed by Miller and Ward (2015). Research data was sourced from share price data of individual companies listed on the Johannesburg Stock Exchange for a period of at least 10 years. Quantitative research holds itself well to further interrogation and results can be easily replicated.

A quantitative approach was widely used in the investigation of market timing strategies. Creswell (2013) argued for various factors critical to quantitative research, which are projected relation between variables, importance of validity/reliability and

replicable methods to collect data. Each of which were areas of focus in this study.

### 4.5 Time Horizon

A longitudinal design was employed to study events occurring in the JSE over the course of at least ten years. A longitudinal study can be described as the collection of data on a topic over the period of investigation (Saunders and Lewis, 2012). Share price data for companies listed on the JSE was collected over a minimum period of 10 years to a maximum of 57 years. A quantitative study, coupled with a longitudinal approach was a sound approach to track changes in market indices (Blumberg, Cooper and Schindler, 2008). This type of analysis can also be described by time series analysis.

### 4.6 Reliability and validity

Validity assesses the degree to which data collection methodologies measure what they set out to measure, which subsequently affects research findings. It adds credibility to the conclusions drawn.

Saunders and Lewis (2012) defines reliability as the extent to which data collection methods and analysis procedures will produce repeatable results and lists factors that threaten research findings such as subject error, subject bias, observer error and observer bias. This study may be prone to subject error due to the time interval chosen; this shall be minimized by using a minimum ten-year period.

Reliability follows on from validity and no matter how repeatable or precise data was gathered, if the analysis procedure was flawed it then calls into question the research conclusions. Saunders and Lewis (2012) provides a framework to assess validity and reliability, shown in Table 3. This framework was previously adapted and applied by De Kock (2016), measured against the market timing data gathering and analyses used.

**Table 3: Validity and reliability framework, Saunders and Lewis (2012)**

| *Validity* | | *Reliability* | |
|---|---|---|---|
| ***Term*** | ***Description*** | ***Term*** | ***Description*** |
| Subject selection | Preferential selection of research subjects resulting in unrepresentative research population | Subject error | Data collection methods at different times such as measuring foot traffic during day as opposed to night |
| History | Events within the study period which have a significant impact on the findings | Subject bias | Research subjects providing in-accurate information as to protect their personal interests |
| Testing | Effects of measurement of data or collection on the research subject | Observer error | The various ways in which researchers may pose questions in different ways which creates biases in the findings |
| Mortality | Loss of subjects during the study such as death of participants. | Observer bias | The various ways in which researchers interpret the same data set creating a bias in the findings |
| Ambiguity about causal direction | Confusion in the direction of cause and effect | | |

### 4.7 Population

A population is a complete set of group members (Saunders and Lewis, 2012). The population of this study was those companies categorized according to the ICB list (Sector list shown in Appendix A). The use of ten JSE industry indices mimics the entire population of companies on the JSE and are used as proxies for each industry movement.

Historic share price data for these indices were readily available from several sources and was sourced from the proprietary software called The Style Engine and verified against Google Analytics.

### 4.8 Unit of analysis

To meet the objectives of the study, to investigate a market timing strategies to beat the average market return over a long run, the unit of analysis was the calculated cumulative portfolio return.

### 4.9 Research instrument

The research instrument utilized for this study was Microsoft excel, using basic features and value add-ons such as Data Solver and other data management techniques. Microsoft Excel had the required functionality and goal seeking functions required for this study. Numerous texts exist on the functionality and methods of Microsoft Excel in research, such as that conducted by Anderson, Sweeney and Williams (2014) and Levine, Berenson, and Stephan (1999).

### 4.10 Techniques and sampling method

The ten super sectors indices on the JSE indices were chosen for independent investigation in market timing strategies. Each of the sectors were used to form groups of portfolios for investigation, as shown in Table 4. The ICB broadly classifies markets into ten super sectors and as there was no preference for any one super sector; all ten were investigated for exploitable arbitrage opportunities. This type of non-probabilistic sampling method can be described as a typical case purposive sampling technique. Purposive sampling can be defined as a technique in which the researcher's judgement was used to select samples from a population per a specific rationale (Saunders and Lewis, 2012).

The ten super sector indices were interrogated using two broad techniques as listed:

- Football method:
    - Calculate the maximum and minimum cumulative returns possible with percentage accuracy to achieve each
    - Overlay the buy and hold strategy cumulative return to assess performance
- Market timing strategy (Asset allocation method of Faber (2007)
    - Analyse the performance of a market timing strategy by switching from the equity index to a low risk option (bonds, then a one month fixed return money market fund). Table 4 lists the ten groups of portfolios
    - Overly market timing fund against the benchmark buy and hold strategy.
- Synergize results from two methods
    - Draw insights for the average active investor from the potential returns possible against a simple market timing strategy.

The football method, re-ignited in the 1980's by Firer et al. (1987), calculates the maximum and minimum potential returns possible with forecasting accuracy. While

insights can be drawn, it suffers from not being operational for the average investor. To bridge the gap, a simple market timing strategy, as described by Faber (2007), was utilized. Between the two calculations methods, each index will be assessed and a conclusion will be drawn for the use of the specified indices.

**Table 4: JSE industry sector indices**

| *Group* | *Equity portfolio* | | | | *Low risk portfolio* | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | *Bond portfolio* | | *Money market* | |
| | *Industry* | *Description* | *Code* | | *Description* | *Code* | *Description* | *Rate/month* |
| 1 | 0001 Oil & Gas | JSE Oil & Gas Index | J500 | | JSE Composite all bonds | JSE:ALBI | 1month fixed term | 0.21% |
| 2 | 1000 Basic Materials | JSE Basic Materials Index | J510 | | JSE Composite all bonds | JSE:ALBI | 1month fixed term | 0.21% |
| 3 | 2000 Industrials | JSE Industrial Index | J520 | | JSE Composite all bonds | JSE:ALBI | 1month fixed term | 0.21% |
| 4 | 3000 Consumer Goods | JSE Consumer Goods Index | J530 | | JSE Composite all bonds | JSE:ALBI | 1month fixed term | 0.21% |
| 5 | 4000 Health Care | JSE Health Care Index | J540 | | JSE Composite all bonds | JSE:ALBI | 1month fixed term | 0.21% |
| 6 | 5000 Consumer Services | JSE Consumer Services Index | J550 | | JSE Composite all bonds | JSE:ALBI | 1month fixed term | 0.21% |
| 7 | 6000 Telecommunications | JSE Telecommunications Index | J560 | | JSE Composite all bonds | JSE:ALBI | 1month fixed term | 0.21% |
| 8 | 7000 Utilities | JSE Utilities Index | J570 | | JSE Composite all bonds | JSE:ALBI | 1month fixed term | 0.21% |
| 9 | 8000 Financials | JSE Financial Index | J580 | | JSE Composite all bonds | JSE:ALBI | 1month fixed term | 0.21% |
| 10 | 9000 Technology | JSE Technology Index | J590 | | JSE Composite all bonds | JSE:ALBI | 1month fixed term | 0.21% |

Share price data was sourced using proprietary software, The Style Engine, over a period of at least 17 years (1995-2017) to calculate JSE relative sector movements. Share price data extracted was verified against Google analytics. Each sector on the JSE can be likened to strata and each stratum will be constructed with companies chosen per the following criteria:

- By sector derived from ICB categories (Appendix A)
- Companies in each ICB sector will be ranked by market capitalisation (sample shown in Appendix A)
- The share price data was corrected to be used as in the market timing strategy.

### 4.11 JSE indices

#### 4.11.1 JSE All share index (ASLI-J203)

The JSE was opened for trading in 1887 during the gold mining era in South African history. The JALSH: IND is an equity tracked index constructed as a market capitalisation-weighted index used to measure the movement of JSE equity market

(Bloomberg, 2016). It has been cited as an acceptable proxy for the average movement of the market. This index was used as a litmus test to assess potential value of each of the market timing strategies.

### 4.11.2 JSE all bonds index (ALBI)

The JSE ALBI is a composite index comprising of the top 20 conventionally listed bonds ranked by market capitalisation, liquidity and terms of more than one year (JSE, 2013). This index tracks the long-term bonds of primarily government owned entities and hence, is regarded as a lower risk investment as compared to the traditional equities. The index was used in the market timing approach of Faber (2007), to switch into during bearish periods on the JSE. Switching between equities and bond stocks is a common market timing approach.

### 4.11.3 JSE super sector indices

The JSE adopts the ICB classification system which classifies over 60 000 companies worldwide and is commonly used in mature stock markets. It employs an investor focused approach to provide clear industry distinctions to assist investment strategies. The ICB at the highest-level divides industries into ten sectors ((J500 Oil & Gas (OILGAS), J510 Basic Materials (BMATS), J520 Industrials (INDI), J530 Consumer Goods (CGDS), J540 Health Care (HC), J550 Consumer Services (CSVS), J560 Telecom (TELEC), J570 Utilities, J580 Financials (FINI) and J590 Technology (TECH)). The study aims to study the use of the ten inductor sector indices as proxies in market timing strategies.

The JSE in-line with the Russell recalculation policy and guidelines, recalculate selected indices to include re-invested dividend yields generating a Total return index (TRI). The JSE calculates TRI traded correction for the J203 and J580 financials. Consequently, TRI data was excluded from this study and will improve comparability between the indices.

## 4.12. Data Analysis and Approach

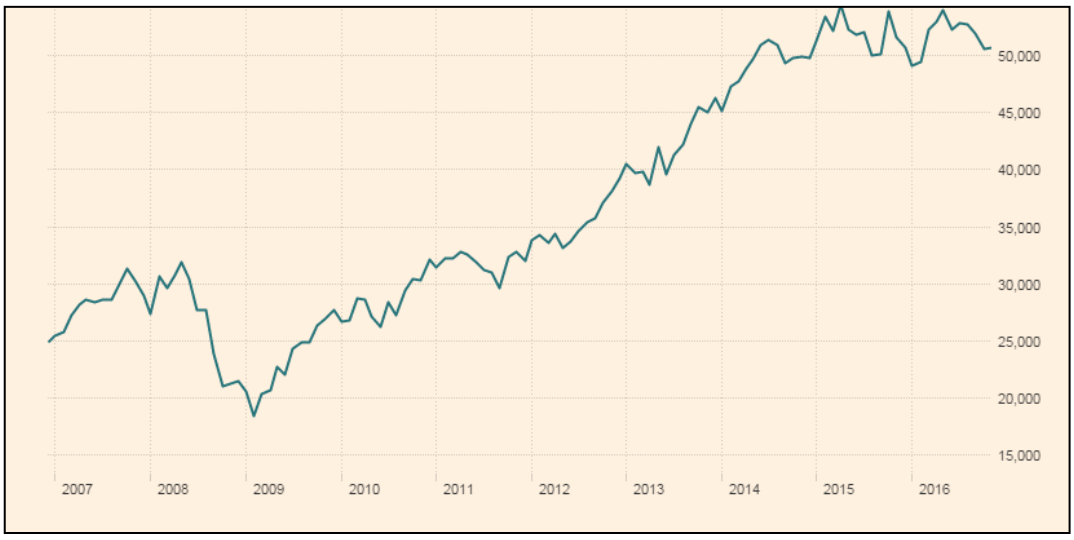
### 4.12.1 Control equity portfolio creation: JSE J203

A control amount of R1 was invested into the J203 fund and returns will be calculated as a cumulated portfolio return with a single share offering. Share price data shall be

extracted from The Style engine for a period of 17-years (1995-2017). This single share portfolio will act as the control group to assess performance. Interest will be calculated using Microsoft excel. Figure 4 shows the ten-year share price movement of the J203.

First time investors typically wade into the stock market via popular investment indexes such as the J203. Hence, using this CAR was prudent to an investor and a useful gauge to assess performance of the market timing strategies investigated.

**Figure 4: J203 share price movement over a 10-year period, Financial Times (2016)**




### 4.12.2 Control portfolio: Bond portfolio: JSE ALBI

A government bond is a capital raising instrument whereby a government issues a promise of guaranteed periodic interest and final amount payment at maturity for an invested amount. This investment type was deemed to be a low risk investment instrument as was backed largely by the South African Reserve Bank (SARB).

A bond control portfolio was required to compare returns against the other control and market timing portfolios, with the benefit of bonds being low risk at the cost of low average returns, as compared with other equity funds. The chosen portfolio shall be the JSE: ALBI index. A control amount of R1 shall be used and invested into JSE: ALBI index and returns will be calculated as a cumulated portfolio return, as a single share offering.

The JSE: ALBI since 1994 has outperformed the J203 in terms of annual return and particularly interesting for an investor. This can be attributed to the tumultuous history of South Africa during the end of Apartheid.

### 4.12.3 Money market low risk investment (Cash)

Pure cash investments such as cash deposits in the bank are regarded as low risk options. Events such as banking collapses are rare in South Africa and such investments are low risk as compared to equity or bond markets. The (SARB) repayment rate (Repo rate) is the rate at which it lends to private banks in South Africa. The Repro rate is a suitable proxy to the historic investor deposit rates of traditional South African banks and is conservative in nature. While banks offer various investment instruments most stable cash investment returns mirror the repo-rate.

### 4.12.4 Market timing portfolios

Ten groups of two portfolios each were investigated in this study, shown in Table 4. Each group consisted of a pure equity index, with the momentum method of Faber (2007) used as a market timing indicator, to predict returns and switch per interval. Each group shall begin interval one with R1 in the pure equity index. Table 2 lists the ten groups of portfolios to be investigated, which includes the ten industry sectors on the JSE, the JSE: ALBI as the bond index and money market fixed cash deposit. The market timing strategy will switch between the two portfolios per market timing strategy.

### 4.12.5 Headline differences in JSE Sector valuations

Prior to creating the active portfolios, each sector's relative headline differences were required to be calculated for use as initiators in market timing strategies. The method outlined was used to calculate the relative sector performances. This method can be laid out as:

- Step 1: Download the stock prices, dividends and market capitalisation using The Style Engine
- Step 2: Calculate the returns for each of the stocks and calculate the return for the sector. The return for each stock will be calculated as follow:

$$Return = \frac{(Price\ end\ of\ month - Price\ end\ last\ month)}{Price\ end\ of\ last\ month}$$

$$Index\ Return = \sum\left(\frac{Market\ cap\ of\ stock\ i}{Total\ Market\ cap}\right) \times Return\ stock\ i$$

- Step 3: Compound the value of the R1 invested in this index return, according to the equation:

$$Price_{EOM} = Price_{EOMLM} \times (1 + Price\ of\ the\ month)$$

- Step 4: Plot the curve
- Step 5: Analyse the data to yield a forecast model.

### 4.12.6 Football method

The correlated headline differences will be used as market timers to determine when to switch between sectors and shares. The method of Ward and Terblanche (2009) was used to calculate the potential cumulative return, the forecasted accuracy and missed periods. Security returns are generated using the multiplier effect to create upper and lower graph (best-case and worst-case line), shown in Figure 2, as described by Firer et al. (1987). The following is the flow of calculation:

- Calculate the multiplier:

$$X = \frac{1+Rg/100}{1+\frac{Ri}{100}}$$

Where

X = multiplier

Rg = smallest security return

Ri = largest security return

- A factor was generated for each period, which was used to calculate the best and worst-case scenarios through formula (5):

$$Un = U_{100\%} \times A1 \times A2 \times \ldots \times At$$

Where:

Un = final return after n periods with (z/n)% forecasting precision

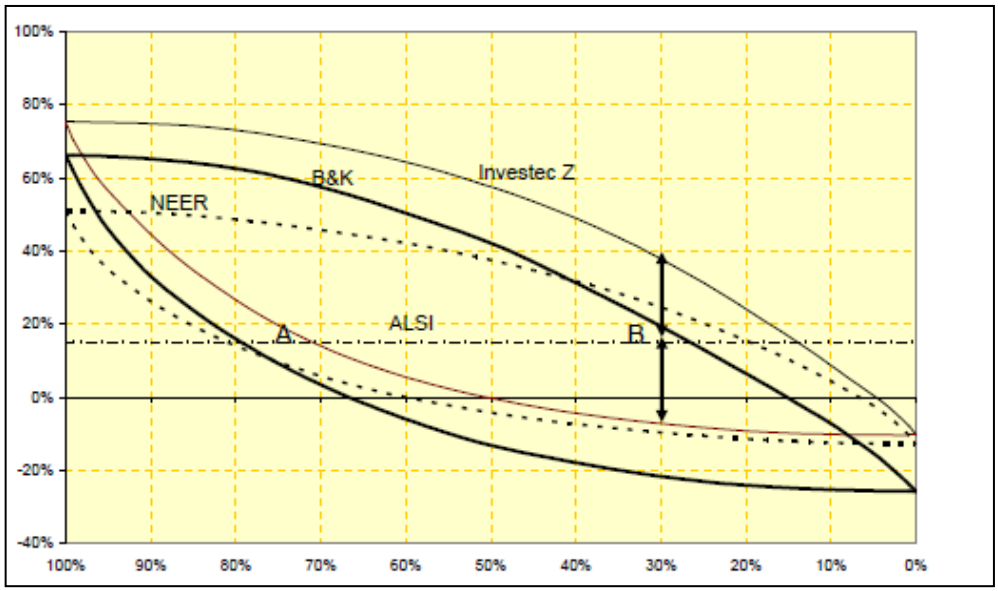
$A_{100\%}$ = final return after n periods with 100% forecasting precision

Uz = multiplier rank Z.

t = count of incorrect forecasts

- Best case boundary conditions were established by ranking multipliers in ascending order and vice versa for worst case boundary conditions.
- The annualised returns were graphically represented with percentage accuracy predicted for each portfolio generating a risk-return football, as described by Jeffrey (1984) and shown in Figure 2, as calculated by Ward and Terblanche (2009):

**Figure 5: Security return oval for three market timing strategies, Ward and Terblanche (2009).**




### 4.12.7 Market timing: Asset allocation method

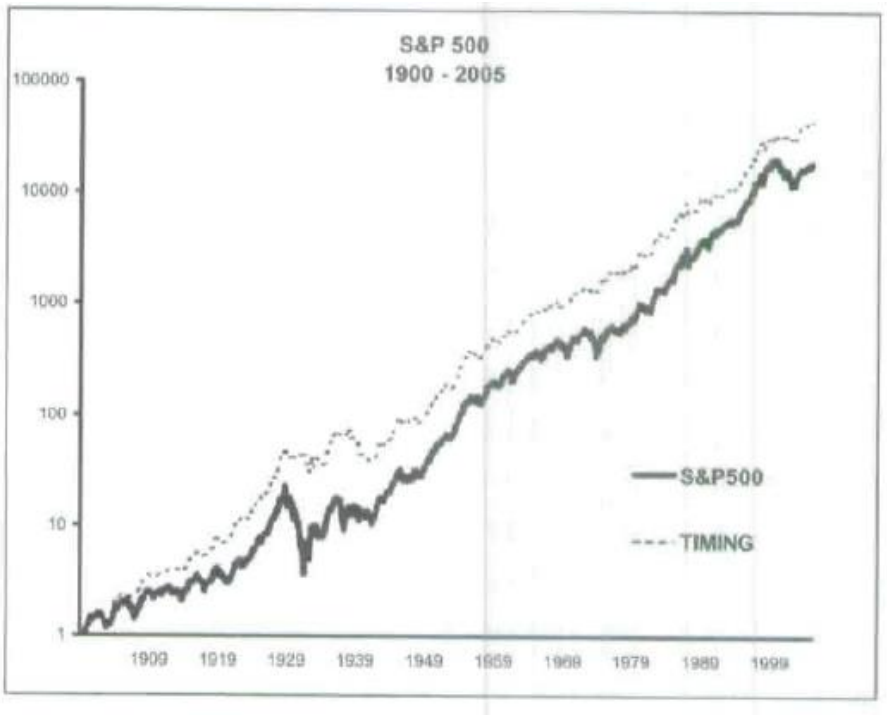
Within the field of market timing, the football method, as described by Ward and Terblanche (2009), was not significantly replicated post the 1990's and to strengthen the empirical evidence of this study, the method of asset allocation of Faber (2007) was used as described:

- Buy strategy (to equity stock)
  - Closing security price greater than ten-month simple moving average.
- Sell strategy (to cash)
  - Monthly closing security price less than ten-month simple moving average.
- Subject to the following:
  - Daily closing share price data points must be consolidated monthly including dividends.

- Cash returns are regarded as secure and fixed for one month at 0% interest rate.
- Ignore taxes and assume trade prices are executed at the closing month security price (ignore share slippage).
- Include transactions costs as a lump sum to include all brokerage fees at 2% of trade value.
- Switching prices are those at the closing price.

Faber (2007) presented the result of his proposed market timing strategy as applied to the S&P 500 from 1900-2005 but using the prevailing fixed term cash deposit rate shown in Figure 6.

**Figure 6: Market timing method of Faber (2007)**




### 4.13 Portfolio annual growth percentage rate

Once the calculations were completed for the market timing groups and control portfolios, the average growth rate must be determined. The average growth rate was calculated using the compound average growth rate, as recommended by Firer, Ross, Westerfield and Jordan (2012). The compound growth rate over n periods can be described as:

$$r = \left(\frac{FV}{PV}\right)^{\frac{1}{n}} - 1$$

Where r = the compound annual growth rate
FV = Future value
PV = Present value
n = number of periods

This annual growth rate was used to compare returns of the market timing and control portfolios.

### 4.14 Limitations and assumptions

In order to achieve the study goals while maintain credibility of results the following assumptions and limitations are present:

- The sample was limited to the JSE and cannot be extrapolated to other markets worldwide. While other markets adopt the same ICB classification, the inherent information coded into share prices of each market, are different. The industrials index of South Africa may be dramatically different to that in Russia.
- Taxation was not considered in this study. Taxation, which could be significant, was ignored based on the premise that long term investors over a 17-year period will re-invest dividends back into shares. Within multiple market timing strategies, the created portfolios were switched into a fixed one month money market cash fund. The annual effect will be minimized due to creation of tax free savings accounts. Hence taxation was ignored.
- Transaction costs were a fixed predefined value. Transaction costs are inherent to each brokerage firm and vary per the investment vehicle. Multiple sensitivity analyses were conducted on various transaction cost percentages.
- During holding periods, index re-arranging was ignored and length of holding periods was tabulated in the results. Indices from J500 to J590 were periodically corrected by the JSE and traded daily.
- The JSE super sector share prices were used as proxies to the actual funds. To re-create funds such as the J500, requires the individual indices company split for the investigated period and share price per company to be stitched together with appropriate weighting to re-create the index. This exponentially increased the chances of error when extrapolated to the ten indices. Index funds such as the Satrix top 40 ETF fund exist that mimic the JSE-J203 all

share index. However, due to lack of funds available, which mirror each super sector index during the period of investigation, it was determined to use the index share price as a proxy.

- Share slippage was ignored.
- This study assumes a rational investor.

# CHAPTER 5: RESULTS

Chapter five details the results of the quantitative analysis described in Chapter four and analysis performed on the acquired data set. This chapter was arranged in the following manner, section 5.1 describes the sampling method, section 5.2 presents the control data, section 5.3-5.4 details proposition one and two respectively. Section 5.5 further investigates the effect of cumulative portfolio return by varying input parameters, followed by preliminary conclusions.

## 5.1 Sampling description

The study aimed to investigate market timing strategies on the JSE using sector valuations. Daily samples of closing daily share price data were downloaded from The Style engine (data link to JSE) for the J203 (All share Index), ALBI (JSE all bond Index) and ten out of the ten JSE industry sector indices. During the data gathering phase, it was not possible to fully gather share price data listed in Chapter 4. The following criteria were applied to select each data set:

- Daily trading data available for period from 1995-2017
    - If not available for a short period, daily trading data available for at least eight years prior to May 2017
    - If available, extended period from 1960-2017
- No break in data gathering.

Closing share price data collected from the Style Engine was compared to closing share price data collected from Google Analytics. Discrepancies in closing share price data were found for the J500 and were omitted from the sample set. The time range of data gathered is shown in Table 7.

### 5.1.1 Reliability and validity

Reliability and validity formed the foundation of research findings in which insights are based upon, hence an evaluation of these facets was paramount to this study. Creswell (2013) advocates the importance of reliability and validity for quantitative studies. Table 5 provides a summary of the findings by applying the reliability and validity framework proposed previously:

**Table 5: Reliability and validity results**

| ***Validity*** | |
|---|---|
| ***Term*** | ***Description*** |
| Subject selection | 10 out of 10 industry sector indices were selected compromising the full population hence subject selection is representative of the market. |
| History | A time series analysis was undertaken, for a period of 22 years (1995-2017) and was extended for one sample to 57 years (1960-2017). The other single sample was tested for 12 years (2002-2015). Atsalakis and Valavanis (2009) in their survey of over 100 various market timing strategies found majority of time series length over 8 years, hence study period was adequate. |
| Testing | Data was extracted as closing share price data from the JSE via The Style Engine which is classified as secondary data, hence no testing effects were noted. |
| Mortality | Each industry index is comprised of active traded shares, and the JSE periodically re-constituents each index with companies that are de-listed or liquidated removed hence survivor-ship bias is present. |
| Ambiguity about causal direction | In each generated portfolio, a switching tool was used to measure ten-month historic share price data to predict in the future month when to alternate between equity and safe investments hence causal direction was clear and not debateable. |
| ***Reliability*** | |
| ***Term*** | ***Description*** |
| Subject error | Closing day share price data was used for the entire sample which is a standard used in market timing strategies hence subject error was minimised. |
| Subject bias | Secondary data in the form of closing share price data was used hence subject bias is not applicable. |
| Observer error | Analysis instrument used was Microsoft excel which has the possibilities of errors, this was minimized re-working calculations, testing with other published data sets and verified by 3rd party. Hence observer error was minimised |
| Observer bias | Data collection methodologies and analysis procedures were based on numerous published research articles. These analysis procedures yield replica table quantitative data hence observer bias was minimized. |

## 5.2 Control portfolios

### 5.2.1 JSE all share index (J203) JSE Albi (ALBI)

The JSE was initially founded in 1887 to raise capital during the mining boom (Bowler, 2012). It has grown to become the 19$^{th}$ largest stock exchange by market capitalisation, JSE (2017). The J203, or JSE/FTSE all share index, is a market cap weighted index of the approximately 160 largest listed companies, covering 99% of this exchange's market capitalization. It was used as a proxy for the equities market.

The ALBI or All bonds index is comprised of 20 plain bonds arranged by liquidity and market capitalisation, JSE (2017). The ALBI is used as a proxy for the movement of the JSE bond market, is reconstituted quarterly and excludes bonds with terms lower than one year. This index was used as an alternate index in the market timing strategy described next.

**Figure 7: Market performance of the J203 and JSE: ALBI from 1995-2017**


**Table 6: J203 and ABLI index data results**

| ***Name*** | ***J203*** | ***ALBI*** |
|---|---|---|
| ***No. months*** | 264 | 264 |
| ***Range*** | 06/1995 - 05/2017 | 06/1995 - 05/2017 |
| ***Initial investment*** | R 1.00 | R 1.00 |
| ***Final investment*** | R 10.98 | R 13.06 |
| ***CAR*** | 11.6% | 12.4% |
| ***Average*** | 10.8% | 11.7% |
| ***Median*** | 14.0% | 9.9% |
| ***Stdev*** | 17.3% | 7.4% |
| ***Max*** | 40.6% | 27.1% |
| ***Min*** | -32.2% | -2.7% |
| ***Sharpe*** | 0.67 | 1.69 |

The cumulative returns for the JSE all-share index (J203) and the JSE ALBI are shown in Figure 7 and in Table 6. A prominent feature was the poor cumulative return performance of the J203 over the period 1995-2017 relative to the ALBI index (CAR: 11.6% vs. 12.4%) with the ALBI exhibiting lower volatility (Stddev: 17.3% vs. 7.4%).

The 1994-1998 period saw South Africa emerge out of previous white rule and the first term of office of the African National Congress. This period was tumultuous politically which resulted in low levels of foreign investment. In 2001-2002 saw the tech-bubble burst in US stock markets which reverberated through worldwide stock markets. The dip in 2008-2009 was a global financial crisis. The key insight over the investigated period was the lower volatility of the ALBI, against the shocks to the equity J203 market.

### 5.2.2 JSE sector indices

The JSE adopted the ICB benchmark with Level 2 classification being the industry sector, shown in Table 7. The JSE utilizes elements of the J203 to construct each index per industry category, JSE (2017). Table 7 details the summary of data gathered with status. Continuous data for the J500 could only be sourced for the period 06/2002 till 12/2015. The J570 never existed and was excluded. Data for the J580 was collected for the period 01/1960-05/2017. The J590 tracked the large increase then dip during the early 2000 dot-com rise and subsequent bubble burst.

**Table 7: Fund data summary**

| *Index Tag* | *Name* | *Status* | *Period* |
|---|---|---|---|
| J500 | Oil & Gas | Defunct | 06/2002- 12/2015 |
| J510 | Basic Materials | OK | 06/1995 - 05/2017 |
| J520 | Industrials | OK | 06/1995 - 05/2017 |
| J530 | Consumer Goods | OK | 06/1995 - 05/2017 |
| J540 | Health Care | OK | 06/1995 - 05/2017 |
| J550 | Consumer Services | OK | 06/1995 - 05/2017 |
| J560 | Telecommunications | OK | 06/1995 - 05/2017 |
| J570 | Utilities | Never existed | |
| J580 | Financials | OK | 01/1960 - 05/2017 |
| J590 | Technology | OK | 06/1995 - 05/2017 |

Figures 8 to 10 provides a graphical representation of the data collected by applying a buy and hold approach with a R1 investment. The J530 had the largest CAR at 18% over the 12-year period with J520 yielded a CAR of 11% at the lowest volatility (standard deviation = 19%). Figure 9 graphically presents data for the J500 during a

13-year period, from 06/2002-12/2015. The J580 had the longest continuous closing daily share price data for a 57-year period, from 01/1960-05/2017, shown in Figure 10. A R1 buy and hold investment in the J580 in 1960 would have yielded R515.48 in May 2017.

**Figure 8: Market performance of the nine industry sectors from 1995-2017**

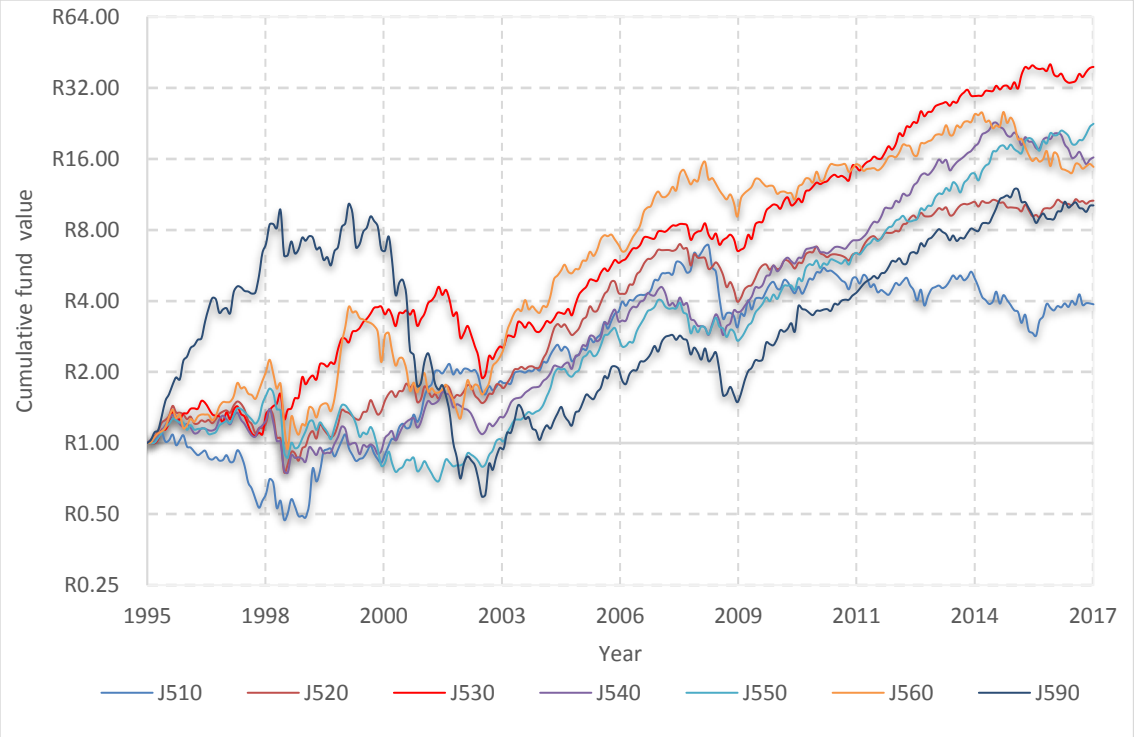


**Figure 9: Market performance of the J500 from 2002-2015**


**Figure 10: Market performance of the J580 from 1960-2017**

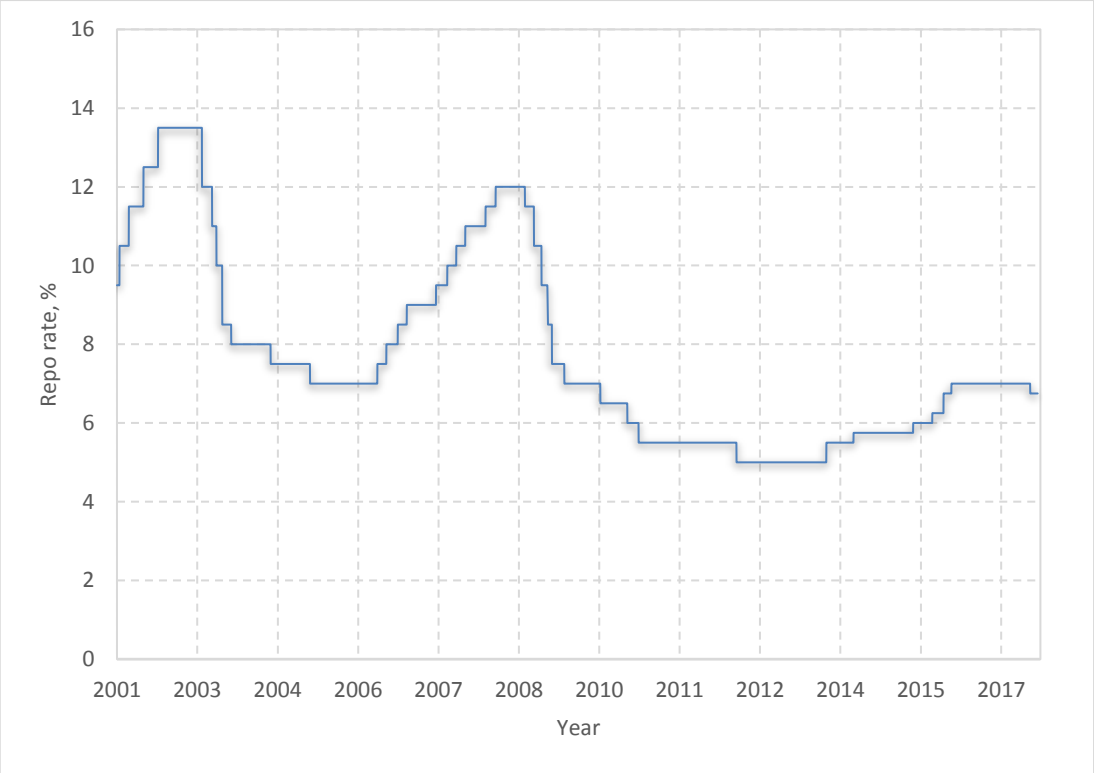
**Table 8: Industry sector buy and hold strategy**

| *Fund* | *J500* | *J510* | *J520* | *J530* | *J540* | *J550* | *J560* | *J580* | *J590* |
|---|---|---|---|---|---|---|---|---|---|
| *No. months* | 163 | 264 | 264 | 264 | 264 | 264 | 264 | 689 | 264 |
| *Range* | 06/2002- 12/2015 | 06/1995 - 05/2017 | 06/1995 - 05/2017 | 06/1995 - 05/2017 | 06/1995 - 05/2017 | 06/1995 - 05/2017 | 06/1995 - 05/2017 | 01/1960 - 05/2017 | 06/1995 - 05/2017 |
| *Initial investment* | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 |
| *Final investment* | R 5.69 | R 3.87 | R 10.64 | R 39.26 | R 16.24 | R 22.55 | R 14.80 | R 514.48 | R 10.16 |
| *CAR* | 14% | 6% | 11% | 18% | 14% | 15% | 13% | 12% | 11% |
| *Average* | 13% | 6% | 11% | 17% | 13% | 14% | 12% | 8% | 11% |
| *Median* | 23% | 13% | 13% | 22% | 18% | 15% | 17% | 14% | 23% |
| *Stdev* | 32% | 30% | 19% | 22% | 24% | 20% | 31% | 32% | 46% |
| *Max* | 55% | 63% | 43% | 41% | 42% | 41% | 85% | 79% | 93% |
| *Min* | -54% | -63% | -31% | -58% | -41% | -27% | -49% | -66% | -114% |
| *Sharpe* | 0.43 | 0.21 | 0.61 | 0.81 | 0.57 | 0.76 | 0.42 | 0.36 | 0.24 |

### 5.2.3 Historic South African repayment rates

The repo rate was the rate at which the SARB lends out to banks in South Africa. Historic repo rates from 2001-2017 are shown in Figure 11. The lowest repayment rate being 5% during 2011-2014. To reduce selection bias for high yielding deposit rates and cater for upfront fees and ongoing administration costs, the money market cash rate to be used in the market timing strategies will be half the lowest repayment rate, being 2.5% (5%/2). This rate was assumed constant for all periods of investigation in this study.

**Figure 11: Historic SARB repayment rate, SARB (2017)**



### 5.2.4 Exclusions and revisions

The exclusions and revisions made during the data collection and validation phase are listed next. Discrepancies in the time range between the J500, J580 and balance primarily relate to the availability of share price data during the study time range.

During the data collection phase, the following exclusion was made:

- Exclude the J570 Utilities index. This index was not adopted on the JSE and no share price information was available and was excluded from the study. As sufficient data for the other nine indices was available, no further investigation of this sector was made.

The following revisions were made:

- Extend the J580 sample range from 1995-2017 to 1960-2017. While collecting secondary data, and determining the optimal study range, it was possible to acquire reliable data from the period 1960-2017 for this index. It was decided to include this data set.
- Limit the data collection range of the J500 from 1995-2017 to 2002-2015. Data collected outside of this period was defunct and could not be used in this study.
- The longer duration of the J580 index and shorter J500 index will be used to draw insights on the effects of varying time ranges.
- Exclude total index returns for J580 in-lieu of standard J580 as the total returns indices were not available for J500, J510, J520, J530, J540, J560 and J590.
- Data for the ALBI was not available for the period 1960-1995. Thus, the marketing timing calculation for the J580 will exclude this control portfolio.

### 5.2.5 Data acronyms

This section presents the data coding adopted in this quantitative analysis. Each calculation set for the two data mythologies contains a host of acronyms and abbreviations, which are detailed in Table 9 that follows:

**Table 9: Acronym description**

| Acronym | Description |
|---|---|
| JXXX | Each JSE Industry index ranging from J500 till J590, excluding J570. |
| JXXX_HL | JSE industry index best timing line |
| JXXX_LW | JSE industry index worst timing line |
| JXXX_BH | JSE industry index buy and hold strategy line |
| JXXX_EB | JSE industry index equity/bond, market timing strategy |
| JXXX_EMM | JSE industry index equity/money market, market timing strategy |
| JXXX_PT | JSE industry index cumulative fund performance of best timing line |
| JXXX_IPT | JSE industry index cumulative fund performance of worst timing line |
| 10MVA | Ten month moving average |
| Index | Buy and hold index line |
| B&H Index | Buy and hold cumulative annual return summary |
| Fund_BD | Market timing portfolio compromised of switches between equities and bonds |
| Switch | Indicator of fund in equities and out of equities |
| Fund_MM | Market timing portfolio compromised of switches between equities and money market |
| Outperformance_MM | Difference between buy and hold strategy and Fund_MM |
| Outperformance_BD | Difference between buy and hold strategy and Fund_BD |

### 5.3 Research proposition one: Football method

It is useful for an investor to determine retrospectively what maximum and minimum returns are possible for a given strategy. As it was unlikely for an investor to predict, with 100% accuracy, when the market will rise and fall over long periods (8 years or more) a landscape of potential returns with forecasting ability was required. To achieve this forecasting ability, various levels of accuracy are required, as described in Table 10 proposed by Terblanche (2010). As follow-on to research proposition two, the associated average annual returns for both market timing strategies are added ex-transaction costs.

Linking research proposition one and two, the average annual returns of the market timing strategies are included for information. The purpose of which was to show a progressive line of investigation by providing a landscape of returns and accuracies

(research proposition one) following through the effects on returns by using a realistic investor strategy (research proposition two).

**Table 10: Levels of accuracy description**

| *Level of accuracy* | *Line name* | *Description* |
|---|---|---|
| Level 1 | 1 | 100% accuracy line, an investor accurately predicts every rise and fall in the index. |
| Level 2 | 5 | 0% accuracy line, an investor inaccurately predicts every rise and fall in the index. |
| Level 3 | 2 | The min accuracy required to beat the associated buy and hold strategy at every interval. |
| Level 4 | 4 | The maximum accuracy level (ceiling level) which will result in the buy and hold strategy outperforming the investor's strategy at every interval. |
| Level 5 | 3 | The forecasting accuracy with yields equal probability of success or failure in the switching mechanism of the investor's strategy. |

Section 5.3.1 to 5.3.9 provide a deep dive into each industry sector indices results, including forecasting accuracy with calculated returns and cumulative returns. Section 5.3.1 provides an expanded description with section 5.3.2-5.3.9 presented in a concise manner. This was adopted to avoid repetition. Section 5.4 provides a combined summary of the nine indices investigated.

### 5.3.1 J500 Forecasted returns and accuracy

A graphical representation of the time series calculation set of average annual return versus forecasted percentage accuracy was shown in Figure 12, the cumulative returns are shown in Figure 13 and the summary of level of percentages are shown in Table 11, for the J500 (Oil & Gas index). The J500 time series set was reduced to 13 years from 19 years, in the range 2002-2015.

**Figure 12: J500 Forecasting accuracy and calculated returns**

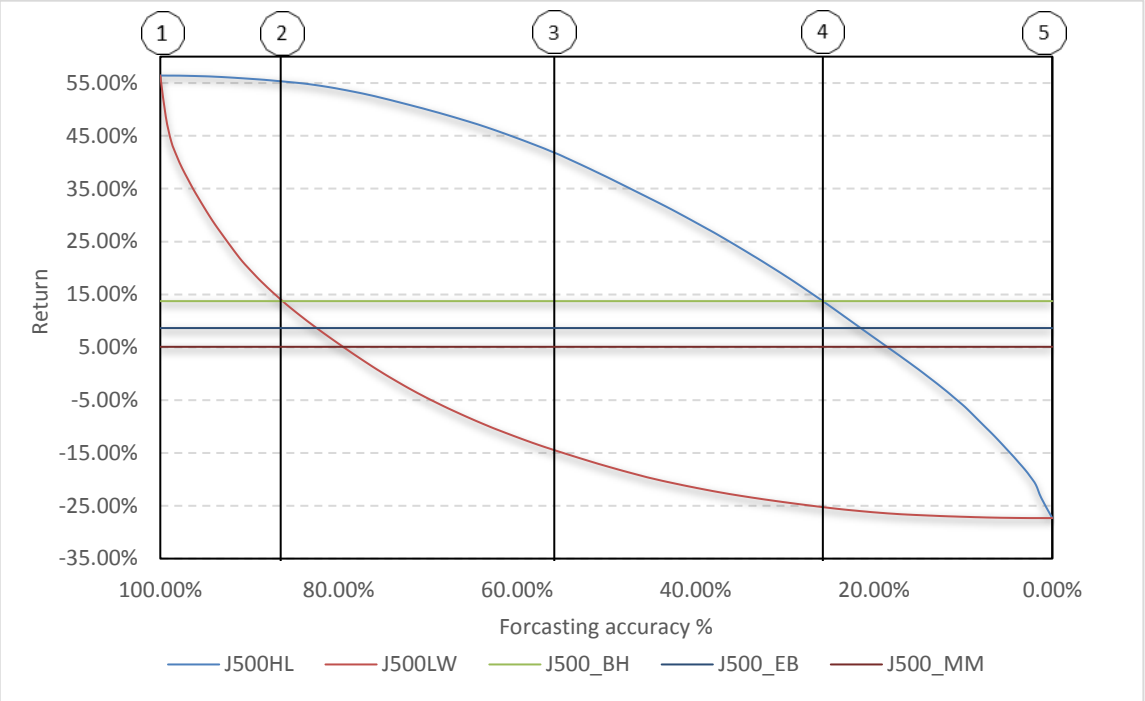



**Figure 13: J500 100% and 0% accuracy predicted cumulative returns**

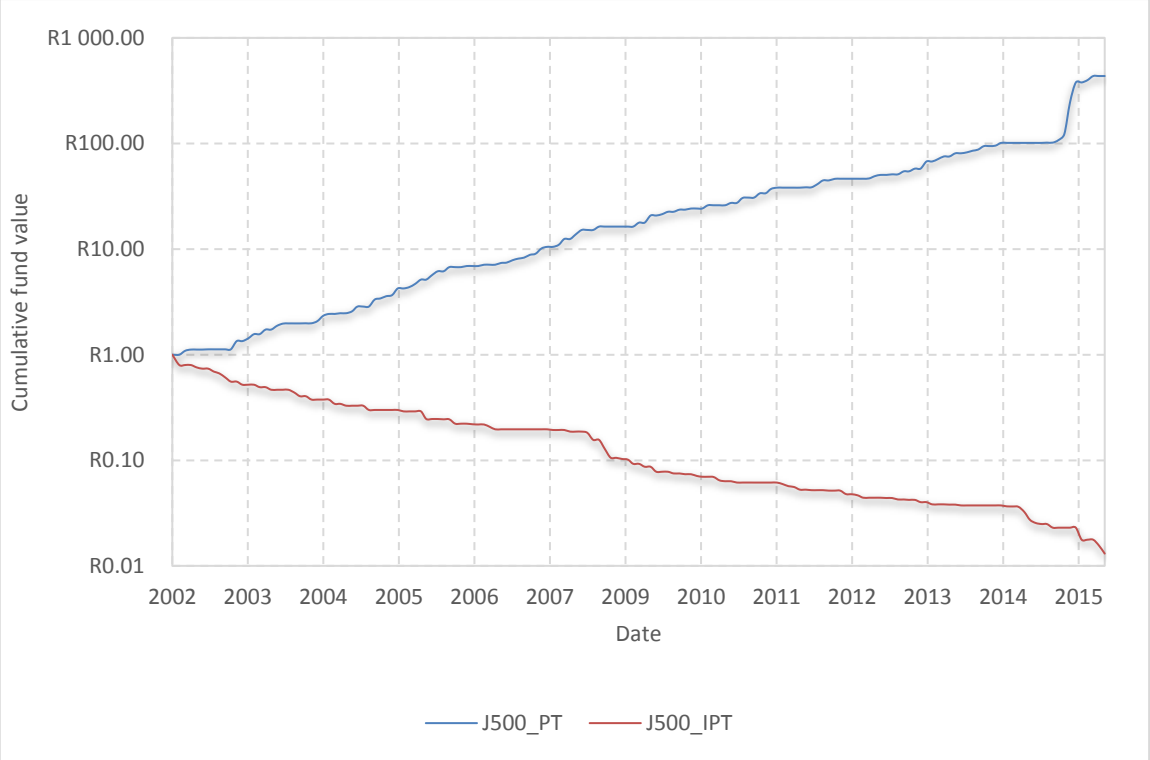


**Table 11: J500 selected forecasted returns and percentage**

| Fund name | Line 1: 100% Accuracy return | Line 2: 0% Accuracy line return | Line 3: Outperform Buy and Hold line | Line 4: Equal probability line | Line 5: Underperform Buy and hold line | Buy and hold return | Equity and MM return | Equity and Bond return |
|---|---|---|---|---|---|---|---|---|
| J500 | 56.41% | -27.34% | 86.50% | 55.83% | 25.72% | 13.72% | 5.08% | 8.63% |

Based on Figure 12, an investor could achieve annual average returns of 56.41%, which is 42.69% higher than the associated buy and hold strategy. To achieve this, an investor would require 100% forecasting accuracy (Line 1). Conversely, had an investor maintained 0%, forecasted accuracy would result in a 27.34% annual average loss (Line 5). Line 1 and 5 represent single point results relative to a 100% and 0% forecasted accuracy respectively.

For an investor to beat the associated buy and hold strategy during all periods, an investor must maintain a minimum of 86.50% forecasted accuracy (Line 2). Between the forecasted accuracy of Line 1 and 2, an investor can achieve returns between 56.41% and 13.72%.

At a forecasted accuracy of 27.72% or less, an investor would not beat the associated buy and hold strategy during all periods (Line 4). Had an investor maintained forecasted accuracy in the range 0% to 27.72% it would have resulted in an annual average return of from -27.34% to 13.72%.

At an equal probability of missing the good and bad periods, an investor must maintain a forecasted accuracy of 55.83% to equal the associated buy and hold strategy of 13.72% (Line 3). The annual average returns for equity/bond and equity/money market, market timing strategies were 8.63% and 5.08% respectively.

### 5.3.2 J510 Forecasted returns and accuracy

The time series calculation set for the J510 (Basic materials index) are shown graphically in Figures 14 and 15. The tabulated average annual returns and forecasted accuracies are shown in Table 12 per lines 1 to 5. This time series set was calculated for a 19-year period in the range 1998-2017.

An investor could achieve an average annual return of 46.13% at 100% forecasted accuracy. Conversely, at 0% forecasted accuracy, an investor would have achieved -

27.31%. These represent point results as Line 1 and 5. To outperform a buy and hold strategy of 6.37% an investor would need to achieve a minimum of 80.15% forecasted accuracy and at a forecasted accuracy of 26.36% or less, the investor would not be able to outperform the buy and hold strategy. At 51.85% forecasted accuracy, an investor would have equal probability of missing the good and bad periods but achieve the buy and hold strategy average annual return of 6.37%. The annual average returns for equity/bond and equity/money market, market timing strategies were 8.63% and 5.08% respectively.

**Figure 14: J510 Forecasting accuracy and calculated returns**

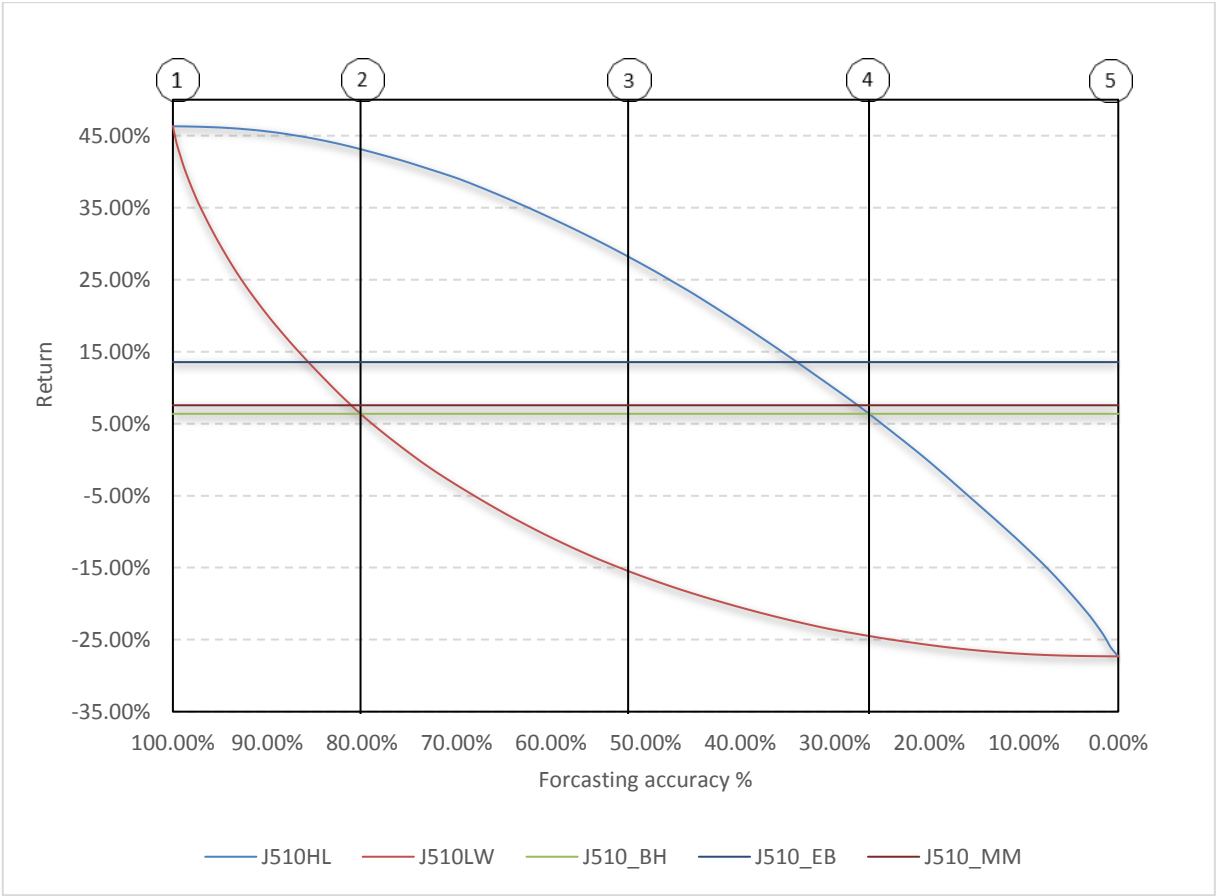


**Figure 15: J510 100% and 0% accuracy predicted cumulative returns**

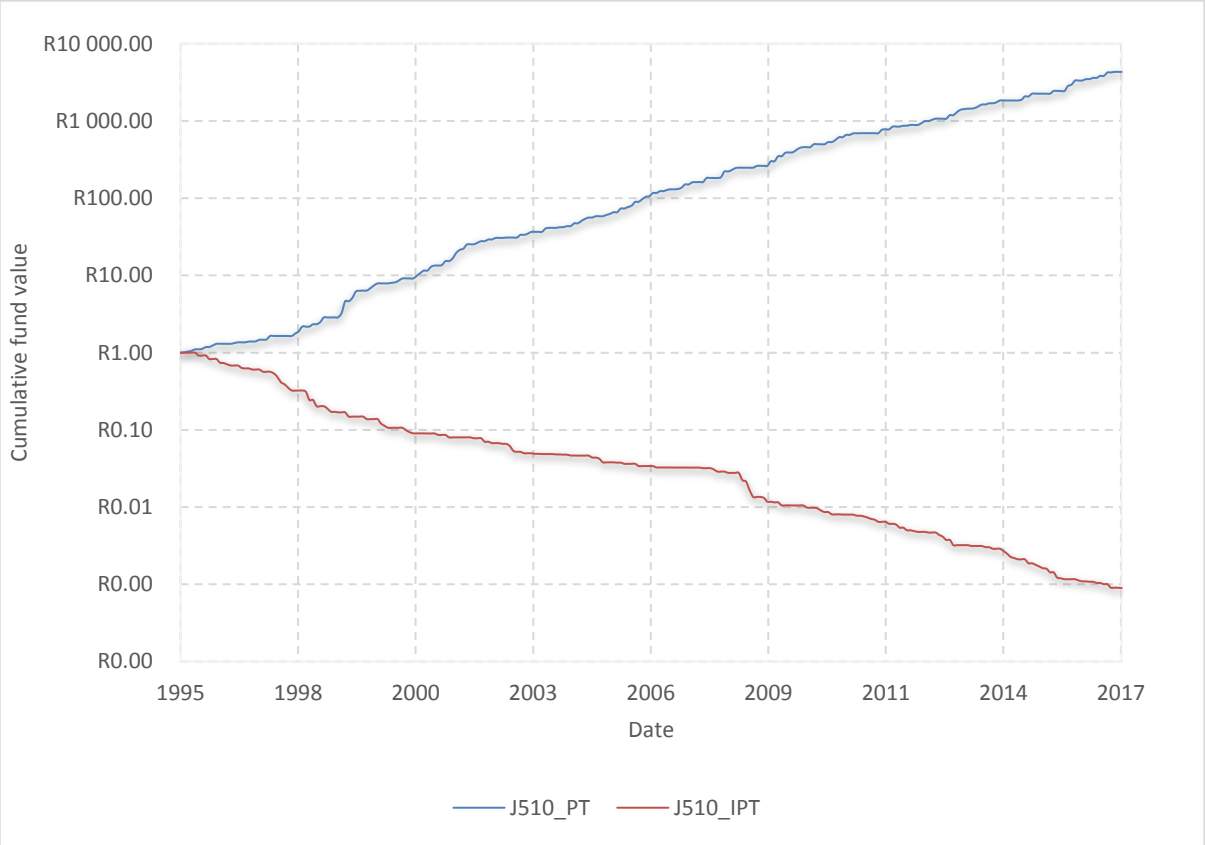



**Table 12: J510 selected forecasted returns and percentage**

| Fund name | Line 1: 100% Accuracy return | Line 2: 0% Accuracy line return | Line 3: Outperform Buy and Hold line | Line 4: Equal probability line | Line 5: Underperform Buy and hold line | Buy and hold return | Equity and MM return | Equity and Bond return |
|---|---|---|---|---|---|---|---|---|
| J510 | 46.31% | -27.31% | 80.15% | 51.85% | 26.36% | 6.37% | 7.56% | 13.55% |

### 5.3.3 J520 Forecasted returns and accuracy

The time series calculation set for the J520 (Industrials index) are shown graphically in Figures 16 and 17. The tabulated average annual returns and forecasted accuracies are shown in Table 13 per lines 1 to 5. This time series set was calculated for a 19-year period in the range 1998-2017.

An investor would have achieved an average annual return of 36.72% at 100% forecasted accuracy. Conversely, at 0% forecasted accuracy, the associated average annual return was -18.56%. These represent point results as Line 1 and 5. To outperform a buy and hold strategy of 11.39% an investor would need to achieve a minimum of 84.73% forecasted accuracy and at 29.32% forecasted accuracy or less

the investor would not be able to outperform the buy and hold strategy. At 59.98% forecasted accuracy, an investor would have equal probability of missing the good and bad periods but achieve the buy and hold strategy average annual return. The annual average returns for equity/bond and equity/money market, market timing strategies were 13.95% and 10.33% respectively.

**Figure 16: J520 Forecasting accuracy and calculated returns**

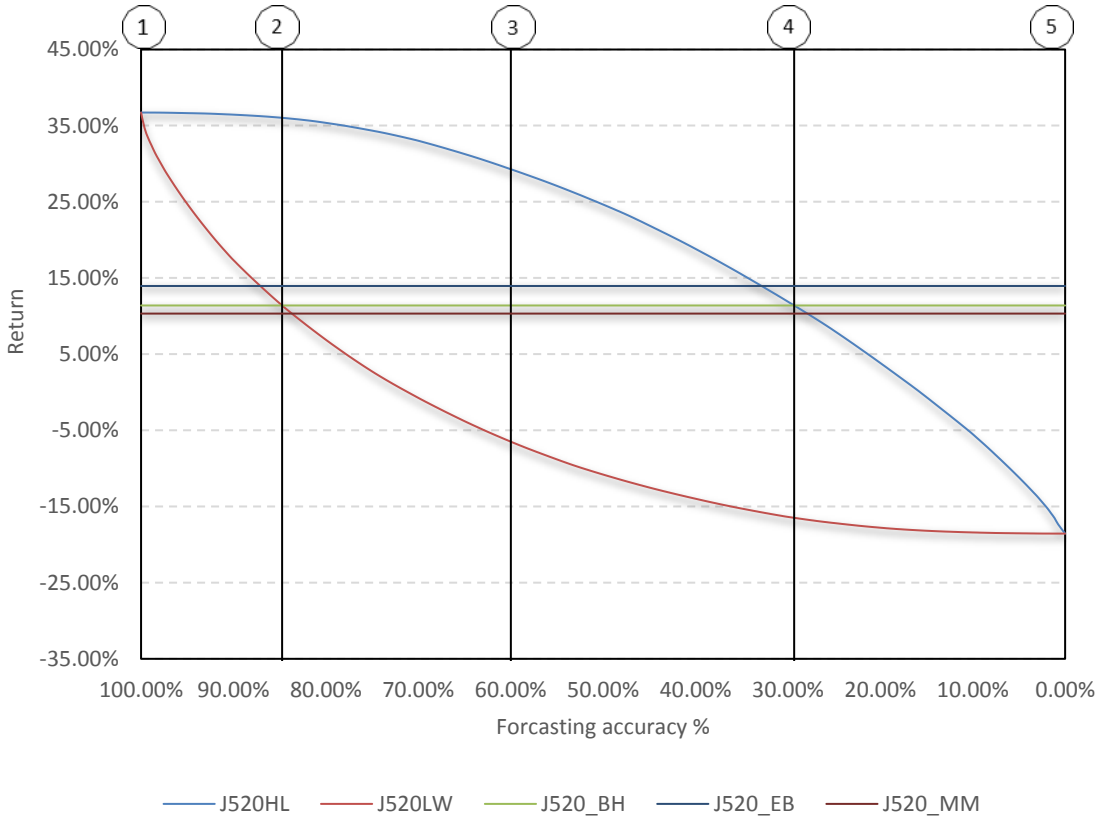


**Figure 17: J520 100% and 0% accuracy predicted cumulative returns**

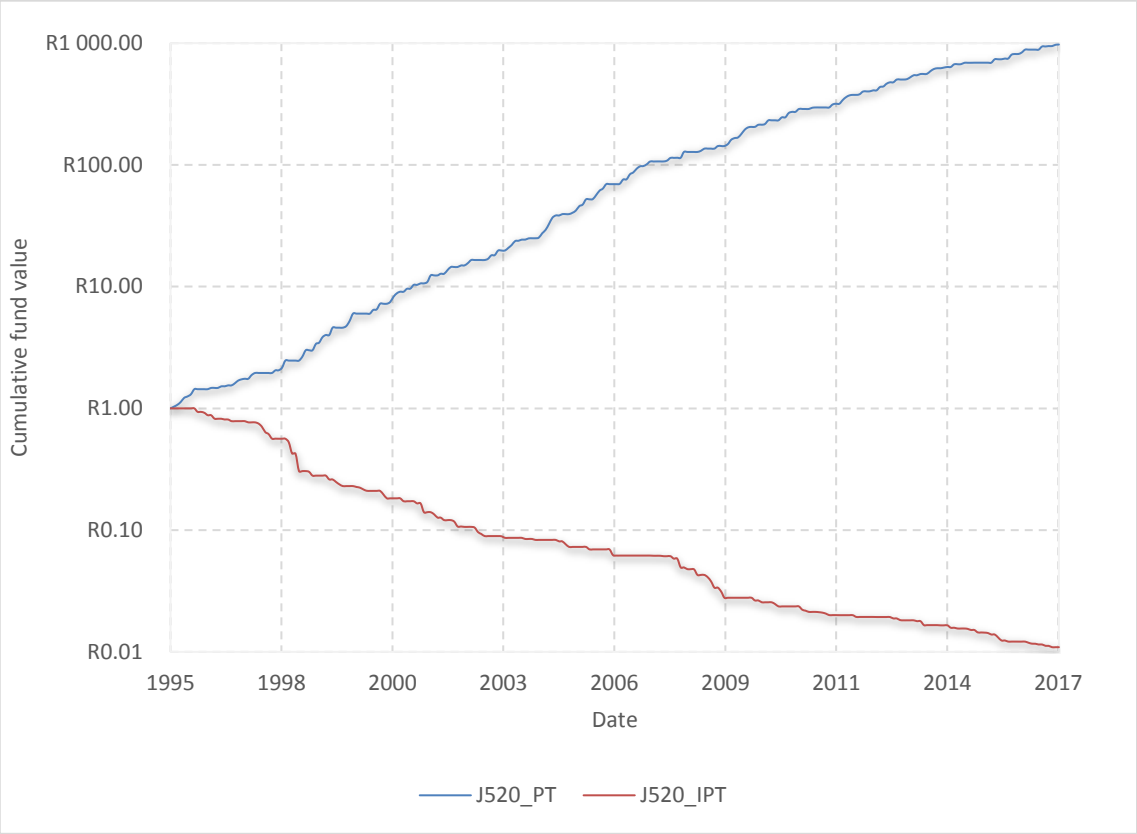



**Table 13: J520 selected forecasted returns and percentage**

| Fund name | Line 1: 100% Accuracy return | Line 2: 0% Accuracy line return | Line 3: Outperform Buy and Hold line | Line 4: Equal probability line | Line 5: Underperform Buy and hold line | Buy and hold return | Equity and MM return | Equity and Bond return |
|---|---|---|---|---|---|---|---|---|
| J520 | 36.72% | -18.56% | 84.73% | 59.98% | 29.32% | 11.39% | 10.33% | 13.95% |

### 5.3.4 J530 Forecasted returns and accuracy

The time series calculation set for the J530 (Consumer Goods index) are shown graphically in Figures 18 and 19. The tabulated average annual returns and forecasted accuracies are shown in Table 14 per lines 1 to 5. This time series set was calculated for a 19-year period in the range 1998-2017.

At 100% forecasted accuracy, an investor would have achieved an average annual return of 45.39%. On the other hand, at 0% forecasted accuracy, the associated average annual return was calculated to be -18.73%. These represent point results as Line 1 and 5. To outperform a buy and hold strategy of 18.23% an investor would need to achieve a minimum of 87.45% forecasted accuracy. At 32.13% forecasted accuracy

or less the investor would not be able to outperform the buy and hold strategy. For an investor to achieve an equal probability of missing the good and bad periods but achieve the buy and hold strategy average annual return, requires a 59.98% forecasted accuracy. The annual average returns for equity/bond and equity/money market, market timing strategies, were 20.19% and 15.54% respectively.

**Figure 18: J530 Forecasting accuracy and calculated returns**

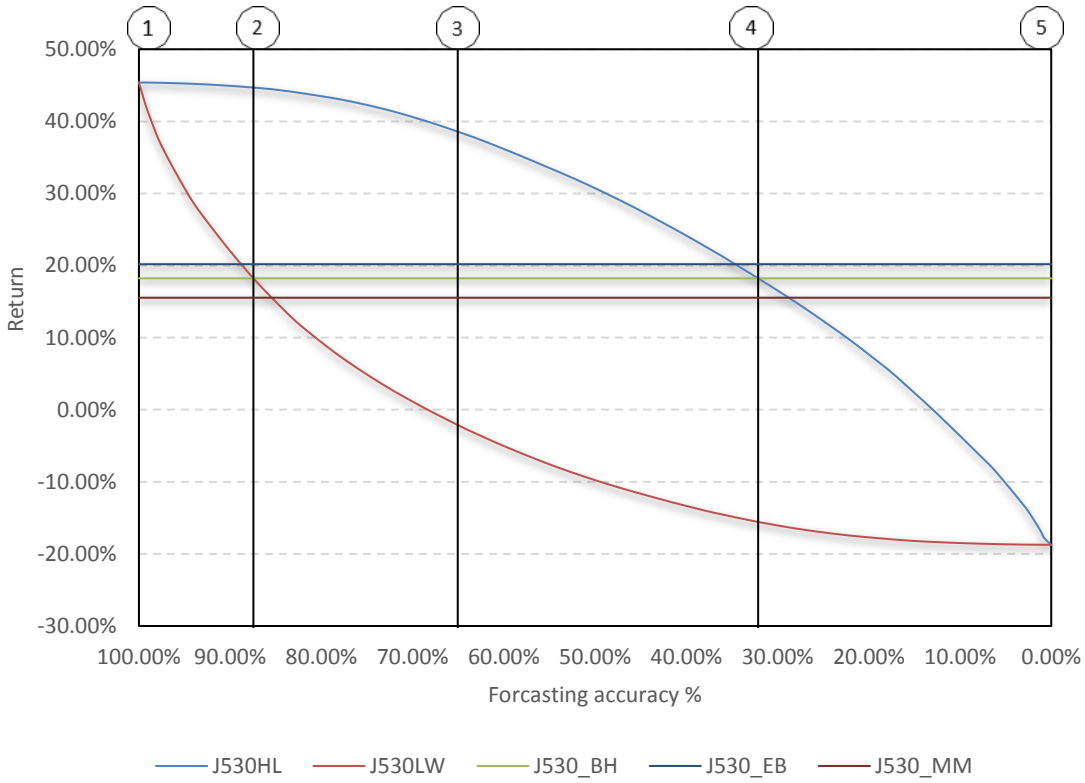


**Figure 19: J530 100% and 0% accuracy predicted cumulative returns**

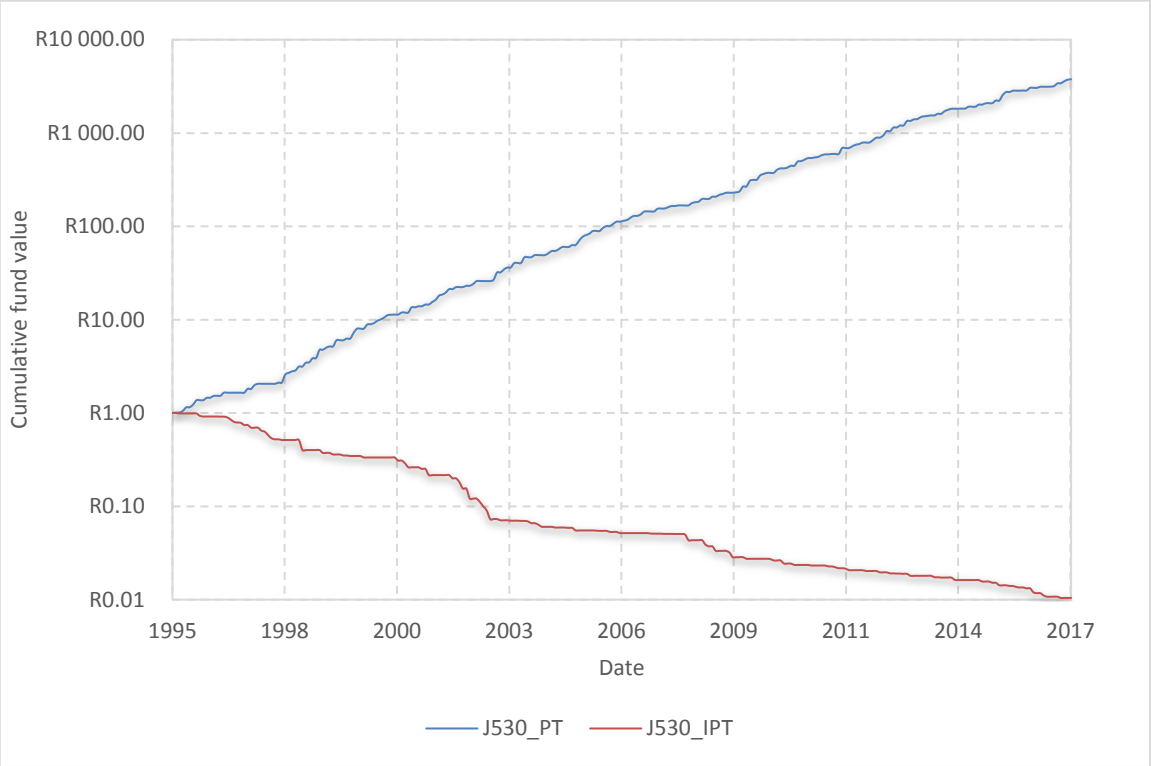



**Table 14: J530 selected forecasted returns and percentage**

| Fund name | Line 1: 100% Accuracy return | Line 2: 0% Accuracy line return | Line 3: Outperform Buy and Hold line | Line 4: Equal probability line | Line 5: Underperform Buy and hold line | Buy and hold return | Equity and MM return | Equity and Bond return |
|---|---|---|---|---|---|---|---|---|
| J530 | 45.39% | -18.73% | 87.45% | 65.05% | 32.13% | 18.23% | 15.54% | 20.19% |

### 5.3.5 J540 Forecasted returns and accuracy

The time series calculation sets for the J540 (Health care index) are shown graphically in Figures 20 and 21. The tabulated average annual returns and forecasted accuracies are shown in Table 15 per lines 1 to 5. This time series set was calculated for a 19-year period in the range 1998-2017.

For an investor to achieve an average annual return of 40.33% required a forecasted accuracy of 100% and at a 0% forecasted accuracy the associated average annual return was -19.11%. These represent point results as Line 1 and 5. To outperform a buy and hold strategy of 13.56% an investor would need to achieve a minimum of 84.31% forecasted accuracy. A 31.48% forecasted accuracy or less would result in an investor not being able to outperform the buy and hold strategy. At 61.54% forecasted

accuracy, an investor would have equal probability of missing the good and bad periods but achieve the buy and hold strategy average annual return. The annual average returns for equity/bond and equity/money market, market timing strategies were 19.19% and 15.10% respectively.

**Figure 20: J540 Forecasting accuracy and calculated returns**

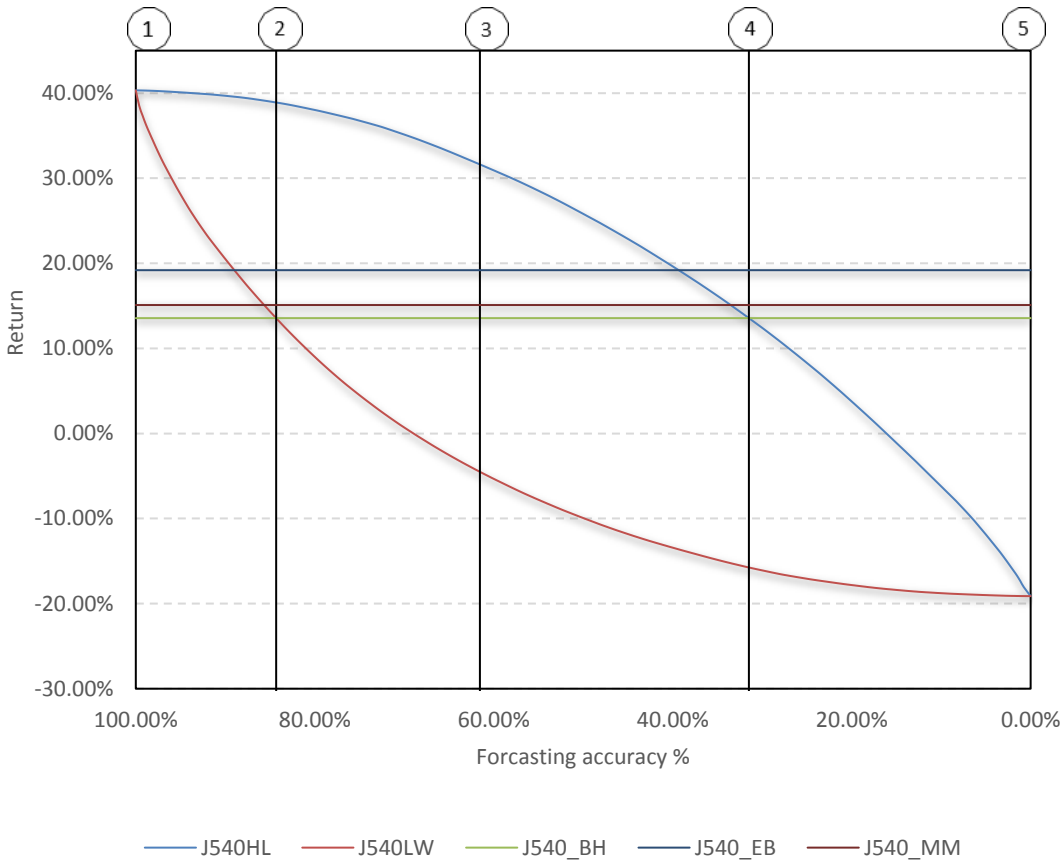


**Figure 21: J540 100% and 0% accuracy predicted cumulative returns**

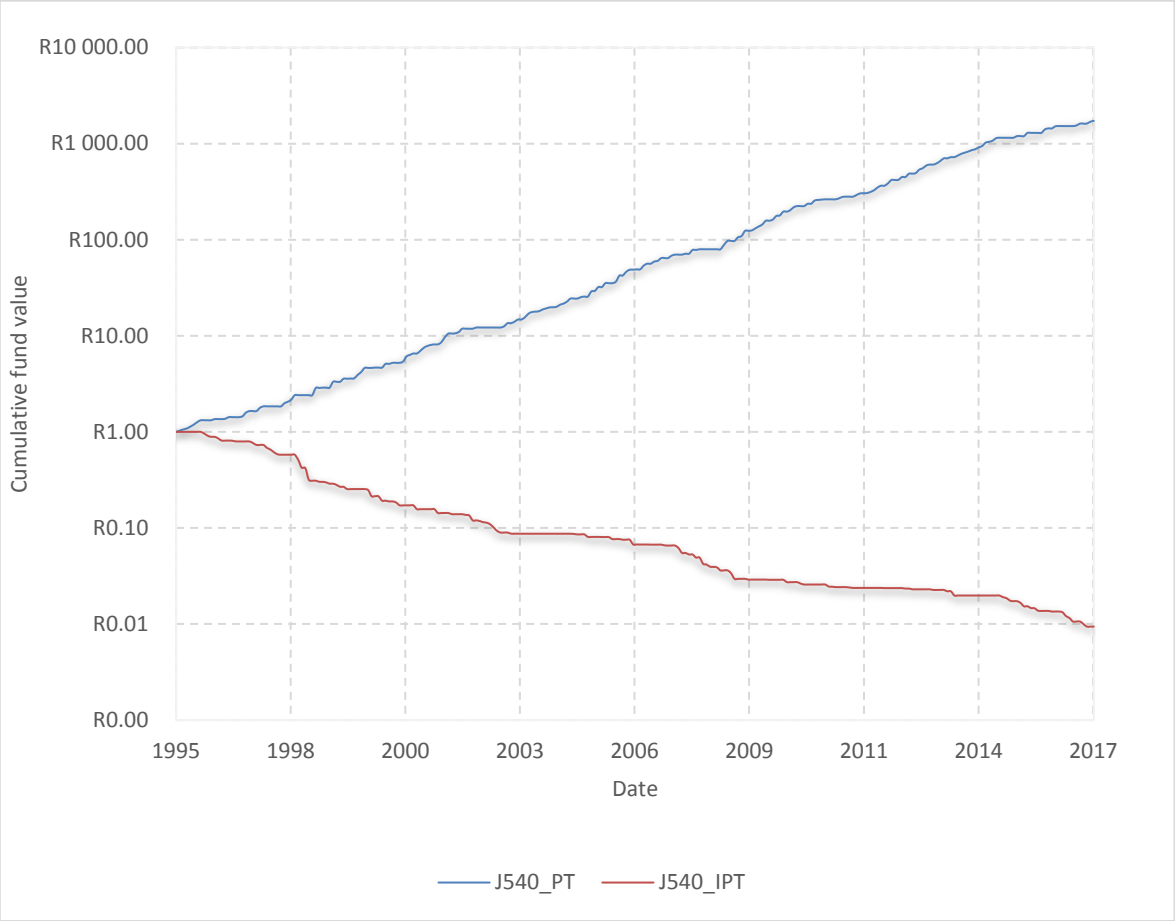



**Table 15: J540 selected forecasted returns and percentage**

| Fund name | Line 1: 100% Accuracy return | Line 2: 0% Accuracy line return | Line 3: Outperform Buy and Hold line | Line 4: Equal probability line | Line 5: Underperform Buy and hold line | Buy and hold return | Equity and MM return | Equity and Bond return |
|---|---|---|---|---|---|---|---|---|
| J540 | 40.33% | -19.11% | 84.31% | 61.54% | 31.48% | 13.56% | 15.10% | 19.19% |

### 5.3.6 J550 Forecasted returns and accuracy

The time series calculation sets for the J550 (Consumer services index) are shown graphically in Figures 22 and 23. The tabulated average annual returns and forecasted accuracies are shown in Table 16 per lines 1 to 5. This time series set was calculated for a 19-year period in the range 1998-2017.

At a 100% forecasted accuracy, an investor would have achieved an average annual return of 44.71%, conversely, at a 0% forecasted accuracy, the associated average annual return was -20.38%. To outperform a buy and hold strategy of 15.27% an

investor would need to achieve a minimum of 83.72% forecasted accuracy. At 33.46% forecasted accuracy or less, an investor would not be able to outperform the buy and hold strategy. At 61.11% forecasted accuracy, an investor would have equal probability of missing the good and bad periods but achieve the buy and hold strategy average annual return. The annual average returns for equity/bond and equity/money market, market timing strategies were 18.47% and 12.92% respectively.

**Figure 22: J550 Forecasting accuracy and calculated returns**

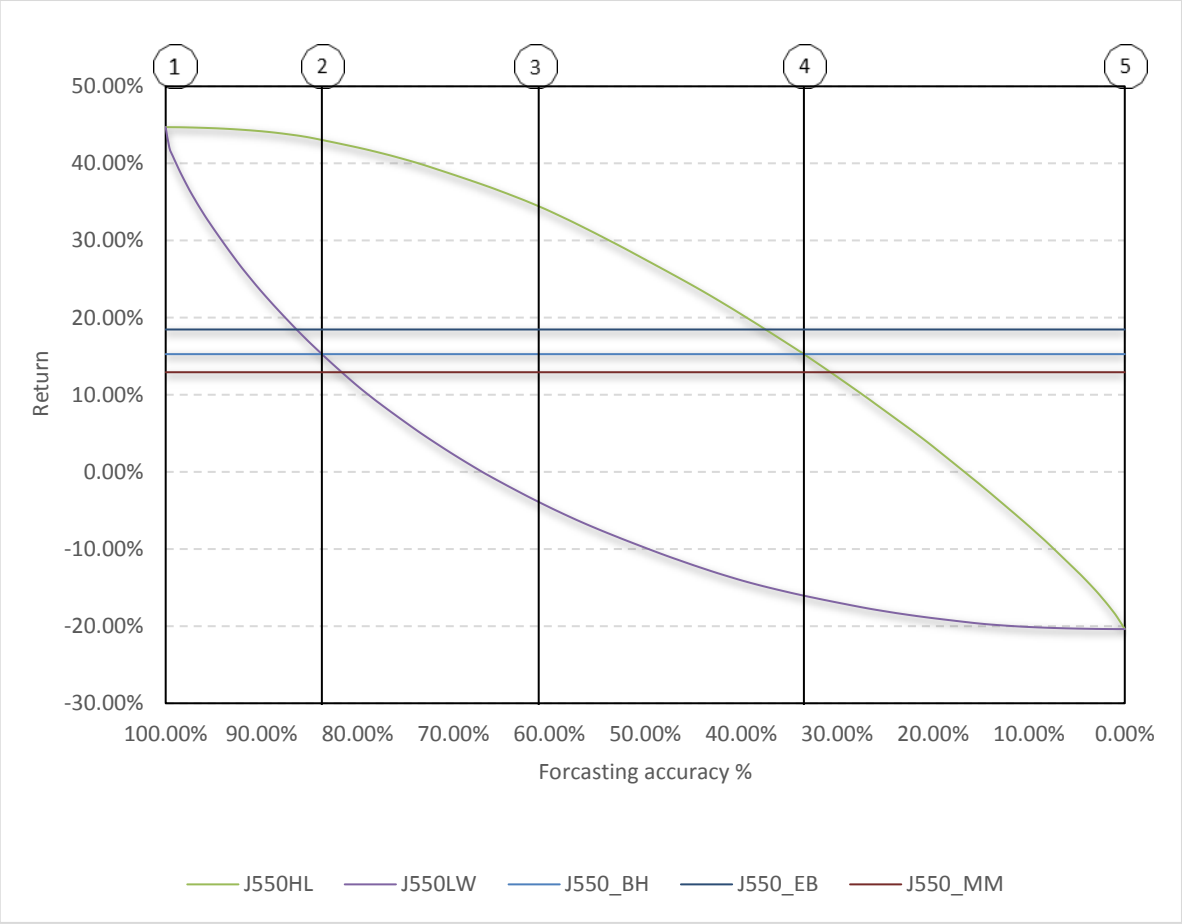


**Figure 23: J550 100% and 0% accuracy predicted cumulative returns**

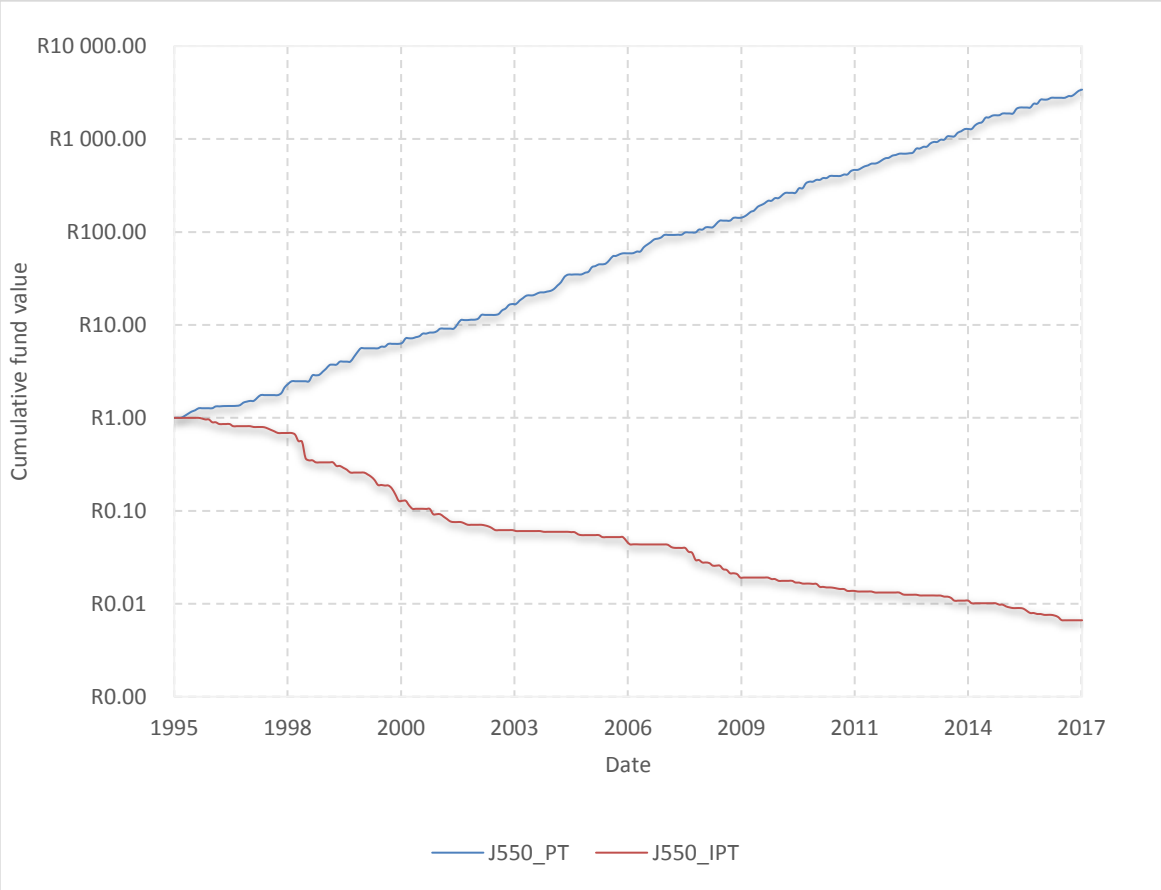



**Table 16: J550 selected forecasted returns and percentage**

| Fund name | Line 1: 100% Accuracy return | Line 2: 0% Accuracy line return | Line 3: Outperform Buy and Hold line | Line 4: Equal probability line | Line 5: Underperform Buy and hold line | Buy and hold return | Equity and MM return | Equity and Bond return |
|---|---|---|---|---|---|---|---|---|
| J550 | 44.71% | -20.38% | 83.72% | 61.11% | 33.46% | 15.27% | 12.92% | 18.47% |

### 5.3.7 J560 Forecasted returns and accuracy

The time series calculation sets for the J570 (Utilities index) are shown graphically in Figures 24 and 25. The tabulated average annual returns and forecasted accuracies are shown in Table 17 per lines 1 to 5. This time series set was calculated for a 19-year period in the range 1998-2017.

An investor would have achieved an average annual return of 52.75% at 100% forecasted accuracy. Conversely, at 0% forecasted accuracy the associated average annual return was -27.32%, as represented by Line 1 and 5 respectively. To outperform a buy and hold strategy of 13.08%, an investor would need to achieve a

minimum of 84.83% forecasted accuracy. At 26.41% forecasted accuracy or less an investor would not be able to outperform the buy and hold strategy. At 55.39% forecasted accuracy, an investor would have equal probability of missing the good and bad periods but achieve the buy and hold strategy average annual return. The annual average returns for equity/bond and equity/money market, market timing strategies were 20.51% and 15.12% respectively.

**Figure 24: J560 Forecasting accuracy and calculated returns**

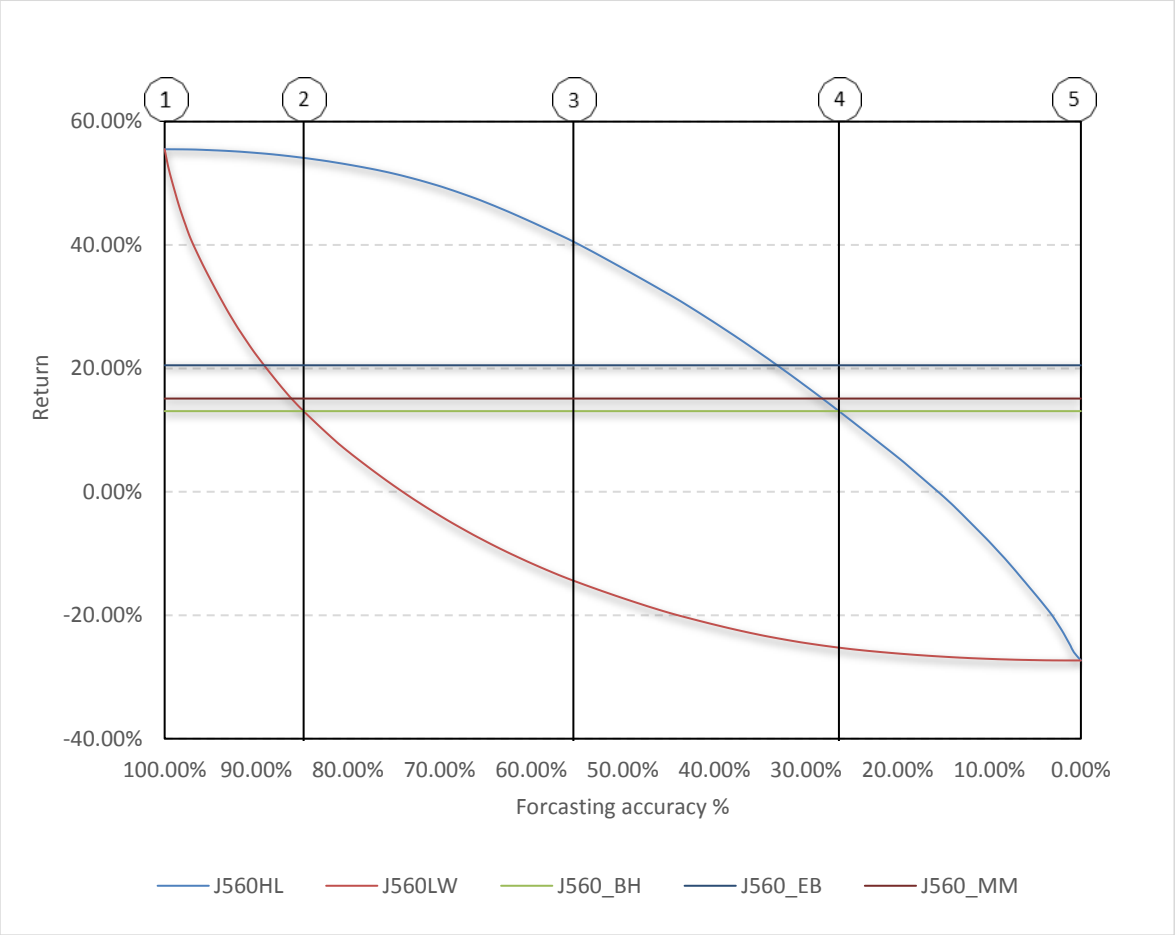


**Figure 25: J560 100% and 0% accuracy predicted cumulative returns**

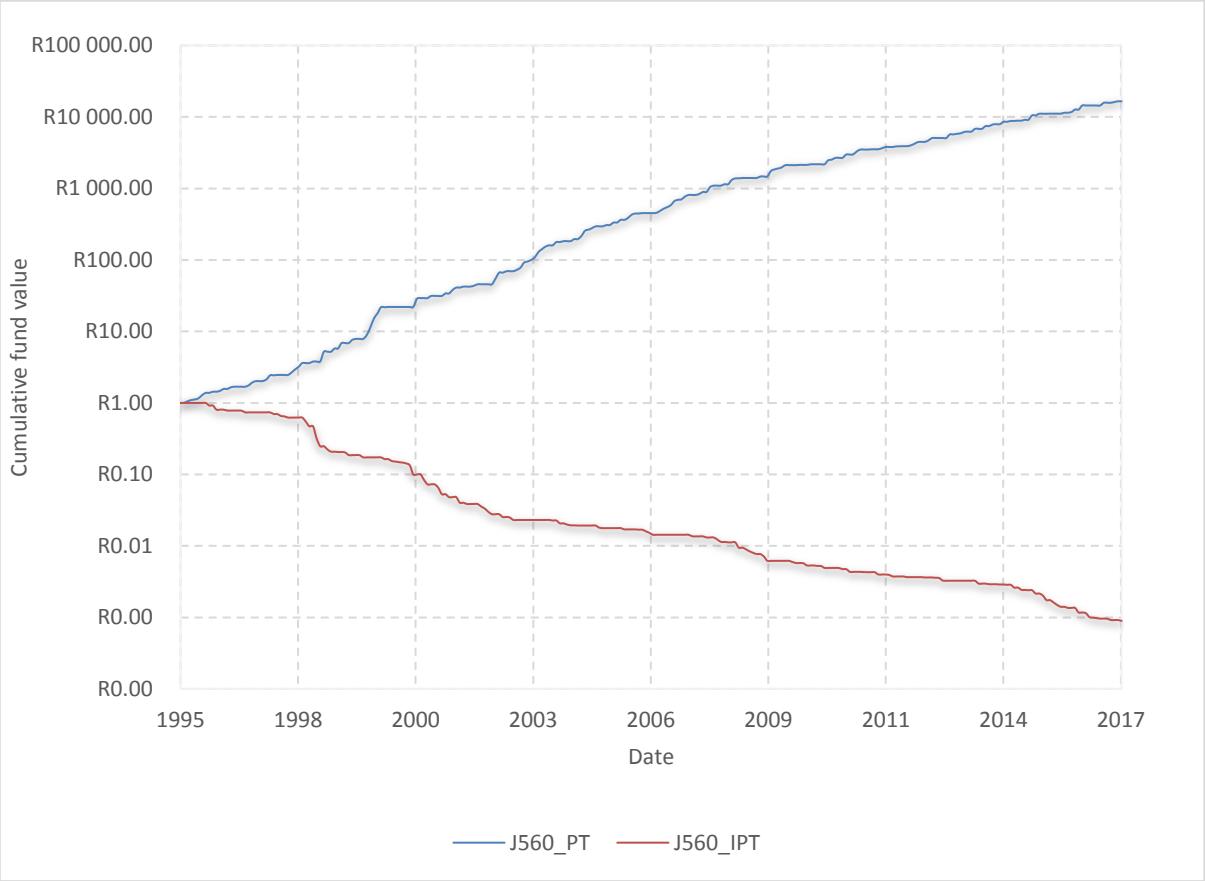



**Table 17: J560 selected forecasted returns and percentage**

| Fund name | Line 1: 100% Accuracy return | Line 2: 0% Accuracy line return | Line 3: Outperform Buy and Hold line | Line 4: Equal probability line | Line 5: Underperform Buy and hold line | Buy and hold return | Equity and MM return | Equity and Bond return |
|---|---|---|---|---|---|---|---|---|
| J560 | 52.75% | -27.32% | 84.83% | 55.39% | 26.41% | 13.08% | 15.12% | 20.51% |

### 5.3.8 J580 Forecasted returns and accuracy

The time series calculation sets for the J580 (Financial index) are shown graphically in Figures 26 and 27. The tabulated average annual returns and forecasted accuracies are shown in Table 18 per lines 1 to 5. The time series was extended from 19 years for 57 years in the range 1960-2017.

An investor would have achieved an average annual return of 37.96% at a 100% forecasted accuracy, conversely at a 0% forecasted accuracy the associated average annual return was -19.19%. These represent point results as Line 1 and 5. To outperform a buy and hold strategy of 11.50% an investor would need to achieve a minimum of 85.77% forecasted accuracy. At a 27.24% forecasted accuracy or less an

investor would not be able to outperform the buy and hold strategy. At 60.08% forecasted accuracy, an investor would have equal probability of missing the good and bad periods but achieve the buy and hold strategy average annual return. The annual average returns for the equity/money market, market timing strategies was 10.83%.

**Figure 26: J580 Forecasting accuracy and calculated returns**

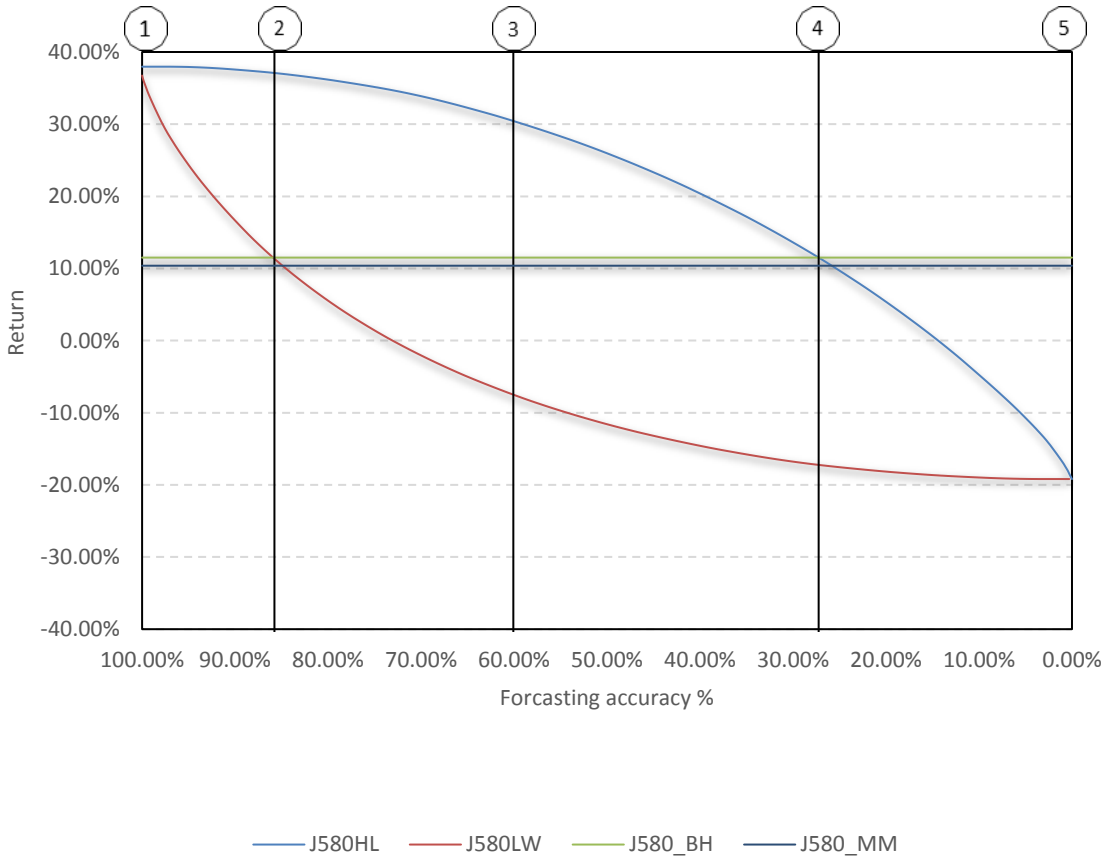


**Figure 27: J580 100% and 0% accuracy predicted cumulative returns**

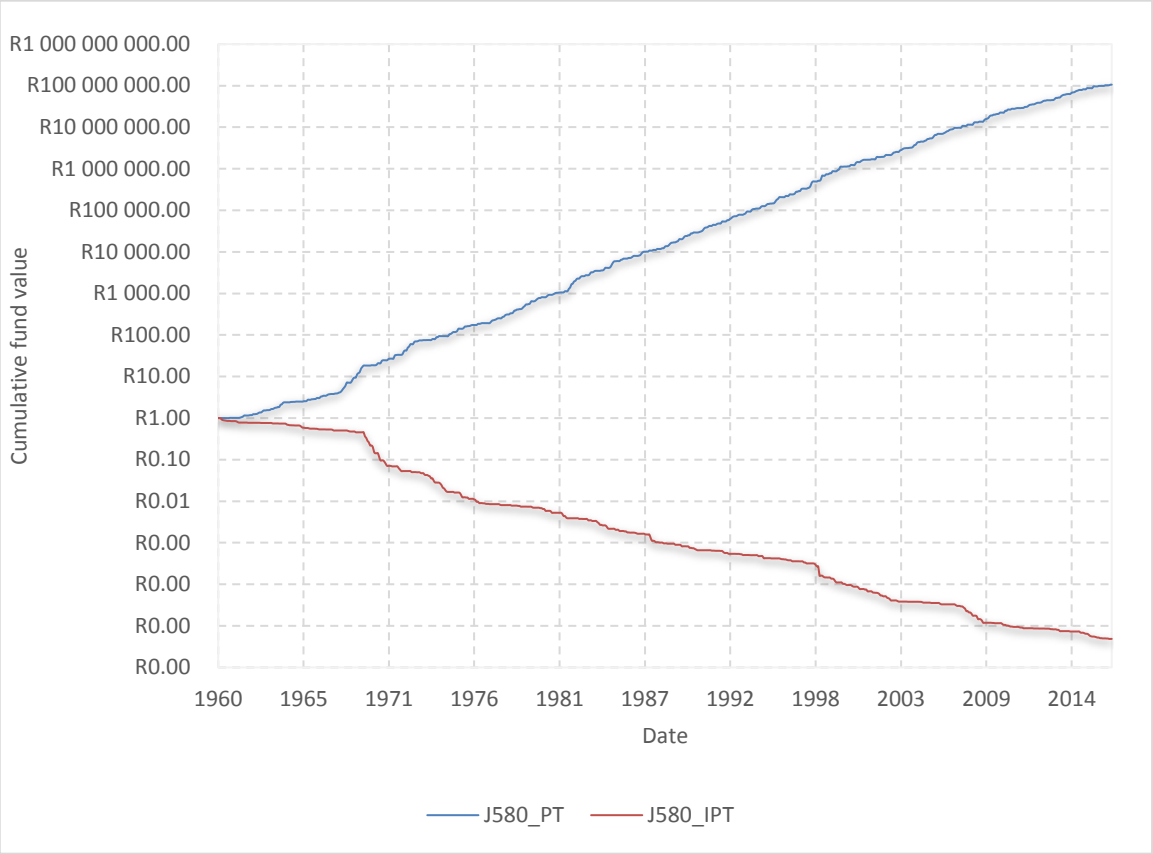



**Table 18: J580 selected forecasted returns and percentage**

| Fund name | Line 1: 100% Accuracy return | Line 2: 0% Accuracy line return | Line 3: Outperform Buy and Hold line | Line 4: Equal probability line | Line 5: Underperform Buy and hold line | Buy and hold return | Qeuity and MM return |
|---|---|---|---|---|---|---|---|
| J580 | 37.96% | -19.19% | 85.77% | 60.08% | 27.24% | 11.50% | 10.38% |

### 5.3.9 J590 Forecasted returns and accuracy

The time series calculation sets for the J590 (Technology index) are shown graphically in Figures 28 and 29. The tabulated average annual returns and forecasted accuracies are shown in Table 19 per lines 1 to 5. This time series set was calculated for a 19-year period in the range 1998-2017.

An investor would have achieved an average annual return of 62.37% at a 100% forecasted accuracy, conversely at a 0% forecasted accuracy the associated average annual return was -31.58%. These represent point results as Line 1 and 5. To outperform a buy and hold strategy of 11.169% an investor would need to achieve a minimum of 84.70% forecasted accuracy. At a 23.62% forecasted accuracy or less an

investor would not be able to outperform the buy and hold strategy. At 53.04% forecasted accuracy, an investor would have equal probability of missing the good and bad periods but achieve the buy and hold strategy average annual return. The annual average returns for equity/bond and equity/money market, market timing strategies were 27.11% and 22.18% respectively.

**Figure 28: J590 Forecasting accuracy and calculated returns**

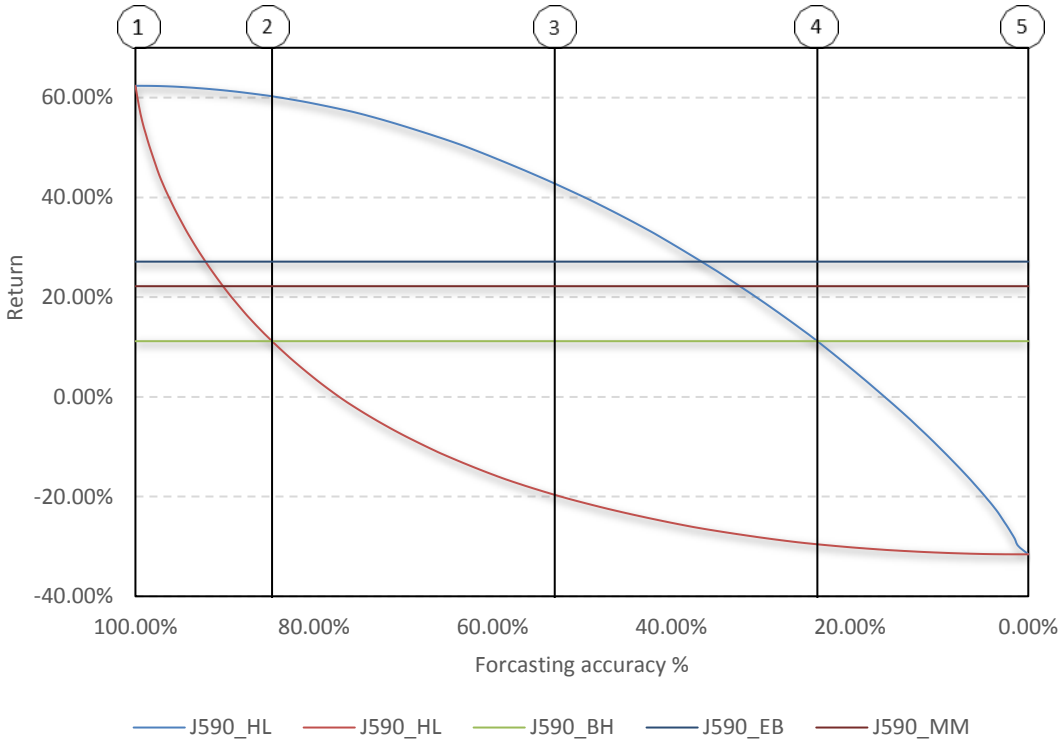


**Figure 29: J590 100% and 0% accuracy predicted cumulative returns**

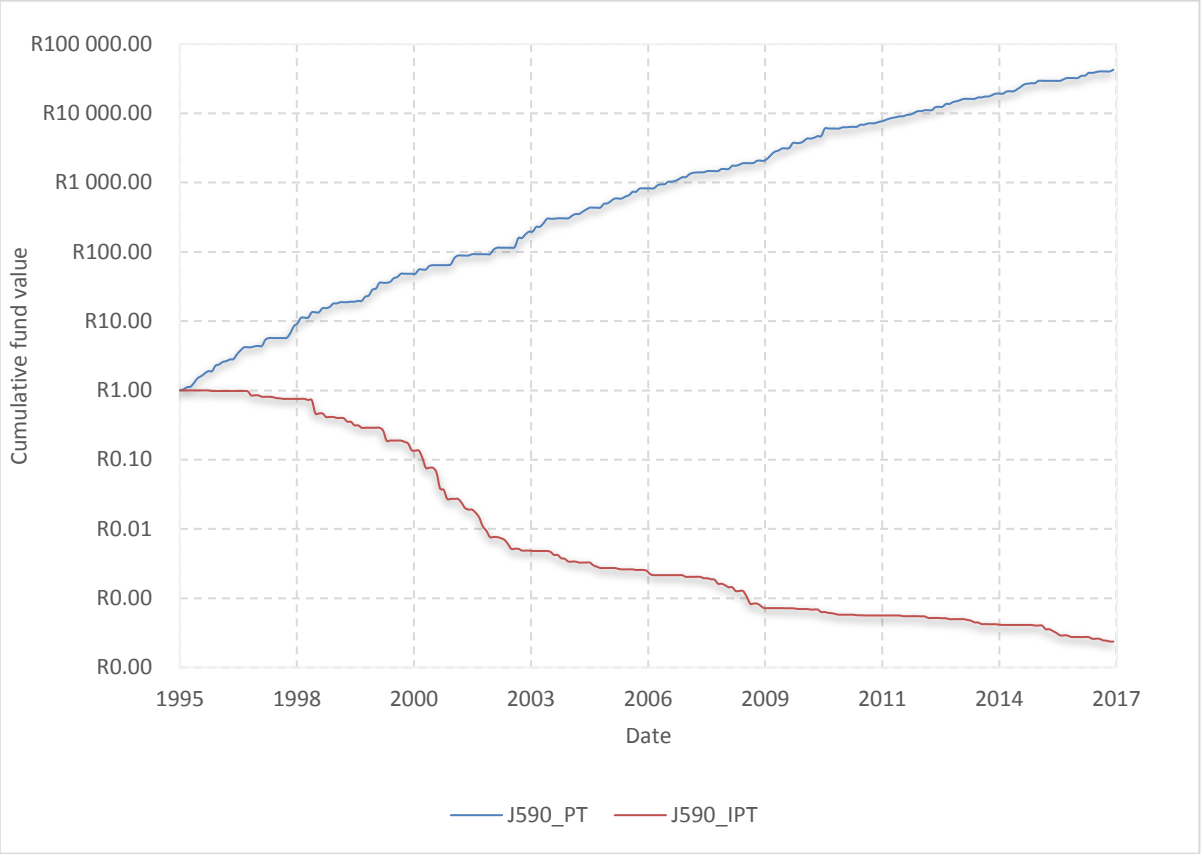



**Table 19: J590 selected forecasted returns and percentage**

| Fund name | Line 1: 100% Accuracy return | Line 2: 0% Accuracy line return | Line 3: Outperform Buy and Hold line | Line 4: Equal probability line | Line 5: Underperform Buy and hold line | Buy and hold return | Equity and MM return | Equity and Bond return |
|---|---|---|---|---|---|---|---|---|
| J590 | 62.37% | -31.58% | 84.70% | 53.04% | 23.62% | 11.16% | 22.18% | 27.11% |

### 5.3.10 Combined data

Figure 30 presents the combined forecasted accuracy versus average annual return for the J500-J590. The combined cumulative returns are shown in Figure 31 with the summary of results tabulated in Table 20. Figure 31 shows the various data set ranges. Table 21 lists the average annual returns of the three portfolio returns.

The maximum average annual return, at 100% forecasted accuracy, was 62.37% for the J590. The median maximum return at 100% accuracy was 45.39%. The minimum average annual return, at 0% forecasted accuracy, was -31.58% also for the J590. The median return associated with 0% forecasted accuracy was -20.38%.

**Figure 30: Combined forecasted returns and accuracies**

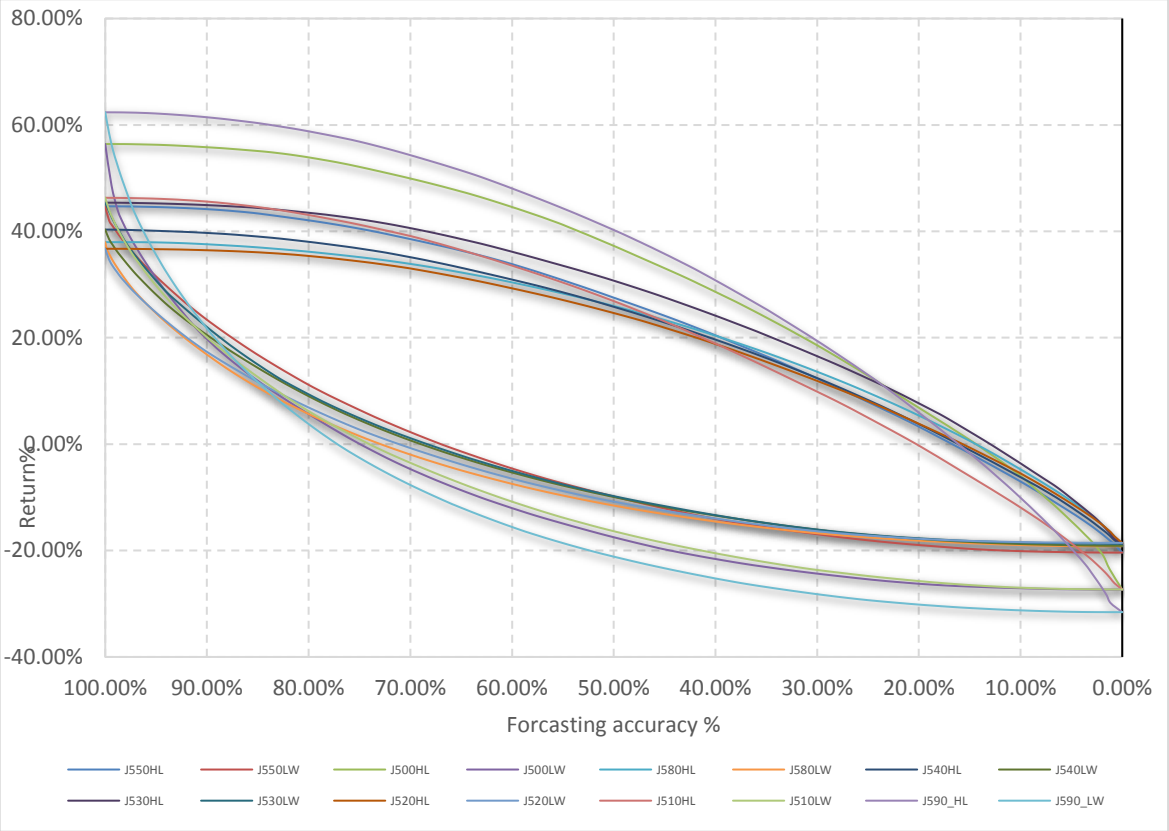



**Figure 31: Combined 100% and 0% accuracy predicted cumulative returns**

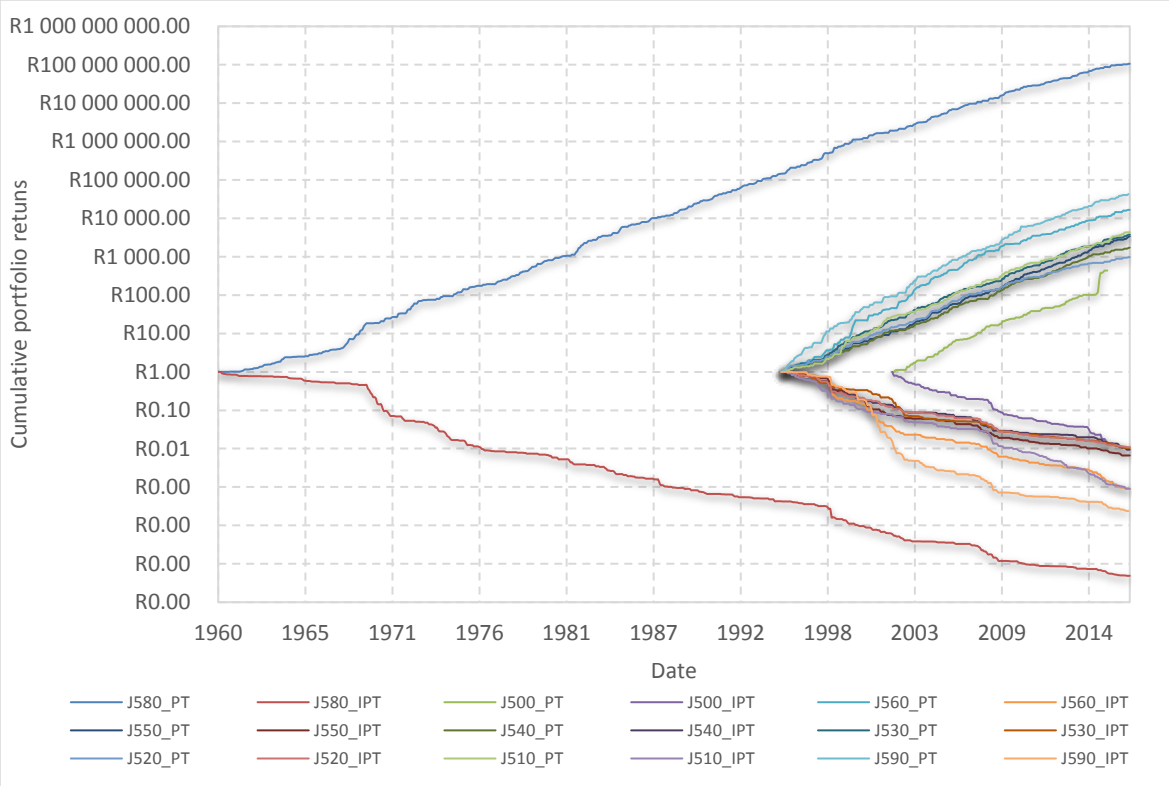


**Table 20: Summary of the cumulative returns**

| | | 100% Predictive Accuracy | | 0% Predictive Accuracy | | Range | |
|---|---|---|---|---|---|---|---|
| FundName | Final investment | End Return | CAGR | End Return | CAGR | No. months | Period |
| J500 | R 5.69 | R 435.18 | 56.41% | R 0.01 | -27.34% | 163 | Jun 2002-Dec 2015 |
| J510 | R 3.87 | R 4 322.67 | 46.31% | R 0.00 | -27.31% | 264 | Jun 1995 - May 2017 |
| J520 | R 10.64 | R 973.67 | 36.72% | R 0.01 | -18.56% | 264 | Jun 1995 - May 2017 |
| J530 | R 39.26 | R 3 763.32 | 45.39% | R 0.01 | -18.73% | 264 | Jun 1995 - May 2017 |
| J540 | R 16.24 | R 1 726.72 | 40.33% | R 0.01 | -19.11% | 264 | Jun 1995 - May 2017 |
| J550 | R 22.55 | R 3 393.98 | 44.71% | R 0.01 | -20.38% | 264 | Jun 1995 - May 2017 |
| J560 | R 14.80 | R 16 570.52 | 55.52% | R 0.00 | -27.32% | 264 | Jun 1995 - May 2017 |
| J580 | R 514.48 | R 105 819 619.99 | 37.96% | R 0.00 | -19.19% | 689 | Jan 1960 - May 2017 |
| J590 | R 10.11 | R 42 762.28 | 62.37% | R 0.00 | -31.58% | 264 | Jun 1995 - May 2017 |

**Table 21: Summary of portfolio average annual returns**

| Fund name | Line 1: 100% Accuracy return | Line 2: 0% Accuracy line return | Line 3: Outperform Buy and Hold line | Line 4: Equal probability line | Line 5: Underperform Buy and hold line | Buy and hold return | Equity and MM return | Equity and Bond return |
|---|---|---|---|---|---|---|---|---|
| J500 | 56.41% | -27.34% | 86.50% | 55.83% | 25.72% | 13.72% | 8.63% | 5.08% |
| J510 | 46.31% | -27.31% | 80.15% | 51.85% | 26.36% | 6.37% | 13.55% | 7.56% |
| J520 | 36.72% | -18.56% | 84.73% | 59.98% | 29.32% | 11.39% | 13.95% | 10.33% |
| J530 | 45.39% | -18.73% | 87.45% | 65.05% | 32.13% | 18.23% | 20.19% | 15.54% |
| J540 | 40.33% | -19.11% | 84.31% | 61.54% | 31.48% | 13.56% | 19.19% | 15.10% |
| J550 | 44.71% | -20.38% | 83.72% | 61.11% | 33.46% | 15.27% | 18.47% | 12.92% |
| J560 | 52.75% | -27.32% | 84.83% | 55.39% | 26.41% | 13.08% | 20.51% | 15.12% |
| J560 | 52.75% | -27.32% | 84.83% | 55.39% | 26.41% | 13.08% | - | 10.38% |
| J580 | 37.96% | -19.19% | 85.77% | 60.08% | 27.24% | 11.50% | 27.11% | 22.18% |

### 5.3.11 Conclusion for research proposition one data analysis

The detailed analysis for research proposition one is presented in section 5.2. It was striking that enormous average annual returns possible for an investor who can predict changes in the market with 100% accuracy. For investors to beat the associated buy and hold strategies at all times, requires forecasting accuracies in excess of 80%, in general. Active managers strive to achieve returns within this range, illustrating the performance required to achieve success.

Table 21 lists the average annual returns ex-transaction cost for both market timing strategies and indicates the equity/bond market timing strategy yields' superior returns in all but one JSE industrial index. The ability for an investor to systematically predict changes in the market is paramount and the focus of research proposition two.

## 5.4 Research proposition two: Market timing data

The market timing methodology, as adapted from Faber (2007), requires switching a stock portfolio between a relatively high-risk asset (Equities) and a relative low risk investment (Bonds/Cash). Both market timing strategies utilize the same switching factor, hence the number of switches was the same for both. The summarised results

are presented in Table 22, with sections 5.4.1-5.4.9 providing index specific exhibits. Section 5.4.1 provides a detailed description of data analyses and, to reduce replication, sections 5.4.2-5.4.9 are presented concisely.

**Table 22: Summary of market timing analysis**

| | Fund | J500 | J510 | J520 | J530 | J540 | J550 | J560 | J580 | J590 |
|---|---|---|---|---|---|---|---|---|---|---|
| Period | No. months | 163 | 264 | 264 | 264 | 264 | 264 | 264 | 689 | 264 |
| | Range | 06/2002- 12/2015 | 06/1995 - 05/2017 | 06/1995 - 05/2017 | 06/1995 - 05/2017 | 06/1995 - 05/2017 | 06/1995 - 05/2017 | 06/1995 - 05/2017 | 01/1960 - 05/2017 | 06/1995 - 05/2017 |
| Buy and hold | Initial investment | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 |
| | Final investment | R 5.69 | R 3.87 | R 10.64 | R 39.26 | R 16.24 | R 22.55 | R 14.80 | R 514.48 | R 10.16 |
| | CAR | 14% | 6% | 11% | 18% | 14% | 15% | 13% | 12% | 11% |
| | Average | 13% | 6% | 11% | 17% | 13% | 14% | 12% | 8% | 11% |
| | Median | 23% | 13% | 13% | 22% | 18% | 15% | 17% | 14% | 23% |
| | Stdev | 32% | 30% | 19% | 22% | 24% | 20% | 31% | 32% | 46% |
| | Max | 55% | 63% | 43% | 41% | 42% | 41% | 85% | 79% | 93% |
| | Min | -54% | -63% | -31% | -58% | -41% | -27% | -49% | -66% | -114% |
| | Sharpe ratio | 0.43 | 0.21 | 0.61 | 0.81 | 0.57 | 0.76 | 0.42 | 0.36 | 0.24 |
| Equity and bond switch | Initial investment | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 |
| | Final investment | R 1.74 | R 6.66 | R 8.81 | R 29.49 | R 29.49 | R 19.83 | R 28.86 | R - | R 113.63 |
| | CAR | 4% | 9% | 10% | 17% | 17% | 15% | 17% | - | 24% |
| | Average | 4% | 9% | 10% | 15% | 15% | 14% | 15% | - | 22% |
| | Median | -9% | 7% | 13% | 13% | 15% | 15% | 15% | - | 24% |
| | Stdev | 28% | 22% | 21% | 19% | 16% | 19% | 24% | - | 23% |
| | Max | 55% | 63% | 43% | 41% | 42% | 41% | 85% | - | 68% |
| | Min | -37% | -33% | -32% | -27% | -21% | -22% | -17% | - | -14% |
| | Sharpe ratio | 0.15 | 0.41 | 0.50 | 0.87 | 1.02 | 0.78 | 0.70 | - | 1.06 |
| Equity and money market switch | Initial investment | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 |
| | Final investment | R 1.11 | R 2.03 | R 4.34 | R 12.42 | R 13.70 | R 6.94 | R 10.59 | R 54.91 | R 47.78 |
| | CAR | 1% | 3% | 7% | 12% | 13% | 9% | 11% | 7% | 19% |
| | Average | 1% | 3% | 7% | 11% | 12% | 9% | 11% | 9% | 18% |
| | Median | -11% | 5% | 7% | 7% | 11% | 3% | 6% | 4% | 14% |
| | Stdev | 29% | 25% | 22% | 21% | 18% | 20% | 25% | 25% | 30% |
| | Max | 55% | 63% | 43% | 41% | 42% | 41% | 85% | 79% | 93% |
| | Min | -41% | -48% | -45% | -22% | -31% | -28% | -22% | -29% | -44% |
| | Sharpe ratio | 0.03 | 0.13 | 0.31 | 0.59 | 0.69 | 0.45 | 0.45 | 0.29 | 0.65 |
| | No. of switches | 28 | 44 | 34 | 32 | 23 | 36 | 36 | 82 | 26 |

As expected, the highest yielding market timing strategy was the equity and bond switch for the J590; achieving 24% CAR at the highest risk adjusted return (Sharpe ratio) for any strategy at 1.06 and a 19% CAR for equity and money market switch. Notably, for a 19-year period a R1 investment into the equity and money market switch strategy for the J590 yielded a R47.44 return as compared to the R53.99 return for the same strategy for the J580 over 57-years. The most number of switches was recorded for the J580 index which had the longest period investigated. When comparing the indices with the same range, the J510 had the most number of switches at 44 versus 23 of the J540.

The highest yielding buy and hold strategy was using the J530 index attaining a CAR of 18% at the 3rd lowest standard deviation of 22%. The J590 yielded the 2nd worst CAR of 11% at the highest standard deviation of 46%. The lowest standard deviation calculated was the equity and bond switch market timing strategy for the J540 at 16%

with a CAR of 17%. The lowest CAR of 1% was calculated for the J500 equity and bond market switch strategy with the lowest risk adjusted return of 0.03. Results are listed for each index in Table 23 to 31.

### 5.4.1 J500 Oil &Gas index

Market timing involves switching a portfolio between a riskless and risky asset classes. This study investigated two market timing strategies, which are graphically presented in Figure 32, with the traditional buy and hold strategy, ten month moving average and switching factor. Figure 33 shows the frequency of average yearly portfolio returns of the buy and hold strategy and two market timing strategies using the J500. Each of the two market timing strategies average yearly portfolio returns performance are measured relative to the buy and hold strategy shown in Figure 34. Selected fund performance data is tabulated in Table 23.

**Figure 32: J500 Cumulative portfolio returns**

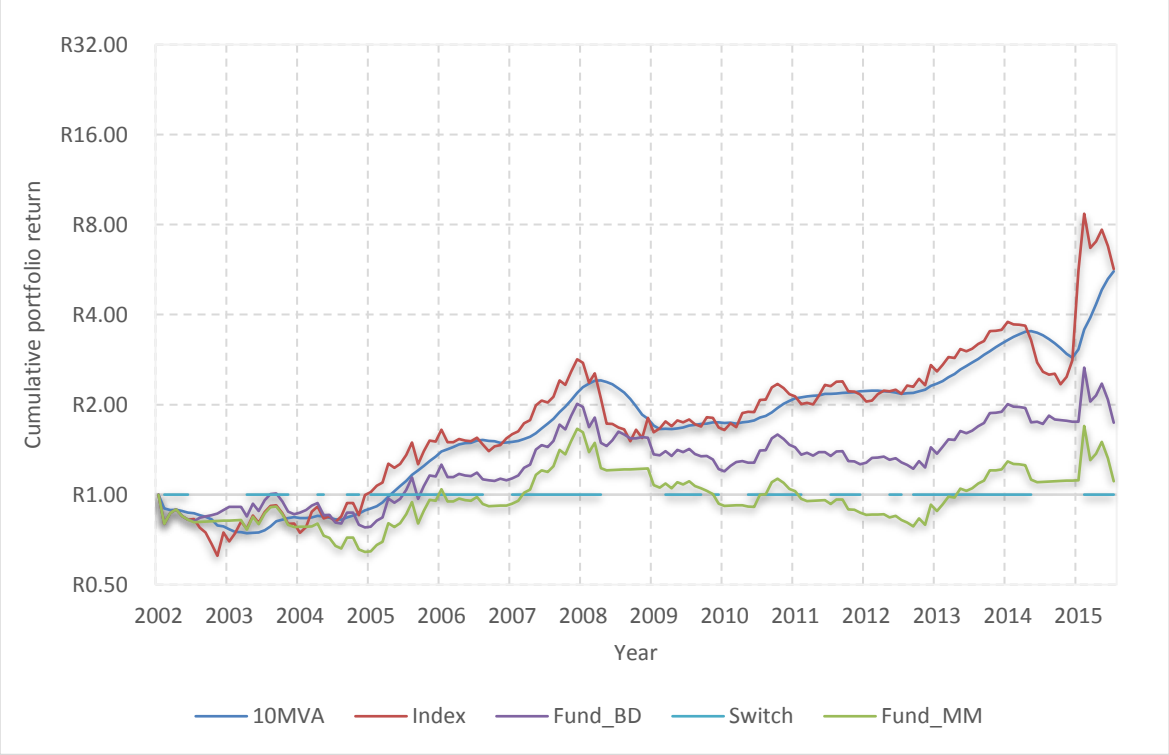


**Figure 33: J500 Portfolio returns frequency**

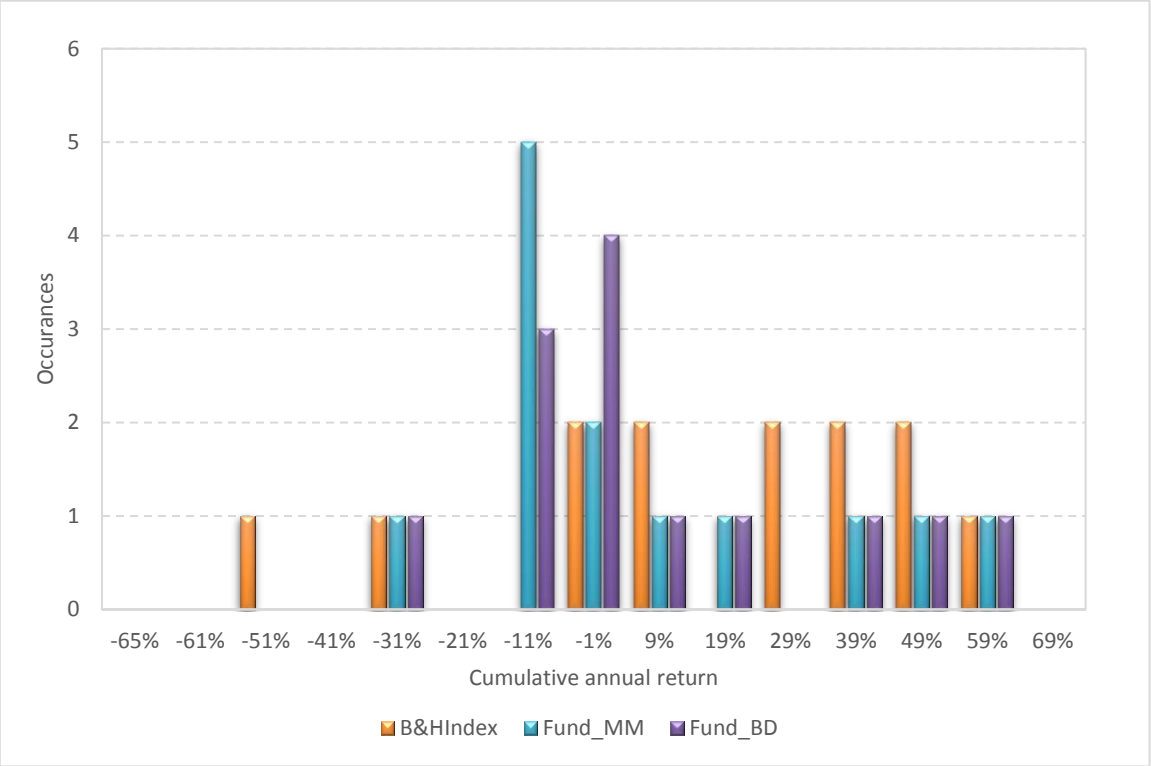



**Figure 34: J500 Bond and money market fund outperformance**

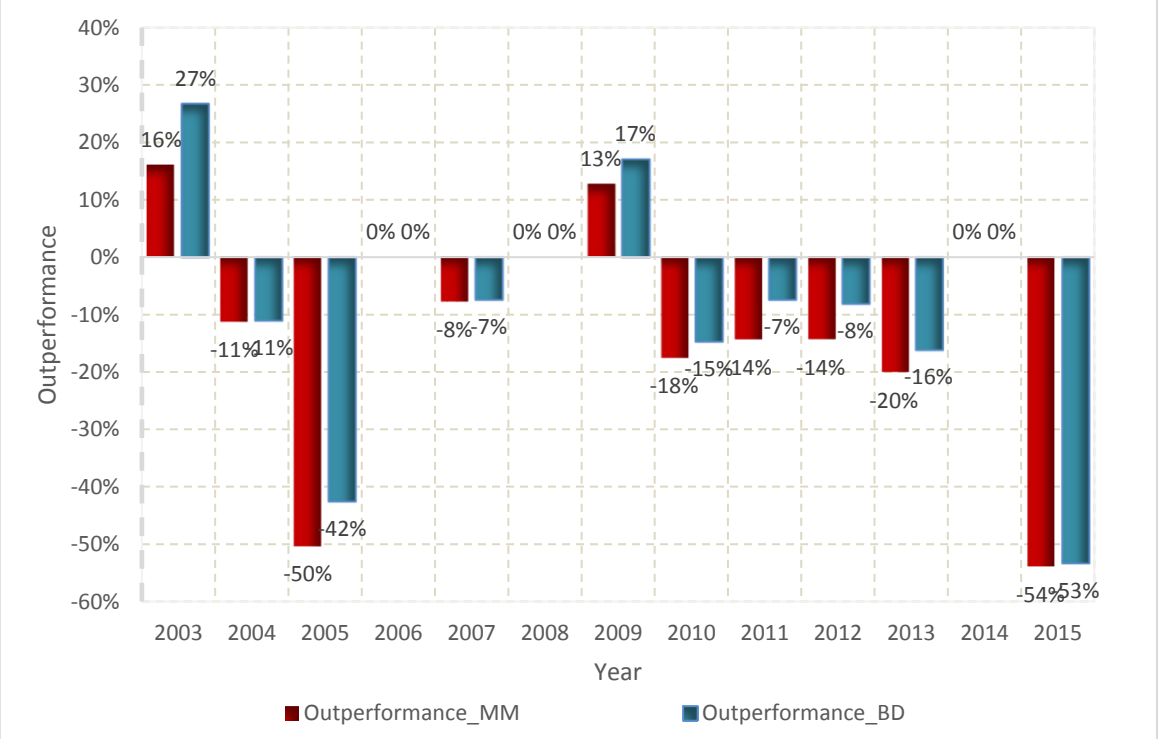


**Table 23: J500 Portfolio summary**

| | B&H Index | Fund_BD | Fund_MM |
|---|---|---|---|
| ***No. months*** | 163 | | |
| ***Range*** | 06/2002- 12/2015 | | |
| ***Initial investment*** | R 1.00 | R 1.00 | R 1.00 |
| ***Final investment*** | R 5.69 | R 1.74 | R 1.10 |
| ***CAR*** | 14% | 4% | 1% |
| ***Average*** | 13% | 4% | 1% |
| ***Median*** | 23% | -9% | -11% |
| ***Stdev*** | 32% | 28% | 29% |
| ***Max*** | 55% | 55% | 55% |
| ***Min*** | -54% | -37% | -41% |
| ***Sharpe ratio*** | 0.43 | 0.15 | 0.03 |
| ***No. of switches*** | 0 | 28 | |

An R1 investment in both market timing strategies yielded a maximum of R1.74 (4%CAR) by using the equity and bond market timing strategy, clearly a poor strategy relative to the buy and hold strategy which yielded R5.69 (14% CAR), albeit at the highest standard deviation (32%). The Fund_MM performed the worst with an accrued return of R1.10 for a R1 investment over 13 years. Figure 32 shows the periods within which each market timing portfolio was in equities (Switch = 1). It was evident that the ten-month moving average switching technique was slow to realise sharp changes in the index such as large upward or downward movements.

The buy and hold strategy achieved seven years of average annual returns above 19% as compared to Fund_BD that attained five years per Figure 33. The buy and hold strategy consistently outperformed both market timing strategies post 2008 financial crisis, as shown in Figure 34.

### 5.4.2 J510 Basic materials index

The Fund_BD yielded the largest CAR of 9% at the lowest standard deviation of 22% resulting in a R6.66 return which was 72% higher than the buy and hold strategy (R3.87) for the same R1 investment. The Fund_MM attained a final return of R2.03 (3% CAR) by using the equity and money market timing strategy, clearly a poor strategy relative to the equity/bond market timing strategy. Figure 35 shows the periods within which each market timing portfolio was in equities (Switch = 1).

The Fund_BD strategy achieved 14 years of average annual returns above or equal to 19% as compared to 7-years for the buy and hold strategy per Figure 36. Fund_BD consistently outperformed other portfolios post 2008, shown in Figure 37.

**Figure 35: J510 Cumulative portfolio returns**


**Figure 36: J510 Portfolio returns frequency**

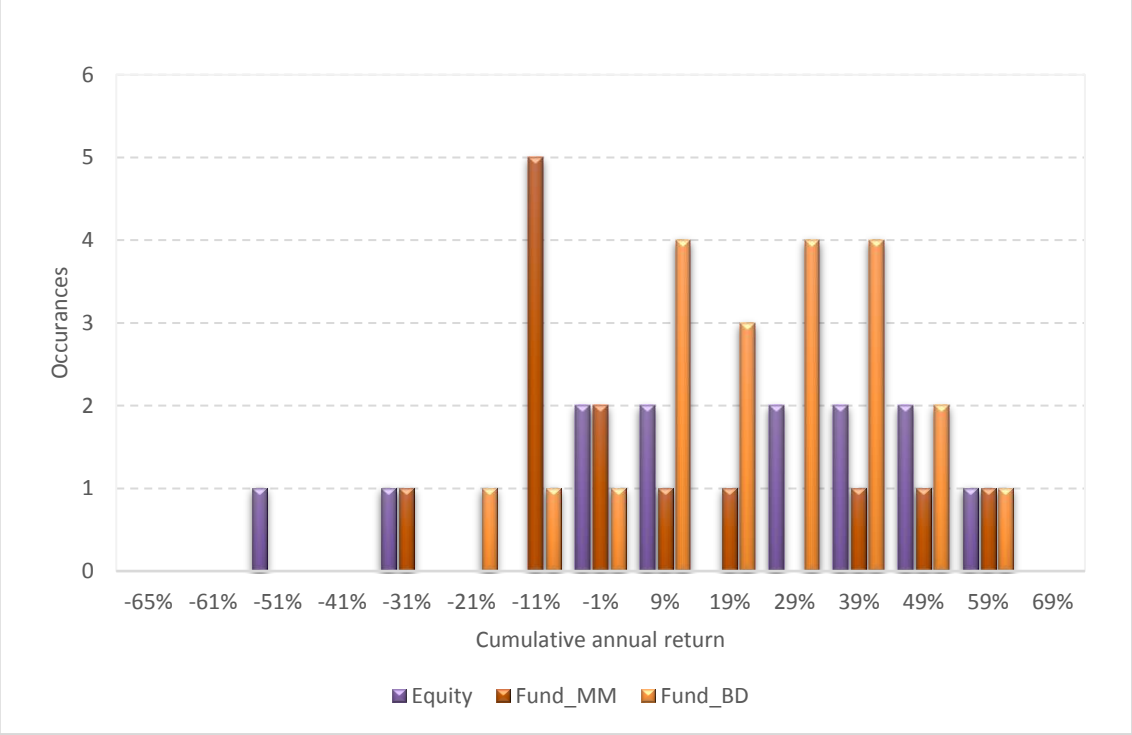


**Figure 37: J510 Bond and money market fund outperformance**

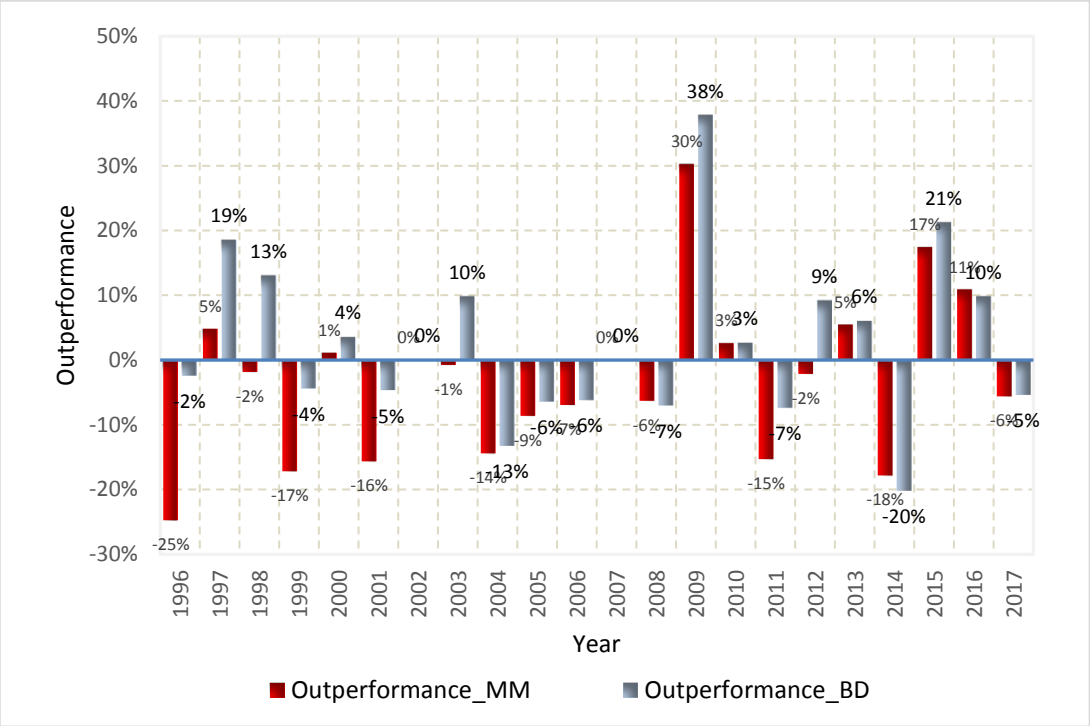



**Table 24: J510 Portfolio summary**

| | *B&H Index* | *Fund_BD* | *Fund_MM* |
|---|---|---|---|
| ***No. months*** | 264 | | |
| ***Range*** | 06/1995 - 05/2017 | | |
| ***Initial investment*** | R 1.00 | R 1.00 | R 1.00 |
| ***Final investment*** | R 3.87 | R 6.66 | R 2.03 |
| ***CAR*** | 6% | 9% | 3% |
| ***Average*** | 6% | 9% | 3% |
| ***Median*** | 13% | 7% | 5% |
| ***Stdev*** | 30% | 22% | 25% |
| ***Max*** | 63% | 63% | 63% |
| ***Min*** | -63% | -33% | -48% |
| ***Sharpe ratio*** | 0.21 | 0.41 | 0.13 |
| ***No. of switches*** | 0 | 44 | |

### 5.4.3 J520 Industrials index

The buy and hold strategy yielded the largest CAR of 11% at the lowest standard deviation of 19% achieving a R10.64 return which was 21% higher than the next best Fund_BD (R8.81) for the same R1 investment. The Fund_MM attained a final return of R4.43 (7% CAR) by using the equity and money market timing strategy, clearly a poor strategy relative to the buy and hold strategy. Figure 38 shows the periods within which each market timing portfolio was in equities (Switch = 1).

The buy and hold strategy achieved 14 years of average annual returns above or equal to 17% as compared 13 years for the Fund_BD strategy per Figure 39. Each strategy had superior performing periods with the buy and hold strategy achieving consistently better performances over the period investigated.

**Figure 38: J520 Cumulative portfolio returns**

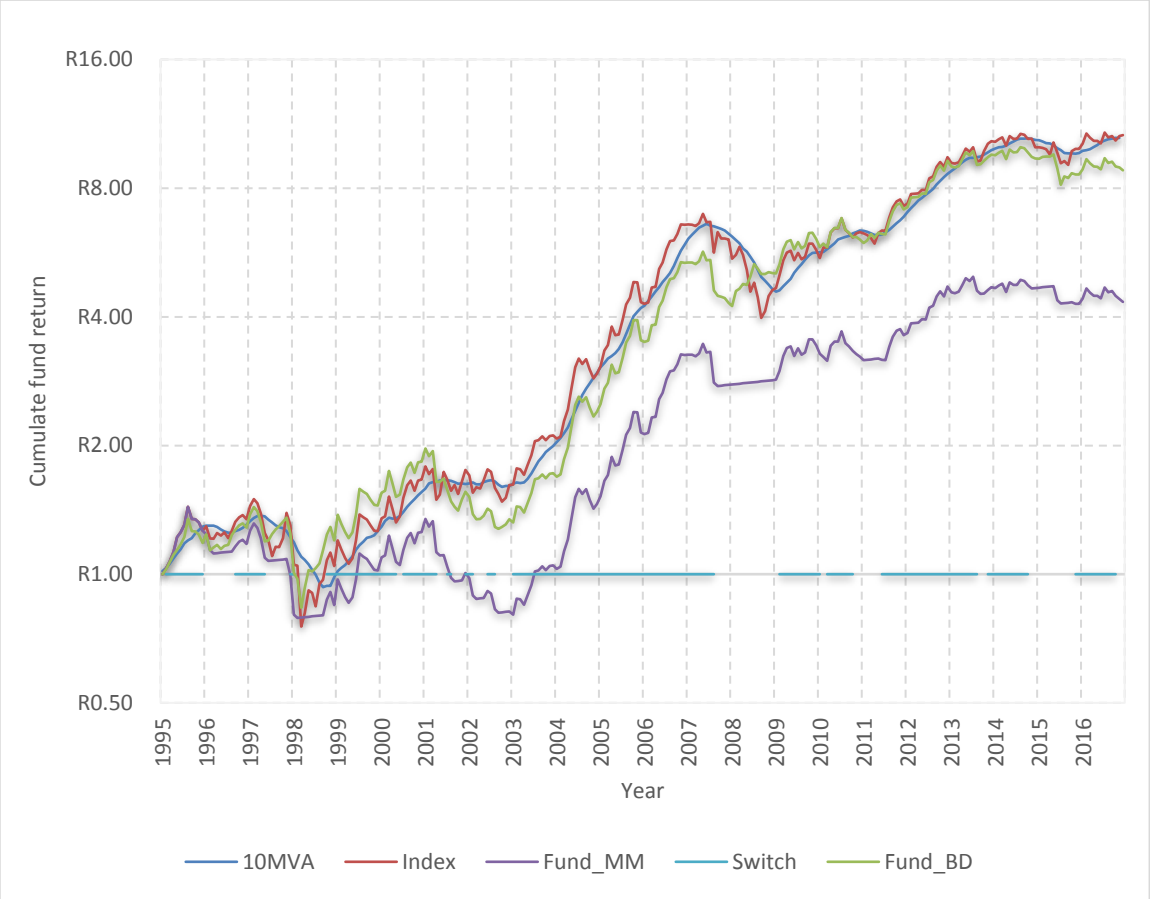


**Figure 39: J520 Portfolio returns frequency**

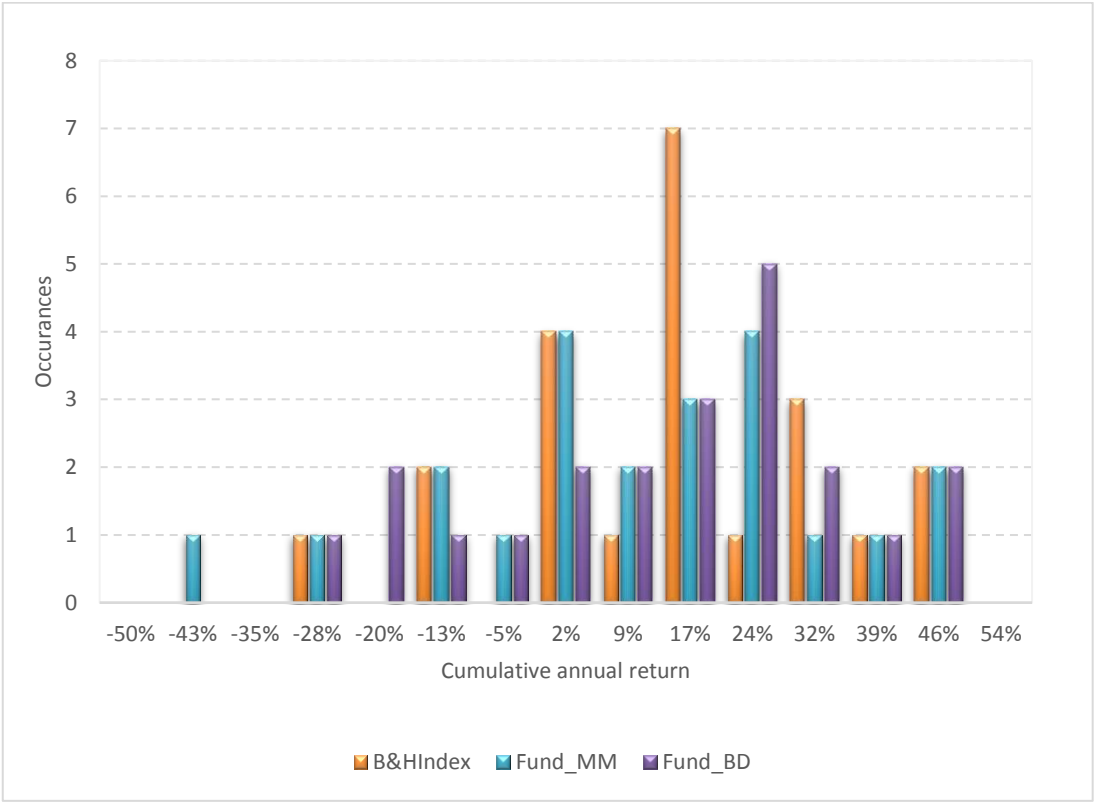



**Figure 40: J520 Bond and money market fund outperformance**

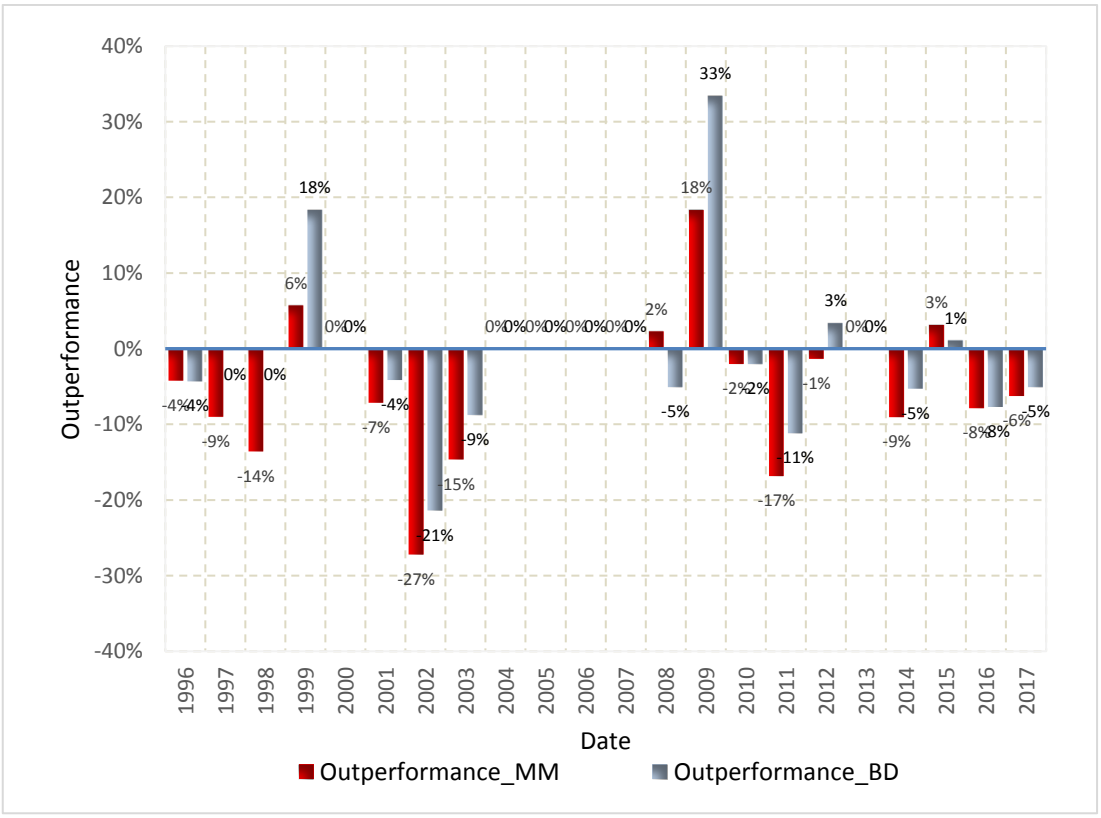


**Table 25: J520 Portfolio summary**

| | *B&H Index* | *Fund_BD* | *Fund_MM* |
|---|---|---|---|
| ***No. months*** | 264 | | |
| ***Range*** | 06/1995 - 05/2017 | | |
| ***Initial investment*** | R 1.00 | R 1.00 | R 1.00 |
| ***Final investment*** | R 10.64 | R 8.81 | R 4.34 |
| ***CAR*** | 11% | 10% | 7% |
| ***Average*** | 11% | 10% | 7% |
| ***Median*** | 13% | 13% | 7% |
| ***Stdev*** | 19% | 21% | 22% |
| ***Max*** | 43% | 43% | 43% |
| ***Min*** | -31% | -32% | -45% |
| ***Sharpe ratio*** | 0.61 | 0.50 | 0.31 |
| ***No. of switches*** | 0 | 34 | |

### 5.4.4 J530 Consumer goods index

The buy and hold strategy yielded the largest CAR of 18% at the highest standard deviation of 22% achieving a R39.26 return which was 33% higher than the next best Fund_BD (R29.49) for the same R1 investment. The Fund_MM attained a final return of R12.42 (12% CAR) by using the equity and money market timing strategy, clearly a poor strategy relative to the buy and hold strategy. Figure 41 shows the periods within which each market timing portfolio was in equities (Switch = 1).

Both the buy and hold and the Fund_BD strategy achieved 11-years of average annual returns above or equal to 14 per Figure 42. The buy and hold strategy consistently outperformed both market timing strategies post 2007 per Figure 43.

**Figure 41: J530 Cumulative portfolio returns**

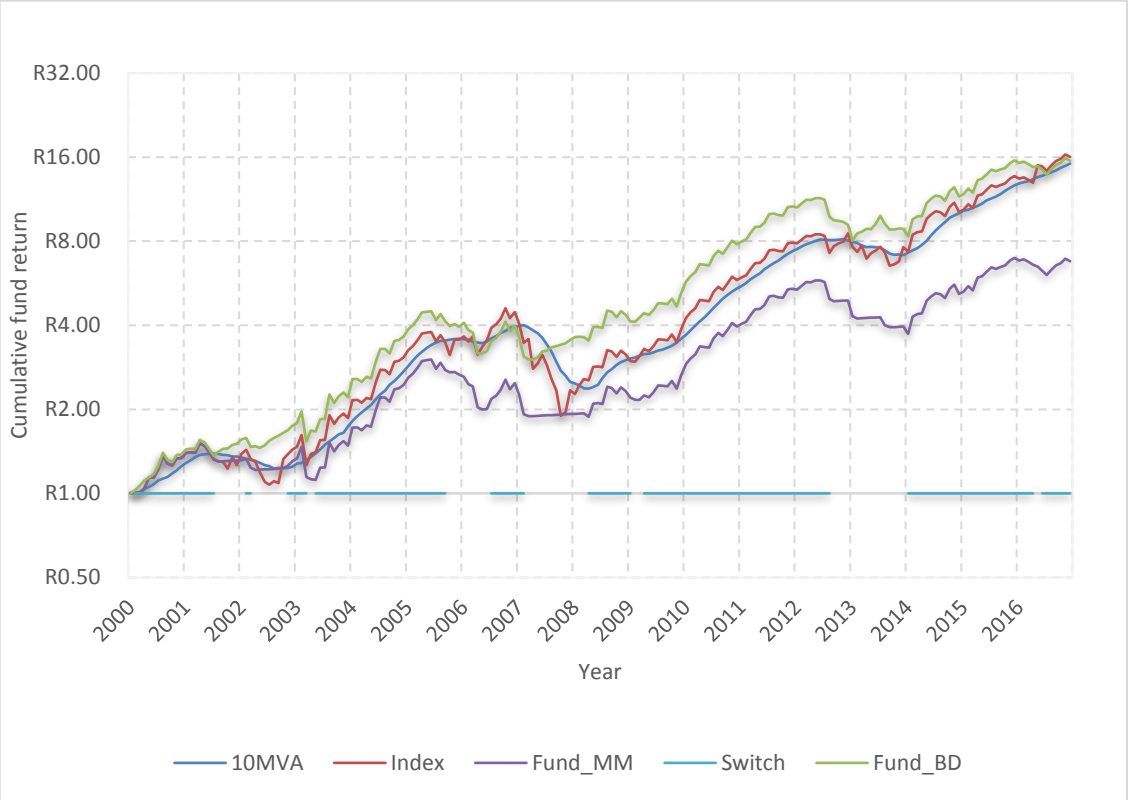



**Figure 42: J530 Portfolio returns frequency**

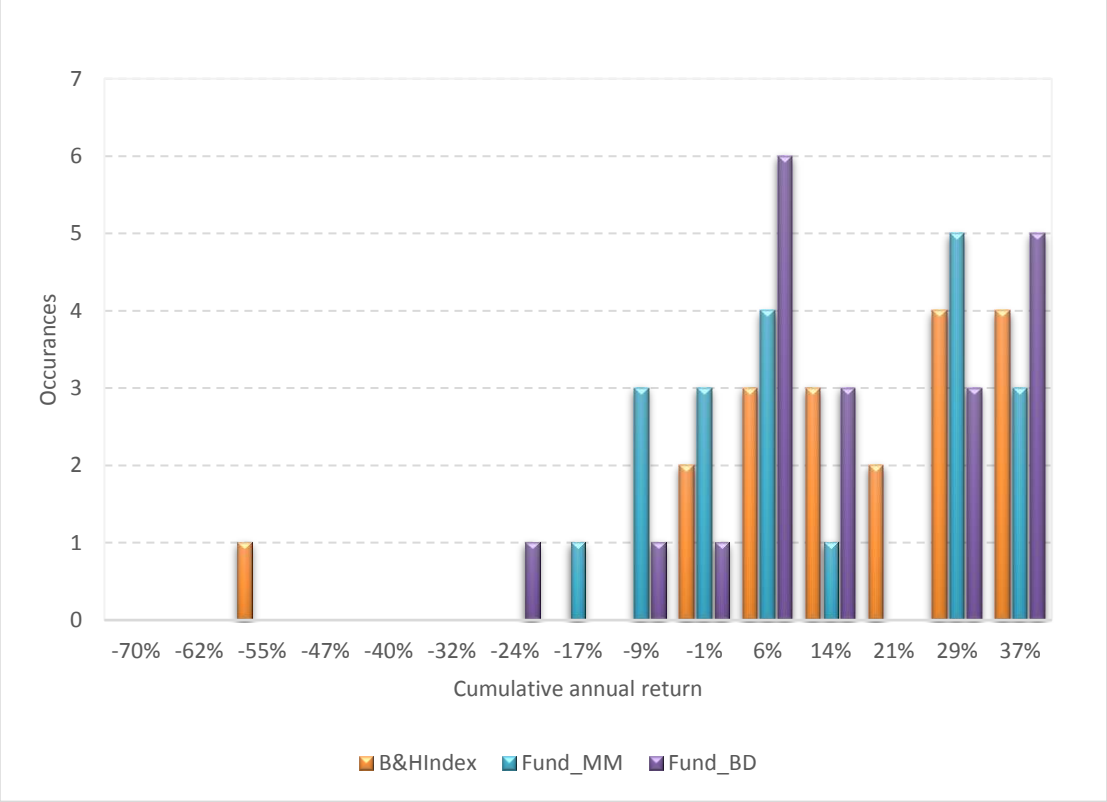


**Figure 43: J530 Bond and money market fund outperformance**

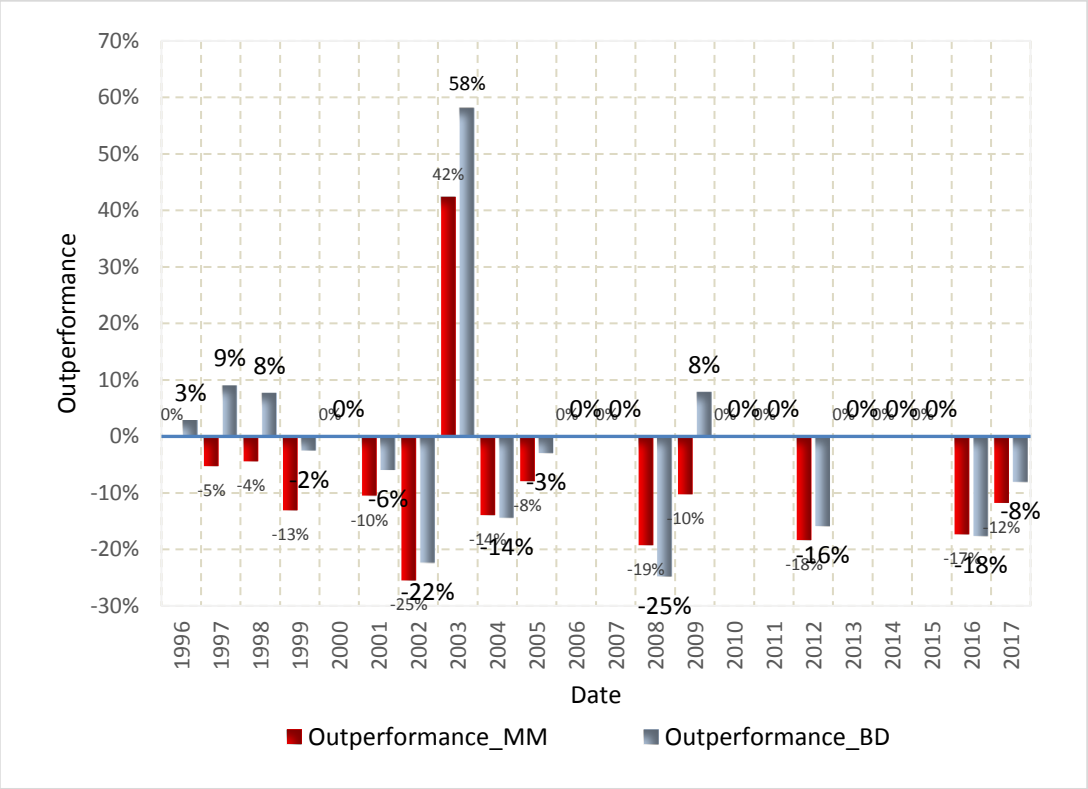



**Table 26: J530 Portfolio summary**

| | *B&H Index* | *Fund_BD* | *Fund_MM* |
|---|---|---|---|
| ***No. months*** | 264 | | |
| ***Range*** | 06/1995 - 05/2017 | | |
| ***Initial investment*** | R 1.00 | R 1.00 | R 1.00 |
| ***Final investment*** | R 39.26 | R 29.49 | R 12.42 |
| ***CAR*** | 18% | 17% | 12% |
| ***Average*** | 17% | 15% | 11% |
| ***Median*** | 22% | 13% | 7% |
| ***Stdev*** | 22% | 19% | 21% |
| ***Max*** | 41% | 41% | 41% |
| ***Min*** | -58% | -27% | -22% |
| ***Sharpe ratio*** | 0.81 | 0.87 | 0.59 |
| ***No. of switches*** | 0 | 32 | |

### 5.4.5 J540 Healthcare index

The Fund_BD yielded the largest CAR of 17% at the lowest standard deviation of 16% achieving a R29.49 return which was 45% higher than the next best buy and hold strategy (R16.24) for the same R1 investment. The Fund_MM attained a final return of R13.70 (13% CAR) by using the equity and money market timing strategy. Figure 44 shows the periods within which each market timing portfolio was in equities (Switch = 1).

The Fund_BD strategy achieved 14 years of average annual returns above or equal to 19% as compared 13 years for the buy and hold strategy per Figure 45. Fund_BD consistently outperformed other portfolios during the study period per Figure 46.

**Figure 44: J540 Cumulative portfolio returns**

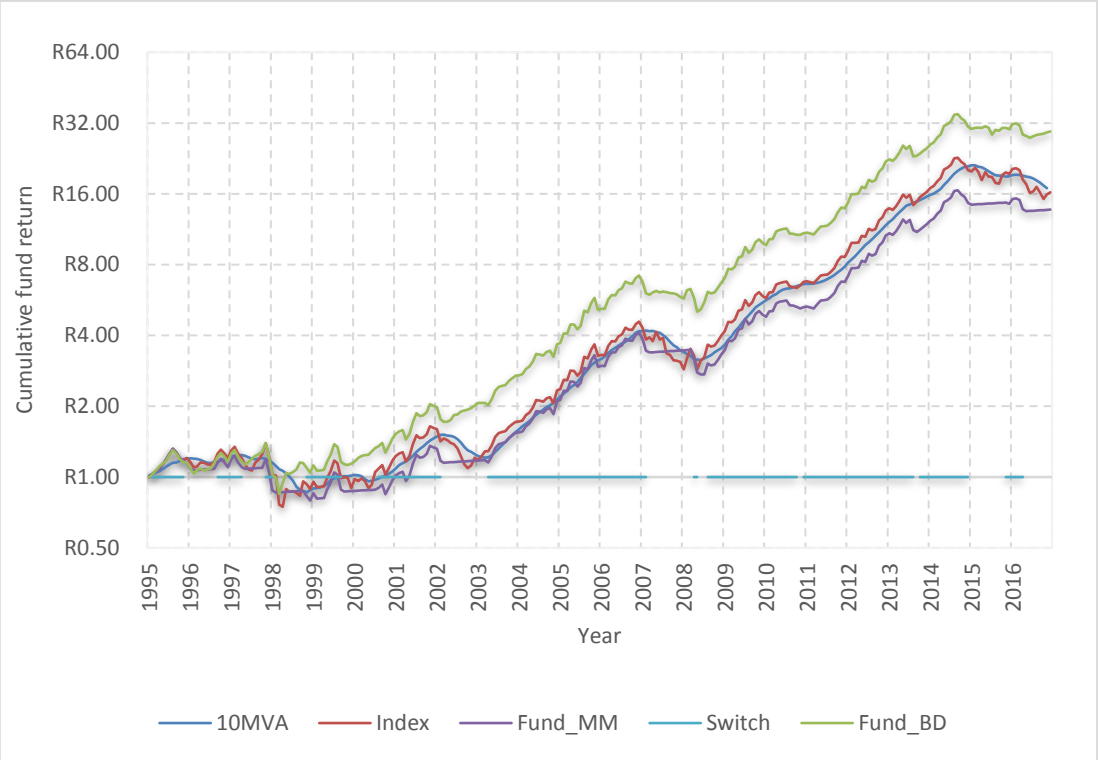


**Figure 45: J540 Portfolio returns frequency**

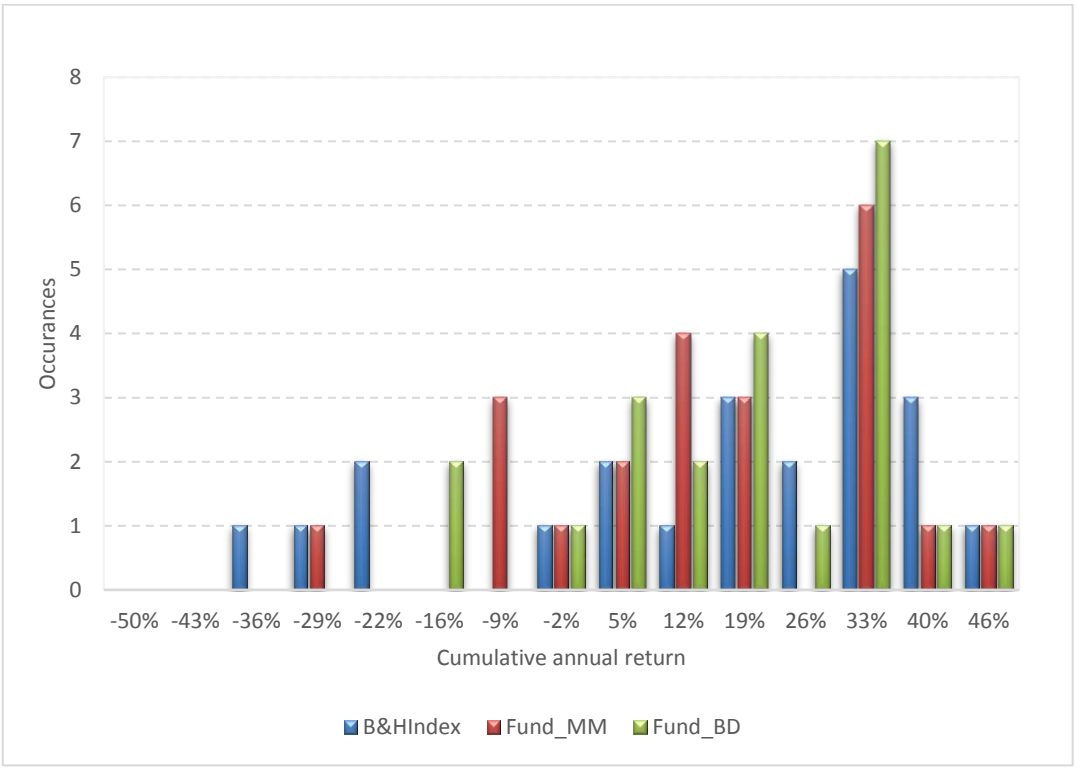



**Figure 46: J540 Bond and money market fund outperformance**

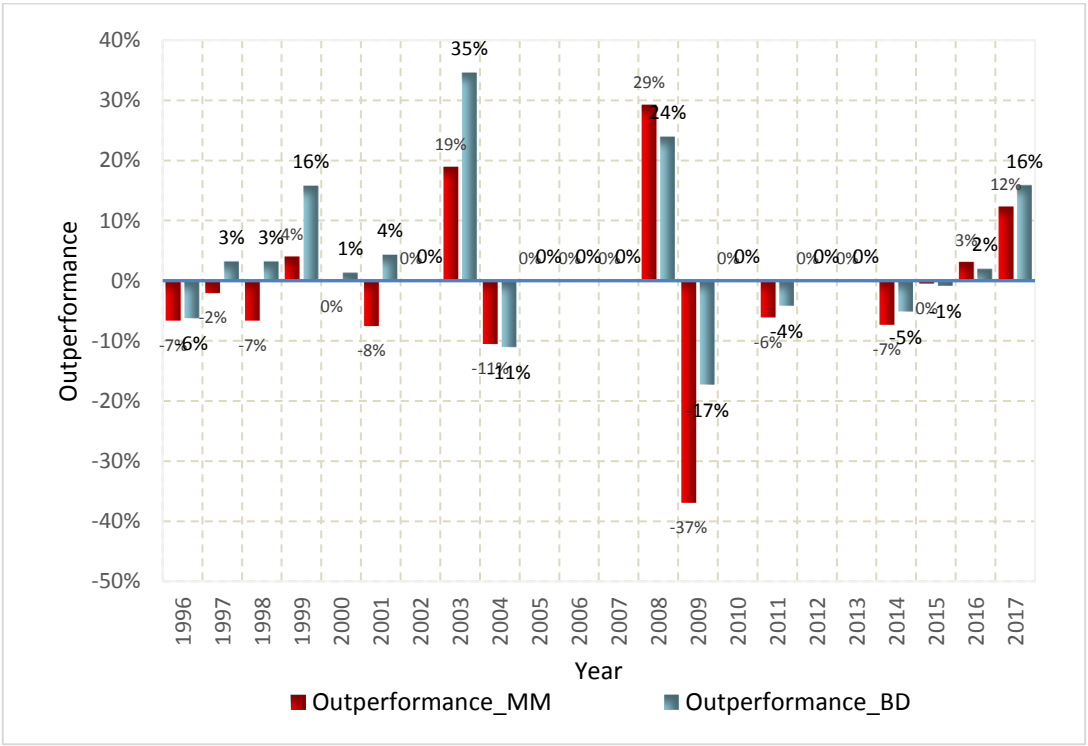


**Table 27: J540 Portfolio summary**

| | *B&H Index* | *Fund_BD* | *Fund_MM* |
|---|---|---|---|
| ***No. months*** | 264 | | |
| ***Range*** | 06/1995 - 05/2017 | | |
| ***Initial investment*** | R 1.00 | R 1.00 | R 1.00 |
| ***Final investment*** | R 39.26 | R 29.49 | R 12.42 |
| ***CAR*** | 18% | 17% | 12% |
| ***Average*** | 17% | 15% | 11% |
| ***Median*** | 22% | 13% | 7% |
| ***Stdev*** | 22% | 19% | 21% |
| ***Max*** | 41% | 41% | 41% |
| ***Min*** | -58% | -27% | -22% |
| ***Sharpe ratio*** | 0.81 | 0.87 | 0.59 |
| ***No. of switches*** | 0 | 32 | |

### 5.4.6 J550 Consumer services

The buy and hold strategy yielded the largest CAR of 15% at the highest standard deviation of 20% achieving a R22.55 return which was 14% higher than the next best Fund_BD (R19.83) for the same R1 investment. The Fund_MM attained a final return of R6.94 (9% CAR) by using the equity and money market timing strategy. Figure 47 shows the periods within which each market timing portfolio was in equities (Switch = 1).

The buy and hold strategy achieved 12 years of average annual returns above or equal to 12% per Figure 48. The buy and hold strategy consistently outperformed both market timing strategies post 2008 per Figure 49.

**Figure 47: J550 Cumulative portfolio returns**

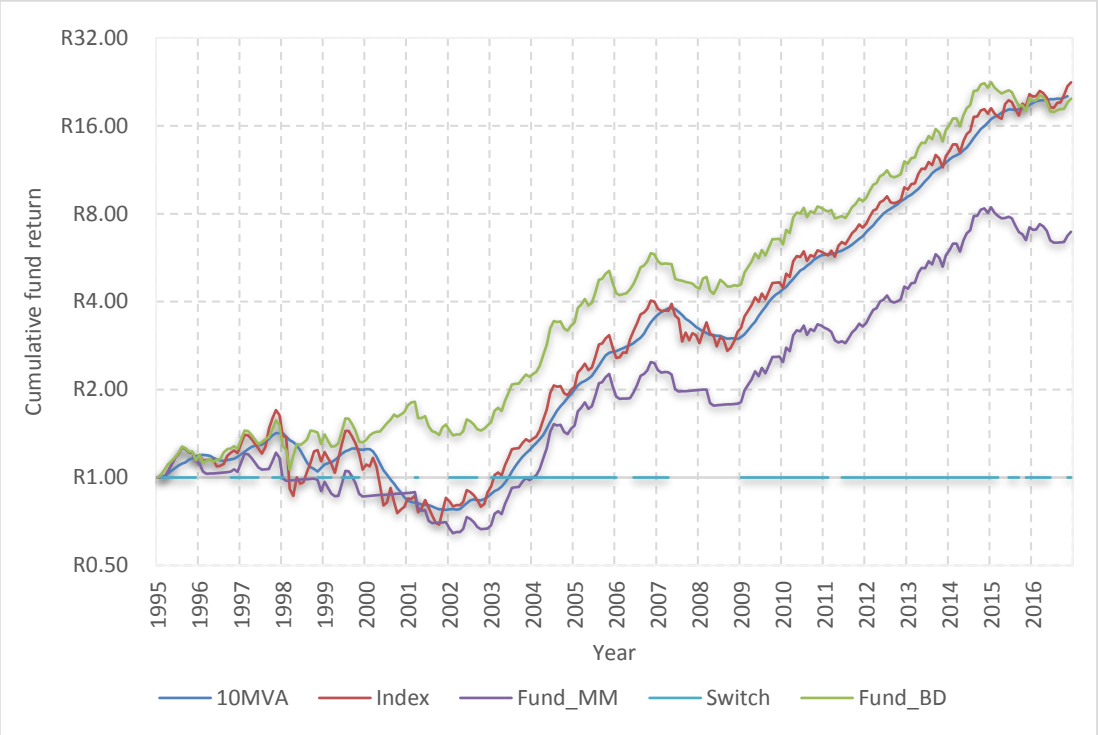



**Figure 48: J550 Portfolio returns frequency**

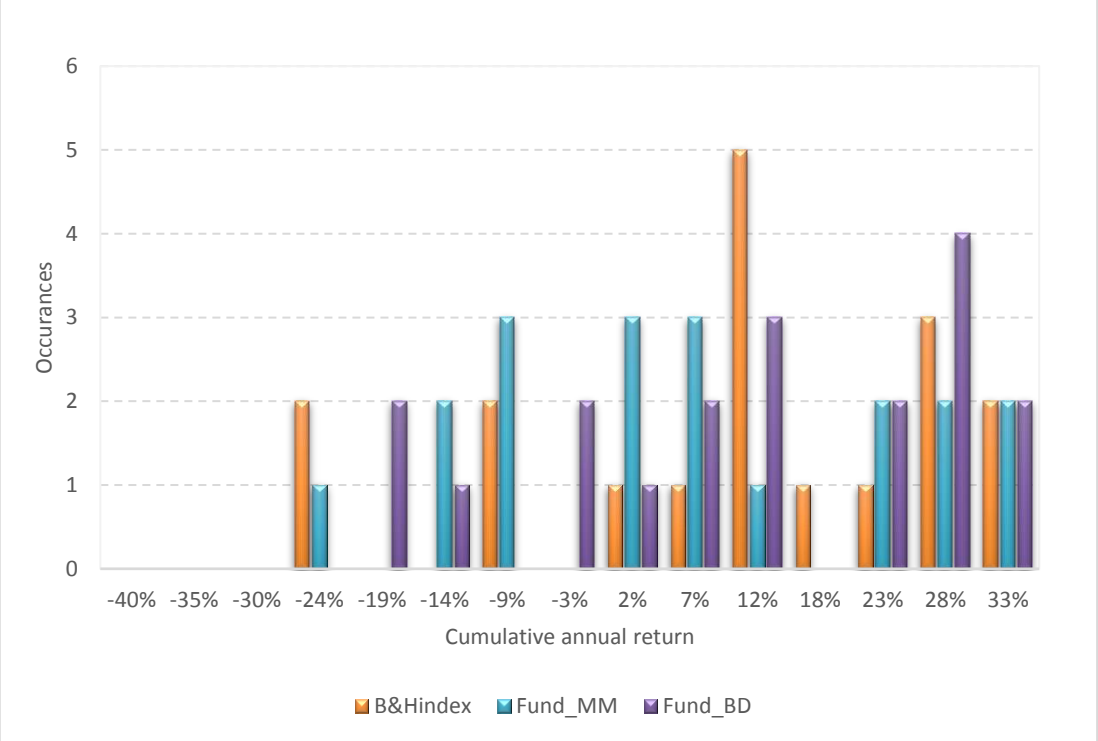


**Figure 49: J550 Bond and money market fund outperformance**

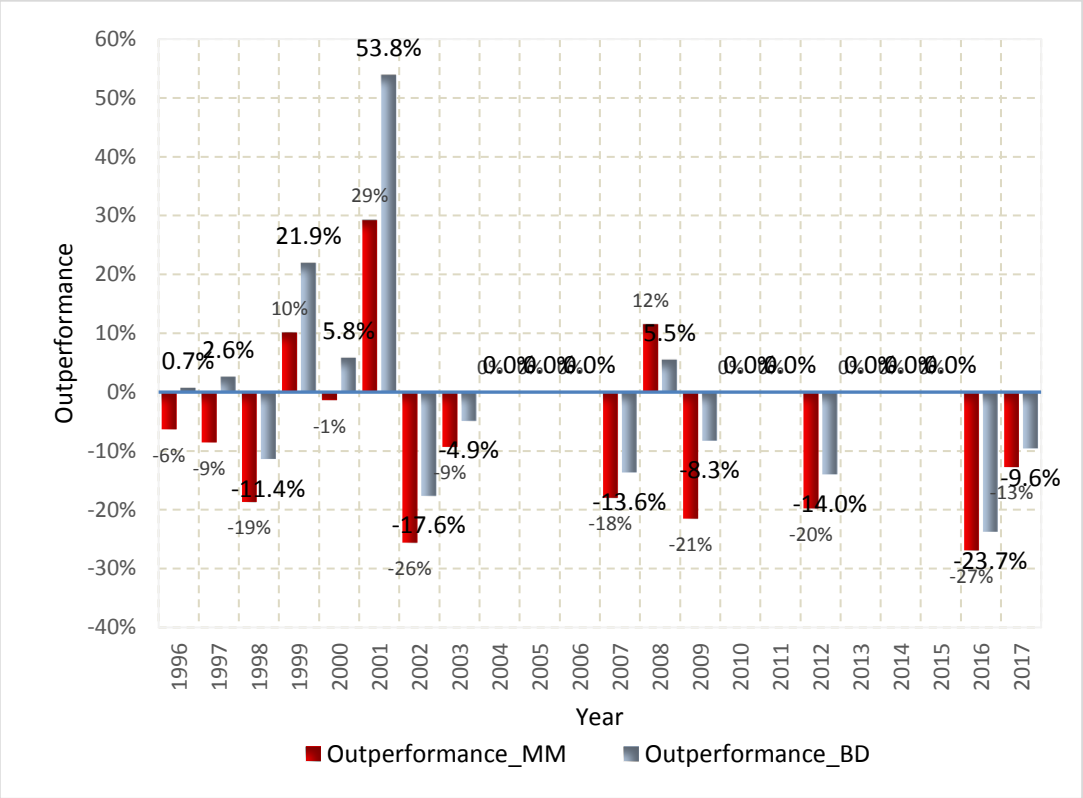



**Table 28: J550 Portfolio summary**

| | *B&H Index* | *Fund_BD* | *Fund_MM* |
|---|---|---|---|
| ***No. months*** | 264 | | |
| ***Range*** | 06/1995 - 05/2017 | | |
| ***Initial investment*** | R 1.00 | R 1.00 | R 1.00 |
| ***Final investment*** | R 22.55 | R 19.83 | R 6.94 |
| ***CAR*** | 15% | 15% | 9% |
| ***Average*** | 14% | 14% | 9% |
| ***Median*** | 15% | 15% | 3% |
| ***Stdev*** | 20% | 19% | 20% |
| ***Max*** | 41% | 41% | 41% |
| ***Min*** | -27% | -22% | -28% |
| ***Sharpe ratio*** | 0.76 | 0.78 | 0.45 |
| ***No. of switches*** | 0 | 36 | |

### 5.4.7 J560 Telecommunications

Fund_BD by far and away outperformed the other two funds by achieving at CAR of 17% at the highest standard deviation of 31% achieving a R28.86 return which was 49% higher than the next best buy and hold strategy (R14.80) for the same R1 investment. The Fund_MM attained a final return of R10.59 (11% CAR) by using the equity and money market timing strategy. Figure 50 shows the periods within which each market timing portfolio was in equities (Switch = 1).

Fund_BD achieved 10-years of average annual returns above or equal to 23% per Figure 51. Figure 52 shows periods of outperformance.

**Figure 50: J560 Cumulative portfolio returns**

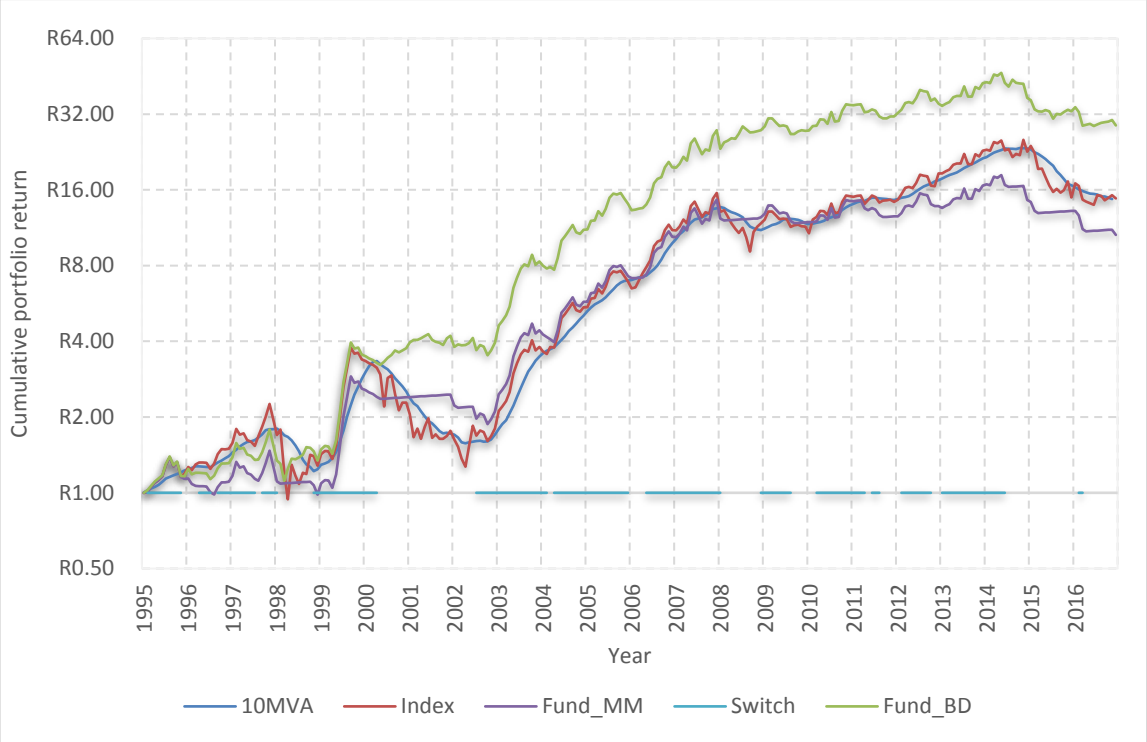


**Figure 51: J560 Portfolio returns frequency**

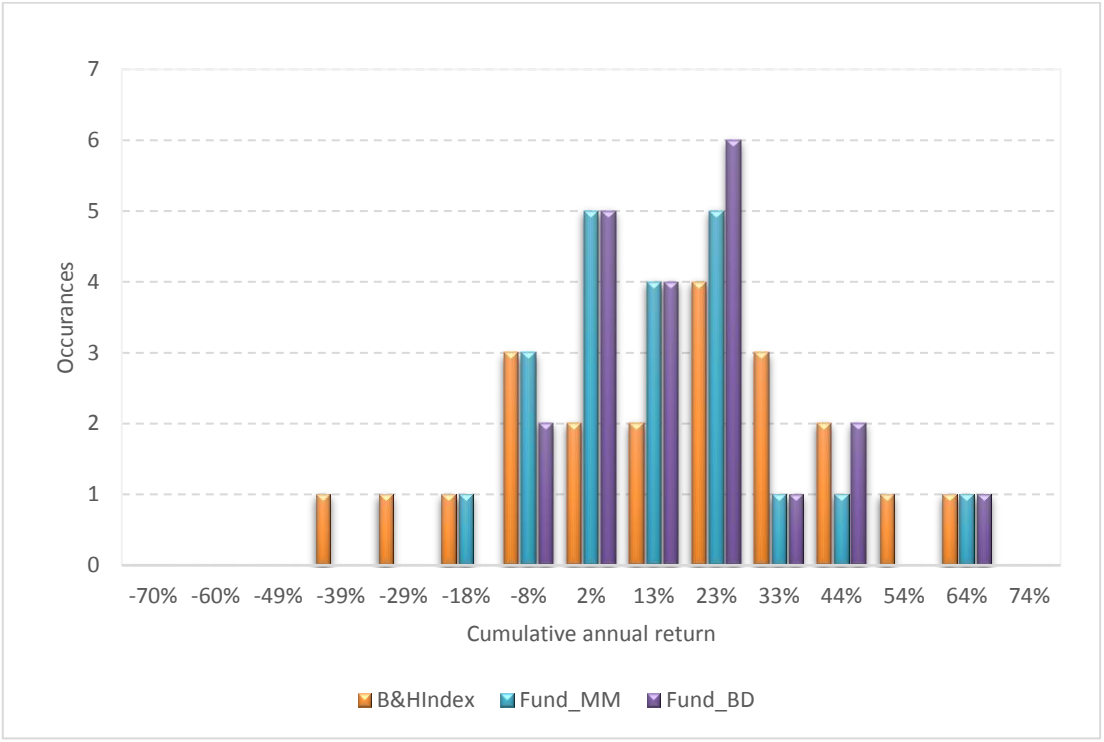



**Figure 52: J560 Bond and money market fund outperformance**

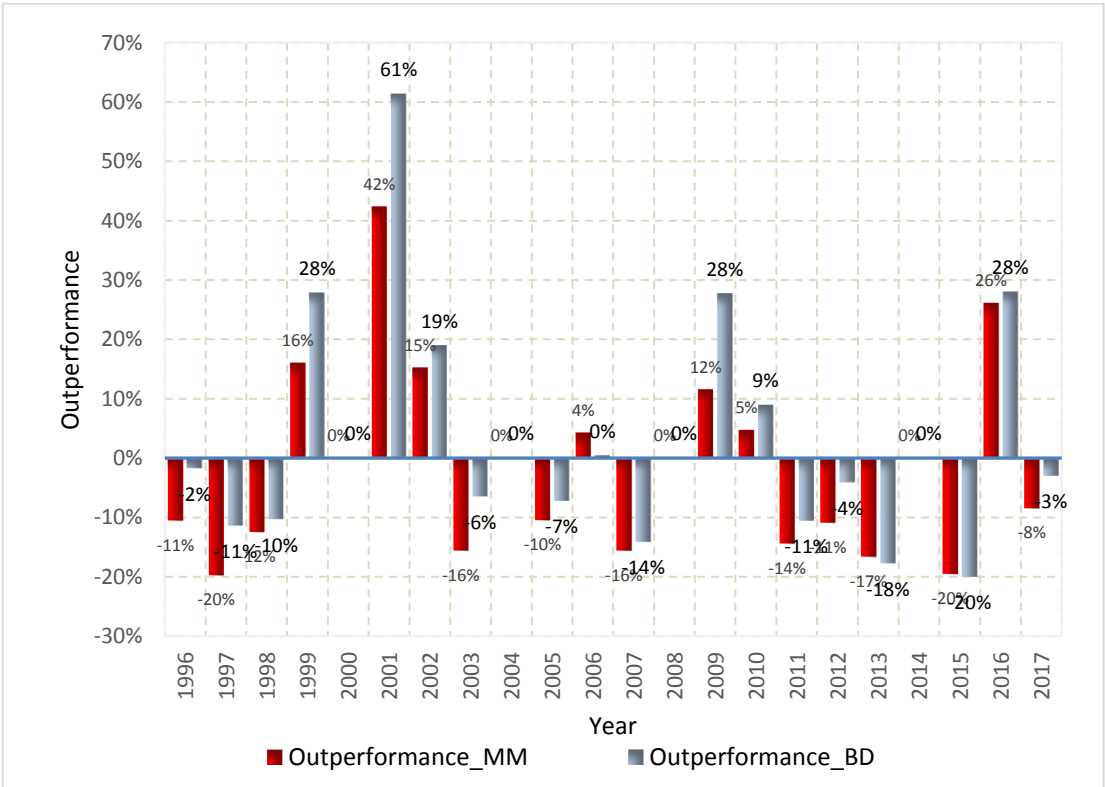


**Table 29: J560 Portfolio summary**

| | *B&H Index* | *Fund_BD* | *Fund_MM* |
|---|---|---|---|
| ***No. months*** | 264 | | |
| ***Range*** | 06/1995 - 05/2017 | | |
| ***Initial investment*** | R 1.00 | R 1.00 | R 1.00 |
| ***Final investment*** | R 14.80 | R 28.86 | R 10.59 |
| ***CAR*** | 13% | 17% | 11% |
| ***Average*** | 12% | 15% | 11% |
| ***Median*** | 17% | 15% | 6% |
| ***Stdev*** | 31% | 24% | 25% |
| ***Max*** | 85% | 85% | 85% |
| ***Min*** | -49% | -17% | -22% |
| ***Sharpe ratio*** | 0.42 | 0.70 | 0.45 |
| ***No. of switches*** | 0 | 36 | |

### 5.4.8 J580 Financials

The buy and hold strategy yielded the largest CAR of 12% at the highest standard deviation of 32% achieving a R514.48 compared to the Fund_MM which netted R54.91 for the same R1 investment. Figure 53 shows the periods within which each market timing portfolio was in equities (Switch = 1). Figure 53 further shows the superior performance of the buy and hold strategy over the market timing strategy during long periods and the destructive ability of switching. During 1995-2005 we saw the negative effect of excessive switches and poor equity returns, resulting in the 307% drop in value.

The buy and hold strategy had more periods of positive performance per Figure 54. The buy and hold strategy consistently outperformed the market timing strategy per Figure 55.

**Figure 53: J580 Cumulative portfolio returns**


**Figure 54: J580 Portfolio returns frequency**

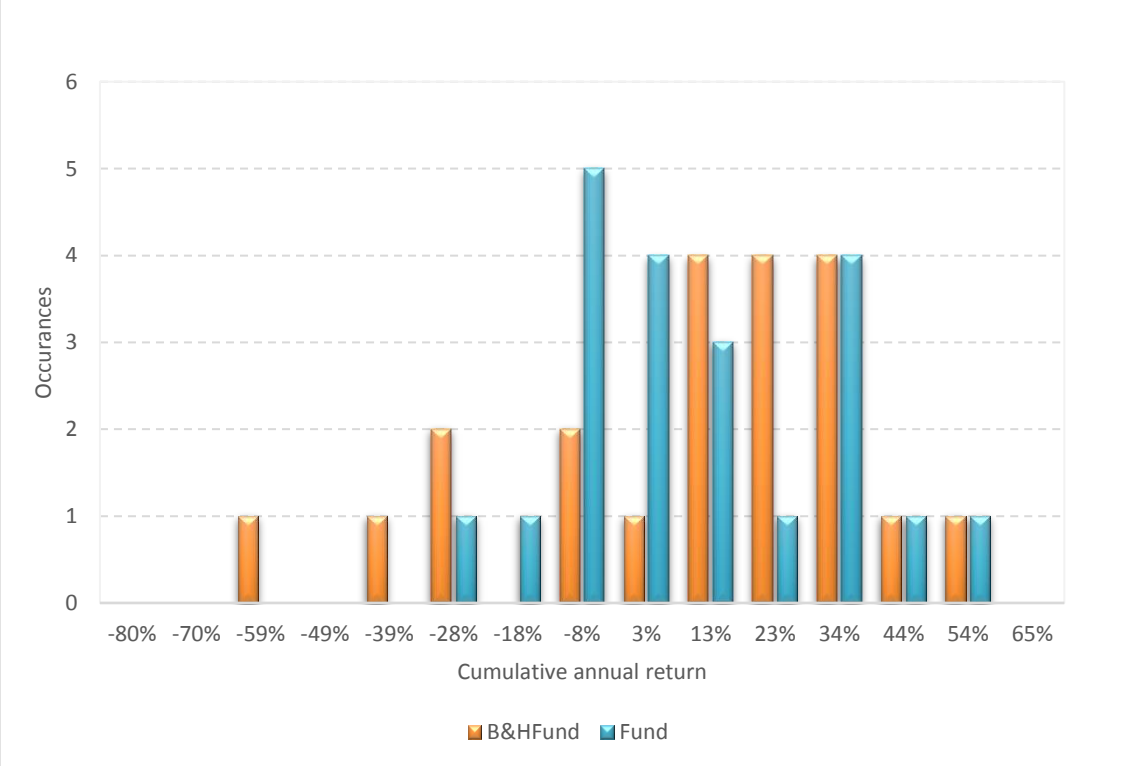


**Figure 55: J580 Bond and money market fund outperformance**

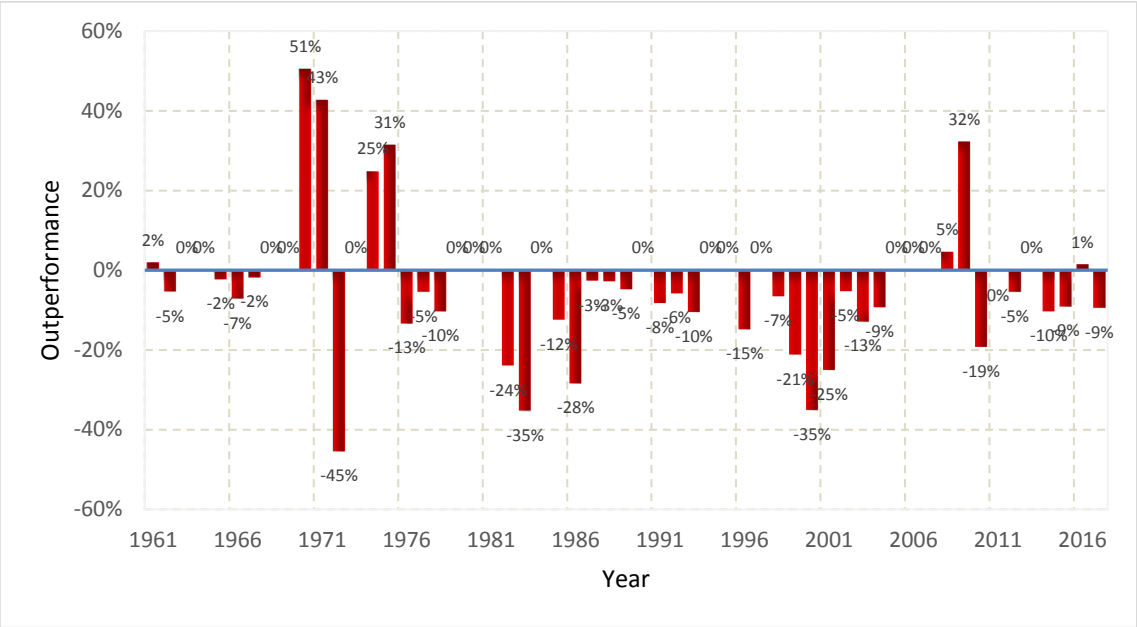



**Table 30: J580 Portfolio summary**

| | *B&H Index* | *Fund_BD* | *Fund_MM* |
|---|---|---|---|
| ***No. months*** | 689 | | |
| ***Range*** | 01/1960 - 05/2017 | | |
| ***Initial investment*** | R 1.00 | R 1.00 | R 1.00 |
| ***Final investment*** | R 514.48 | R - | R 54.91 |
| ***CAR*** | 12% | - | 7% |
| ***Average*** | 8% | - | 9% |
| ***Median*** | 14% | - | 4% |
| ***Stdev*** | 32% | - | 25% |
| ***Max*** | 79% | - | 79% |
| ***Min*** | -66% | - | -29% |
| ***Sharpe ratio*** | 0.36 | - | 0.29 |
| ***No. of switches*** | 0 | 82 | |

### 5.4.9 J590 Technology

The Fund_BD yielded the highest CAR of 24% at the lowest standard deviation of 23% achieving an R113.63 return which was 1018% higher than the next best Fund_MM (R47.78) for the same R1 investment. The buy and hold strategy netted a final return of R10.16 (11% CAR). Figure 56 shows the periods within which each market timing portfolio was in equities (Switch = 1).

The Fund_BD strategy achieved the most years of average annual returns above or equal to 14 per Figure 57. Fund_BD consistently outperformed other portfolios during the study period per Figure 58.

**Figure 56: J590 Cumulative portfolio returns**

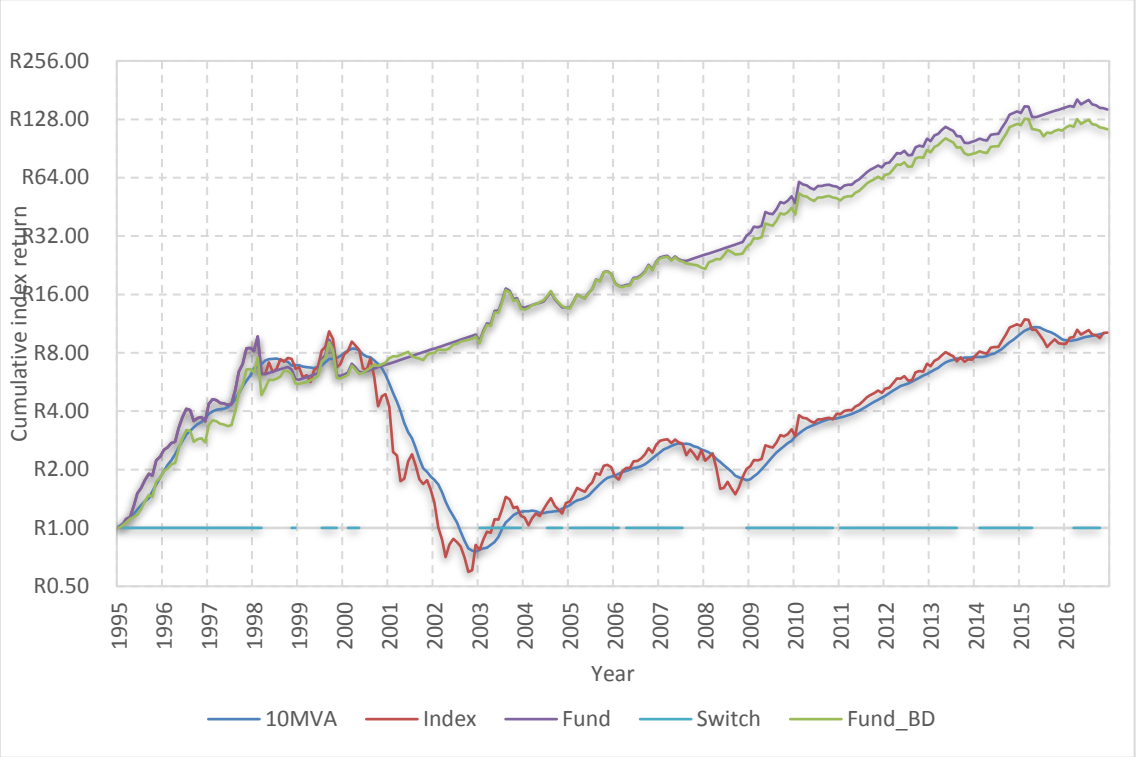



**Figure 57: J590 Portfolio returns frequency**

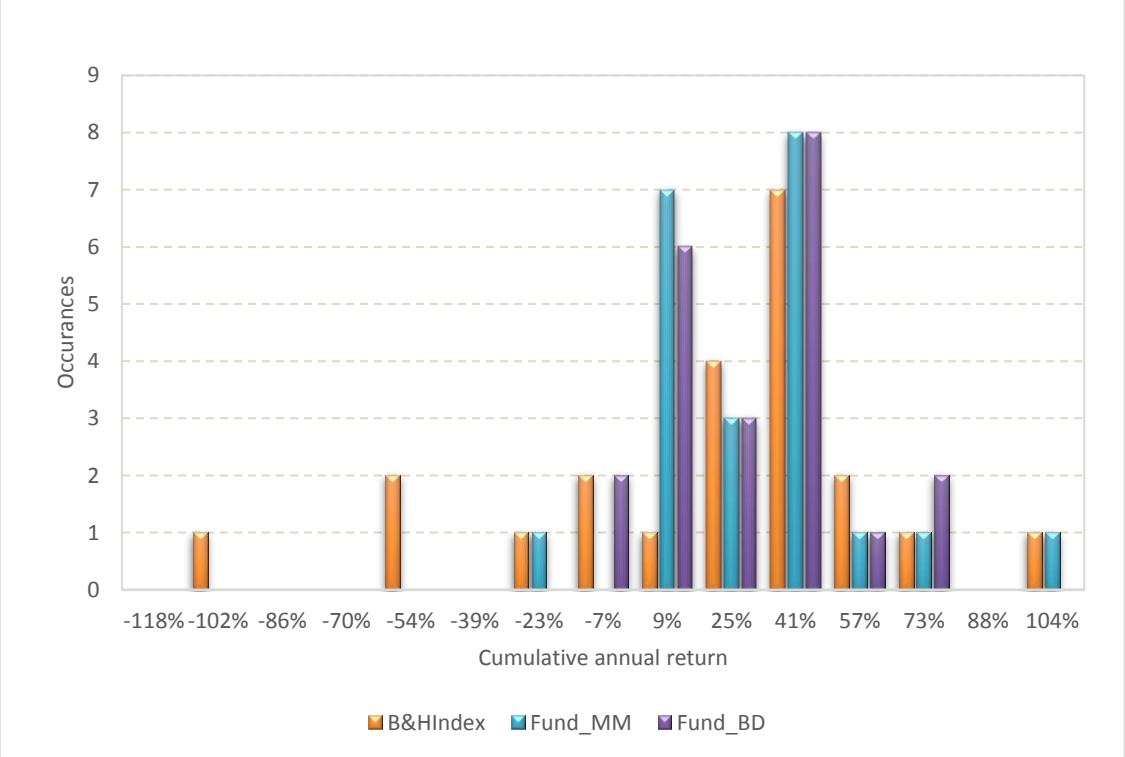


**Figure 58: J590 Bond and money market fund outperformance**

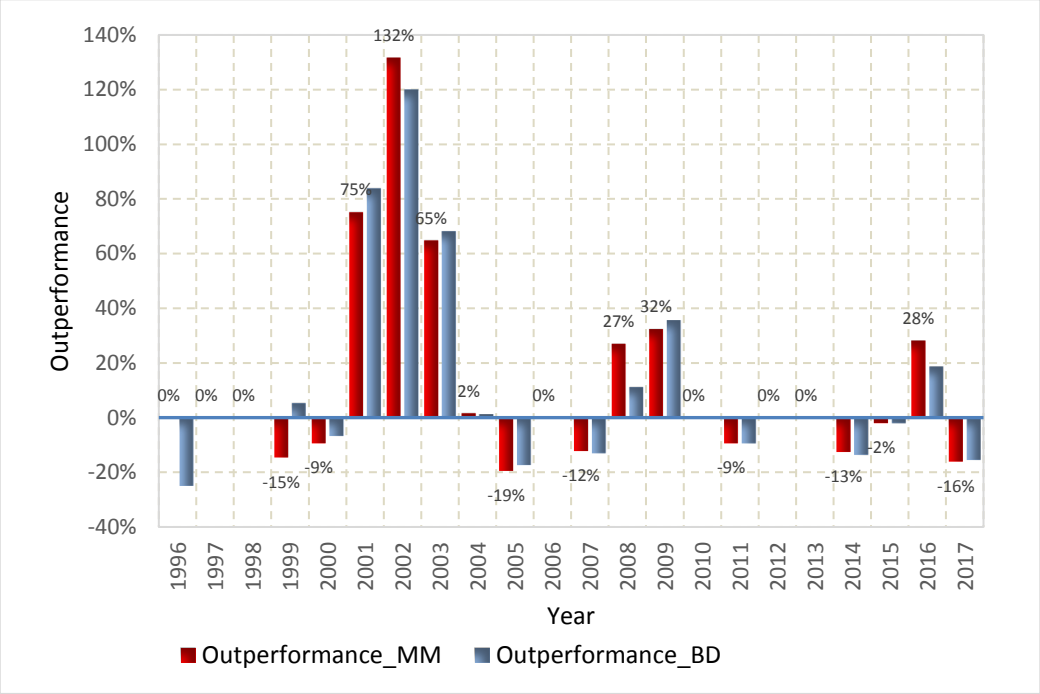



**Table 31: J590 Portfolio summary**

| | *B&H Index* | *Fund_BD* | *Fund_MM* |
|---|---|---|---|
| ***No. months*** | 264 | | |
| ***Range*** | 06/1995 - 05/2017 | | |
| ***Initial investment*** | R 1.00 | R 1.00 | R 1.00 |
| ***Final investment*** | R 10.16 | R 113.63 | R 47.78 |
| ***CAR*** | 11% | 24% | 19% |
| ***Average*** | 11% | 22% | 18% |
| ***Median*** | 23% | 24% | 14% |
| ***Stdev*** | 46% | 23% | 30% |
| ***Max*** | 93% | 68% | 93% |
| ***Min*** | -114% | -14% | -44% |
| ***Sharpe ratio*** | 0.24 | 1.06 | 0.65 |
| ***No. of switches*** | 0 | 26 | |

## 5.5 Sensitivities

The market timing strategies investigated were subject to a fixed per transaction cost of 2% and money market annual rate of 2.5%. To further reduce selection bias, sensitivity analysis was carried out by varying both parameters independently. Section 5.5.1 investigates the effect on average annual returns of the equity/bond market timing strategy by only varying transactions cost. Section 5.5.2 analyses the effect on the equity/money market, market timing strategy by varying the monthly interest rate.

### 5.5.1 Transaction costs

Transaction costs vary depending on the size and body completing the transaction. The effect on fund average annual return rate by varying transaction costs from 0% to 2.5% in 0.5% increments is shown in Figure 60 and listed in Table 32. Predictably, as transaction costs increase, so do average annual rates decrease. The slope of the line is affected by the number of switches. Interestingly, for between 2% and 1.5% transaction costs, the J540/J560/J530 equity/bond market timing strategies yield comparable average annual returns.

**Figure 60: Effect of varying transaction cost on CAR**

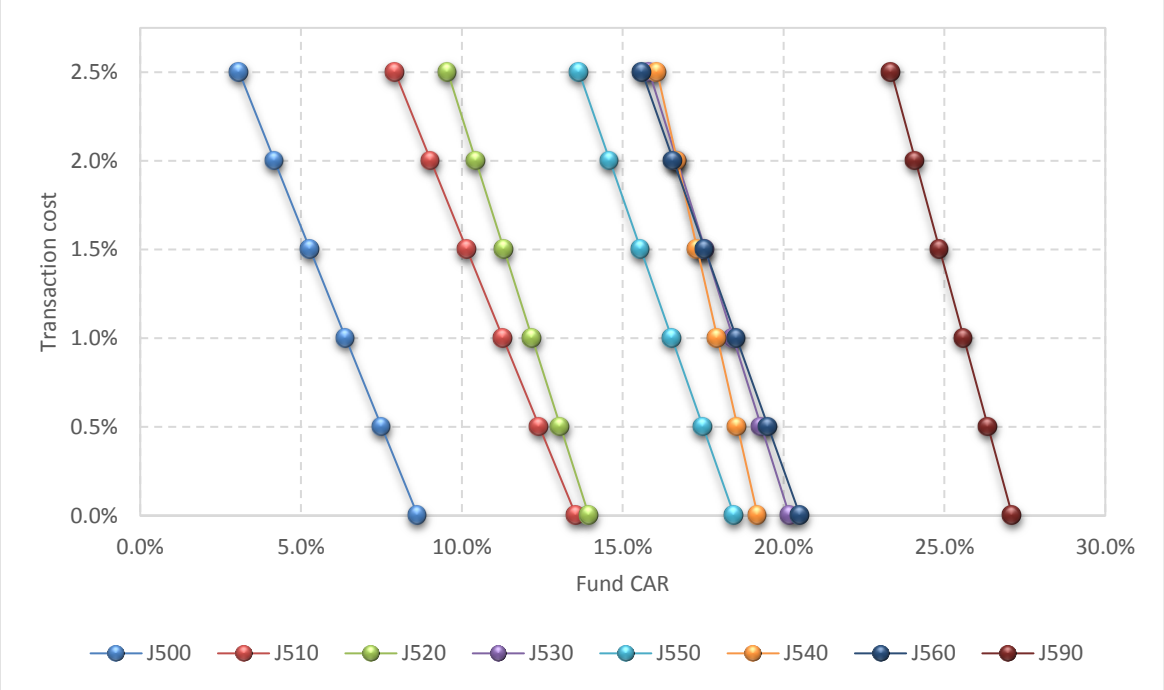



**Table 32: Variation of transactions costs on Fund CAR**

| *Fund return* | *J500* | *J510* | *J520* | *J530* | *J540* | *J550* | *J560* | *J580* | *J590* |
|---|---|---|---|---|---|---|---|---|---|
| *Buy&hold* | *14%* | *6%* | *11%* | *18%* | *14%* | *15%* | *13%* | *12%* | *11%* |
| *Transaction cost* | | | | | | | | | |
| 0% | 8.6% | 13.5% | 14.0% | 20.2% | 19.2% | 18.5% | 20.5% | 10.3% | 27.1% |
| 0.50% | 7.5% | 12.4% | 13.1% | 19.3% | 18.6% | 17.5% | 19.5% | 9.6% | 26.4% |
| 1% | 6.4% | 11.3% | 12.2% | 18.4% | 17.9% | 16.5% | 18.5% | 8.8% | 25.6% |
| 1.50% | 5.3% | 10.2% | 11.3% | 17.6% | 17.3% | 15.6% | 17.6% | 8.0% | 24.9% |
| 2% | 4.2% | 9.0% | 10.4% | 16.7% | 16.7% | 14.6% | 16.6% | 7.2% | 24.1% |
| 2.50% | 3.1% | 7.9% | 9.6% | 15.8% | 16.1% | 13.6% | 15.6% | 6.4% | 23.4% |

### 5.5.2 Fixed monthly interest rate changes

South Africa has four large banking institutions and a myriad of smaller players, each offering varying cash deposit interest rates. For simplicity, the lending money market rate was conservatively fixed. Figure 61 shows the effect of varying the monthly market interest rate between 0% and 1.6% (0% and 19.2% annually) and listed in Table 33. Above a 0.8% monthly interest rate, the J560 yields larger average annual returns than the J530 market timing strategy.

**Figure 61: Effect of varying fixed one month interest rates on Fund CAR**

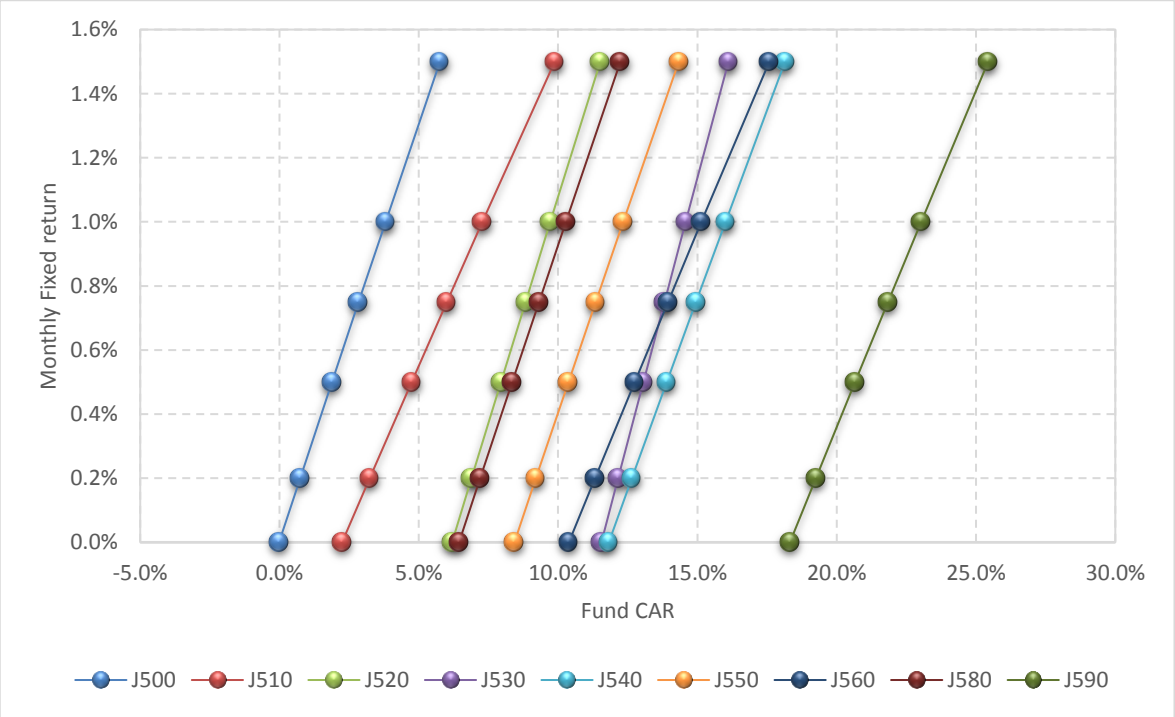



**Table 33: Variation of one month fixed interest rates on Fund CAR**

| *Fund return* | *J500* | *J510* | *J520* | *J530* | *J540* | *J550* | *J560* | *J580* | *J590* |
|---|---|---|---|---|---|---|---|---|---|
| *Buy&hold* | *14%* | *6%* | *11%* | *18%* | *14%* | *15%* | *13%* | *12%* | *11%* |
| *Fixed monthly rate* | | | | | | | | | |
| 0.0% | 0.0% | 2.2% | 6.2% | 11.6% | 11.8% | 8.4% | 10.4% | 6.4% | 18.3% |
| 0.2% | 0.7% | 3.2% | 6.9% | 12.2% | 12.7% | 9.2% | 11.3% | 7.2% | 19.3% |
| 0.5% | 1.9% | 4.7% | 7.9% | 13.1% | 13.9% | 10.4% | 12.7% | 8.4% | 20.7% |
| 0.8% | 2.8% | 6.0% | 8.8% | 13.8% | 15.0% | 11.4% | 13.9% | 9.3% | 21.8% |
| 1.0% | 3.8% | 7.3% | 9.7% | 14.6% | 16.0% | 12.3% | 15.1% | 10.3% | 23.0% |
| 1.5% | 5.8% | 9.9% | 11.5% | 16.1% | 18.1% | 14.3% | 17.6% | 12.2% | 25.4% |

### 5.5.3 Conclusion for research proposition two data analysis

Systematically predicting fluctuations in JSE industry indices close to 100% accuracies using the method of Faber (2007) was not possible. Applying transaction costs of 2% have resulted in the equity/bond market timing strategy outperforming the respective buy and hold strategy in four out of nine JSE industry indices. This is a 50% ($\frac{8/9-4/9}{8/9}$%) reduction in performance of this strategy when no transaction costs were applied. The momentum market timing strategy yielded the largest returns with those JSE industry indices with highest standard deviation, as the case of the 24% CAR return of the J590.

The results become sobering for an investor when compared to a buy-and-hold strategy using the J203 and ALBI which produced CAR returns of 11.6% (17.3% standard deviation) and 12.40% (7.4% standard deviation) respectively. Peculiarly, the largest Sharpe ratio, calculated at 1.69, was for ALBI fund, with the next best being 1.06 for the J590.

In summary, the results show that it was possible to time the market and beat the associated buy and hold strategy. Based on the data presented, the following themes have arisen:

- The ability to predict market fluctuations at 100% accuracy can result in enormous CAR. The J590 index produced an average annual return of 62.37% followed by the J500 yielding 56.41%. The median average annual return for this group of nine indices was 45.39% with lowest average annual return being 36.72%, calculated for the J520
- On average, for an investor to beat the associated buy and hold strategy at all times requires an 84.70% predictive accuracy. Conversely, had an investor achieved an average of 28.73% predictive accuracy or less, the investor would at all times achieve returns lower than the associated buy and hold strategy
- Ex-transaction costs, the market timing approach of Faber (2007), using the equity/bond market timing strategy, yielded superior returns for eight out of nine indices investigated. The highest yielding portfolio was the equity/bond market timing strategy of the J590 producing a CAR of 27.11% compared to the buy and hold strategy CAR of 11.50%
- Including transaction cost of 2% per switch, the market timing strategy of equity/bonds outperformed the associated buy and hold strategy four out of nine times. The J590 predictably producing the highest CAR of 24%. The

equity/money market strategy outperformed the associated buy and hold strategy one out of nine times for the J590.

- Results presented were based on a simple moving average approach using Microsoft Excel. These results are easily replicable on multiple calculation platforms and data can be sourced from various JSE data sources.

A deep-dive analysis and discussion of the results shown, linking back to the literature review and research propositions, are presented in the following chapter. It includes a separate discussion of the data validation. Research proposition one and two results are subsequently presented. A final word on sensitivity analyses are detailed. Insights relevant to the investor are discussed further along with its practical applicability with limitations.

# CHAPTER 6: DISCUSSION OF RESULTS

The former chapter presented the data analysis of the sample collected. This chapter deliberates on those findings, to tie back to preceding chapters and to un-earth useful insights for the potential investor. Sections 6.1-6.2 discusses evidence of share predictability and marketing on the JSE. The data methodology, approach, sample collected and exclusions made were interrogated in section 6.3. Research propositions one and two are discussed in section 6.4 and 6.5 respectively. Limitations and conclusions then follow.

## 6.1 Share price predictability on the JSE

The increase in popularity of passive funds can be attributed to investor apathy, ease to enter the market and investor maturity. The huge fees active managers, such as hedge fund managers, prescribe has come under pressure with low cost passive funds such as the emergence of exchange-traded-funds (ETF). Muller and Ward (2011) showed this to be true for active managers operating on the JSE with decline of active management. This study provided evidence of superior gains in four out of nine indices test portfolios.

The ETF funds follow the index and generate market benchmark returns at a fraction of the cost. Petajisto (2013) highlight the attractiveness of passive investment. However, results, presented in chapter five, show the far superior gains possible, such as 56.41% CAR for the J500 from 2002-2015. While these returns require high levels of forecasting accuracy it highlights the attractiveness to an investor. The question of how to realise those potential ties back to the aim of this report, which was to assess the performance of a market timing strategy. Performance can be measured using volatility or risk but this study's objection function was to maximise and investors' utility being CAR.

The study shows that test portfolios can yield greater CAR than the associated test portfolio for four out of nine JSE indices investigated using historic share price data. This implies a level of predictability, displays evidence of inefficiency and provides evidence in contradiction of the assumption of weak form efficiency, in agreement with the Jefferis and Smith (2004). No parametric or non-parametric tests were performed to test for weak form efficiency. Rather, it was concluded that inefficiencies in the dissemination of information on the JSE were present during the study period. It

creates arbitrage opportunities exploitable for a market timing strategy and the results of this study calculated the large CAR of 24% for the J590 equity/bond test portfolio, from 1998-2017 after including transaction costs.

### 6.2 Market timing

An underlying assumption of this study was of a rational investor and the approach employed was systematic, used historic daily JSE industry sector share price information and therefore was outside the realm of behavioural finance. Rational investors seek to maximise returns, in line with the objectives of this study.

Market timing strategies, using historic information, have been extensively documented in literature and have shown to be successful predictors of share prices. Market timing as a systematic investment strategy. To assume information was perfectly disseminated and fully available is a fallacy in the real markets, supported by Rossi (2015).

This report further refutes the EMH with evidence of predictability of JSE industry sectors during the study period. It was not the point of the study to reject the EMH but rather to highlight inefficiencies in the model that can be exploited by an investor. This was a similar conclusion reached by Degutis and Novickyte (2014), Westerlund and Narayan (2013). In the long run, after an event, a mature market can be modelled by the EMH. Apart from the vast research supporting the model, it can be conceptually defended by the premium investors' place on information.

It is the period between an event and perfect information dissemination in which arbitrage opportunities are possible with a market timing strategy. The previous section listed the in-efficiencies on the JSE during the study period and a market timing strategy is an apt approach in these circumstances. Both Zakamulin (2014) and Pfau (2011) have shown the suitability of a market timing strategy which was prudent for systematic use. This systematic approach can be applied to diverse investors and minimises cognitive biases such as focusing effect, distinction effects and belief bias. These types of bias are inherent with stock picking strategies.

### 6.3 Methodology and sample

The closing share price data was used in-lieu of spot prices so as to avoid selection

bias and is the norm for these types of investigations. The market timing strategy relied upon monthly share price movement based on first and last closed trading day in accordance with Glabadanisdis (2016), De Kock (2016), Bowler (2012) and Miller and Ward (2015).

The study sample presented nine of the ten JSE industry indices encompassing the entire market. The J570 was excluded as was never created and hence did not affect the study objectives. Data range for the J500 was reduced to 13 years representing the largest continuous data sample available. Data sources were deemed valid, reliable and verified against google data analytics. Both data sources link via application programming interface into the JSE data bases. Consequently, the methodology and sample set were deemed appropriate and support this study's research goals.

The J570 was never created by the JSE owing to lack meaningful representation on the market over time. Upon closer inspection of the market historic share price data concurred with this over the study range. Hence this index was excluded from this study. It did not negatively impact the results as nine of ten indices adequately mirror the market movements. The approach, data gathered and excluded was shown to adequately support the research goals of this study.

The data gathering approach and methodology of Faber (2007) was adopted. Its ease of use, replicability and simple mathematical rigour was supported by other researchers such as Miller and Ward (2015). Utilizing this approach with secondary data (closing share price data) allows for improved data verification and applicable to an investor.

By decomposing and adopting sector rotation strategies for two asset classes could mimic a market timing strategy which allows for triangulation of data. However, this analysis was excluded from the study owing to the simple mathematical model adopted.

The data collection process was rigorous by including continuous closing share price data for at least eight years. As the investigated indices were calculated and published by the JSE and not inherent share price data, creates the possibility of discontinuity in data. This was true for the J500 which had numerous gaps in the data, which the JSE could not account for. Collected closing share price data was verified using Google analytics data stream to verify results gathered from The Style Engine.

Excluding taxation had minimal impact on the research goals of this study. An investor's tax profile depends on a myriad of factors such as company structure, absolute share returns and subject to capital gains tax. To create a non-biased tax view would result in a static factor of 28% (South Africa's business tax rate) which mirrors the effect of transaction costs employed.

Share slippage has a greater impact on high frequency traders or day traders. It occurs when the expected trade price differs from the actual price. As this study employed actual closing share price data negated this effect. However, this approach does suffer from inherent look-ahead bias.

### 6.4 Proposition one

The concept of risk versus return are the polar forces investors play off when managing a portfolio. Proposition one defines the risk/return landscape for given indices. It uncovers two underlying properties, potential returns/risk levels and the forecasting accuracy required to achieve an associated return. Further, the potential to achieve hefty returns using a market timing strategy were consistent with the findings of Jeffrey (1984), Firer et al. (1987), Ward and Terblanche (2009) and Dichtl, Drobetz and Kryzanowski (2016).

Delving deeper into consistency, all calculated risk/return footballs indicate, for an investor to at all times outperform the market, requires a forecasting accuracy over the investigated period ranging from 80.15% to 87.45%. The ability to maintain these levels are widely disputed, more recently by Dichtl et al. (2016). Paradoxically, market timing remains as an alluring prospect despite the mountain of evidence against it. Possible explanations must remain within behavioural finance such as the vacuity pertaining to the long term and the potential for excess returns over the market benchmark return. The exploration of these and other behavioural concepts were outside the scope of this study.

Risk as a financial concept has many facets, such as systematic/un-systematic categories and is intended to be broadly treated in this study as it relates to potential portfolio returns. Risk can be thought of as an investment's potential for loss and can be used as a measure to assess potential returns.

In this study, the investigated portfolios have associated historic closing share price returns and the question remains as to the method to equally measure each portfolio's risk and subsequently its return. To solve this dilemma, a mathematical treatment was introduced, the risk adjusted return or Sharpe Ratio, by Sharpe (1964) and extended conceptually by Barberis, Greenwood, Jin and Shleifer (2015). The risk-adjusted ratio was calculated using the standard deviation or variance of a portfolio and was not applicable to the market timing football curves, due to lack of variance based on methodology.

Apart from the calculated CAR, standard deviation and Sharpe ratio, Ward and Terblanche (2009) propose three further methods to assess risk for these types of risk/return curves which are compression rations, switching ratios and worst-to-best ratios. The 3 methods collectively assess each through different lenses. These methods are described next:

### 6.4.1 Compression ratio

Throughout an index's lifecycle, there are periods of abnormally high returns where the investor is required to be in the market. This range can be quantified by using a compression ratio, defined by Ward and Terblanche (2009) as the number of months of abnormally high returns divided by the total number of periods under investigation. Hence, a fund's low compression ratio indicates the low percentage of periods with abnormally high returns posing the largest risk for an investor. Missing such periods may result in the investor losing the ability to beat the associate buy and hold strategy.

For the purposes of this study, abnormal returns are defined as monthly returns larger than half of the annual average returns for the buy and hold strategy. Results are shown in Table 34.

**Table 34: JSE indices compression ratios**

| *Fund name* | *Compression ratio* | *Period* | *Total periods* |
|---|---|---|---|
| J500 | 21% | 1 month | 163 |
| J510 | 38% | 1 month | 264 |
| J520 | 19% | 1 month | 264 |
| J530 | 11% | 1 month | 264 |
| J540 | 16% | 1 month | 264 |
| J550 | 15% | 1 month | 264 |

| | | | |
|---|---|---|---|
| J560 | 22% | 1 month | 264 |
| J580 | 18% | 1 month | 689 |
| J590 | 30% | 1 month | 264 |

Table 34 indicates that the J510 followed by the J590 are the less risky portfolios, with the J530 being the riskiest. These results did not correlate with standard deviation as they look only at abnormally high positive spikes. For example, the J590 buy and hold strategy have the highest calculated standard deviation, yet has the second lowest number of abnormal high returns. No discernible was trend relating switching ratio to cumulative average return, standard deviation or maximum period return could be found consistent with the work of Ward and Terblanche (2009).

### 6.4.2 Switch ratio

The switch ratio was calculated using the method of Ward and Terblanche (2009), as the number of switches divided by the total number of periods investigated. Research proposition one did not consider transaction costs and consequently the switch ratio had no effect on the calculated maximum return. The results are shown in Table 35.

**Table 35: Calculated switch ratio**

| *Fund name* | *Switch ratio* | *CAR for 100% accuracy* | *Switch return ratio* |
|---|---|---|---|
| J500 | 53% | 56% | 94% |
| J510 | 56% | 46% | 121% |
| J520 | 46% | 37% | 125% |
| J530 | 51% | 45% | 113% |
| J540 | 41% | 40% | 102% |
| J550 | 44% | 45% | 97% |
| J560 | 49% | 56% | 89% |
| J580 | 44% | 38% | 117% |
| J590 | 45% | 62% | 72% |

Table 35 indicates what switch ratio an investor needs to achieve to realise maximum CAR. The average switch ratio was calculated to be 48% with a standard deviation of 5%. Table 35 indicates the J590 being the less risky investment with the lowest switch/return ratio. As each fund yielded varying CAR the switch ratio and no transaction cost were considered, the switch ratio was not pertinent to research proposition one. Had transaction cost been implemented, J510 and J510 would have been most affected. The J540, J550 and J580 would have been the least affected.

### 6.4.3 Worst to best ratio

The final measure, proposed by Ward and Terblanche (2009), to assess portfolio risk was to calculate the in-efficiency of market timing as adapted from Jeffrey (1984). The worst to best ratio was defined as:

$$Worst - best\ ratio = \frac{-(\ln(Worst\ fund\ return) - \ln(Buy\ and\ hold\ fund\ return))}{(\ln(Best\ fund\ return\ CAR) - \ln(Buy\ and\ hold\ fund\ return))}$$

The ratio assesses performance relative to the associated buy and hold strategy. It provides an indication of risk with values closer to one indicating lower risk. Results for each calculated fund is shown in Table 36.

**Table 36: Worst to best calculated ratio**

| *Fund name* | Best fund cumulative return | Worst fund cumulative return | Buy and hold cumulative return | W/B ratio |
|---|---|---|---|---|
| J500 | R 435.18 | R 0.01 | R 5.69 | 140% |
| J510 | R 4 322.67 | R 0.00 | R 3.87 | 119% |
| J520 | R 973.67 | R 0.01 | R 10.64 | 152% |
| J530 | R 3 763.32 | R 0.01 | R 39.26 | 180% |
| J540 | R 1 726.72 | R 0.01 | R 16.24 | 160% |
| J550 | R 3 393.98 | R 0.01 | R 22.55 | 162% |
| J560 | R 16 570.52 | R 0.00 | R 14.80 | 138% |
| J580 | R 105 819 619.99 | R 0.00 | R 514.48 | 151% |
| J590 | R 42 762.28 | R 0.00 | R 10.16 | 128% |

The J510 displays the lowest calculated risk at 119% followed by the J590 with 128%. The riskiest fund was by far the J530 with a calculated ratio of 180%. Multiple funds have similar risk levels, such as the J520 and J580.

Incorporating the results of the three-risk performance measures, the J510 and J590 have the lowest risk associated upside return. The J590 consistently places in the top two for each measure. The riskiest fund was the J530 yielding the worst compression ratio and worst/best ratio. Low significance was attached to the switch ratio.

Results of proposition one calculates the potential CAR for a successful market timing strategy for each JSE industry index. It provides an investor with the landscape of returns with associated risk. Had the calculation set stopped at this point, results indicate the J510 and J590 the best funds to invest into and the J530 the one to avoid. The limitation of these results to the investor were no transaction costs included, no

systematic market timing strategy included and no accounting for out of fund return. Proposition two aims to expand on these limitations.

Maintaining forecasting accuracies greater than 80% over long periods are difficult for investors to realize as supported by copious amounts of research, such as presented by Dichtl et al. (2016), Ward and Terblanche (2009) and Firer, Ward and Teeuwisse, (1987). Proposition two follows by assessing two rigorous market timing strategies based on Faber (2007), using a momentum switch and including sensitivity analyses.

### 6.5 Proposition two

The aim of the active investor was to consistently outperform the market benchmark. Proposition one lists the attractive indices made up of potential returns and forecasting accuracy. While this information is useful, it is impractical and prone to selection bias based on potential returns. For an investor to operationalise the strategy requires a systematic approach and assessment criteria. Proposition two was constructed to evaluate said categories. The applicability of using momentum as a market timer was discussed in section 6.5.1 with the choice of alternate asset class discussed in section 6.5.2. To provide a comprehensive analysis of the market timing strategies, three further criteria are discussed in subsequent sections, which are drawdowns, holding period frequency and holding period versus return (section 6.5.3-6.5.5). Further implications are made on the impact of varying the investigated period, in section 6.6 and preliminary conclusions in section 6.7.

#### 6.5.1 Momentum to predict shore term returns

Results of proposition one calculates the potential CAR of the JSE industry indices and market timing results provide evidence of market inefficiency and a level of predictability. Methods to predict future stocks prices are extensive and in-keeping with the spirit of this study, to create a simple method for an investor to employ, a momentum market timer was chosen. Momentum was applicable as it was effective to forecast short term returns, based on the evidence presented in this study. The ability of momentum to predict short term returns are supported by Miller and Ward (2015), Wang and Xu (2015) and Glabadanisdis (2016).

The approach of Faber (2007) was adopted, using ten-month moving average which removed those cognitive biases inherent in the investors' financial decisions, described

by Kubilay and Bayrakdaroglu (2016). This was consistent with study assumption of a rational investor aiming to maximise its utility, CAR. The choice of the ten-month period was based on the 200-day moving average being an optimal momentum period. This has been extensively documented in literature. It can be argued the ten-month time range may not have been optimised for this type of asset class but was adopted to be comparable to previous research methods.

At the onset, to avoid excessive switching in the first five months, the test portfolios were allocated to equities. Thereafter, the relative moving average calculation increased to the ten-month moving average. This accounted for 1.89% of the time range and the effect did not significantly affect the conclusion.

### 6.5.2 Choice of alternate asset classes

The essence of market timing was to switch between a risky and riskless asset classes. Early papers on market timing defined riskless assets as government bonds such as US treasury bills synonymous with security, as opposed to US Banks. In contrast, South Africa's financial institutions are ranked amongst the best in the world and provide numerous money market deposits guaranteeing cash deposits. Hence, to align with previous research and to take cognisance of the South African environment two separate market strategies using equity/bonds and equity/money market were employed.

In all cases the equity/bond market timing strategy outperformed the equity/bond strategy, shown in Table 37. The largest differences between each market timing strategy CAR was calculated for the J560 and the J550 which were 186% and 173% respectively. The magnitude of the difference can be attributed to the low money market deposit rate of 2.5%. The sensitivity analysis quantifies the effect of various fixed deposit rates.

A major contributor to the superior performance of the equity/bond market timing strategy was due to the superior performance of the ALBI, relative to the equities market. This performance may be dampened by the recent downgrade of the South African economy, leading to higher interest rates and conversely a cheaper bond market. The CAR of the ALBI was 14.0% with the lowest standard deviation of 17.3% as compared to the 2.5% assigned to the money market fund.

**Table 37: Equity/bond and equity/money market relative differences**

| *Fund* | | *J500* | *J510* | *J520* | *J530* | *J540* | *J550* | *J560* | *J580* | *J590* |
|---|---|---|---|---|---|---|---|---|---|---|
| *Equity and bond switch* | Initial investment | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 |
| | Final investment | R 1.74 | R 6.66 | R 8.81 | R 29.49 | R 29.49 | R 19.83 | R 28.86 | R - | R 113.63 |
| *Equity and money market switch* | Initial investment | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 | R 1.00 |
| | Final investment | R 1.11 | R 2.03 | R 4.34 | R 12.42 | R 13.70 | R 6.94 | R 10.59 | R 54.91 | R 47.78 |
| | Relative difference | 57% | 228% | 103% | 137% | 115% | 186% | 173% | - | 138% |

### 6.5.3 Drawdowns

Successful market timing strategies avoid bear markets and predict bull markets. Those bear periods destroy wealth and if avoided, maximises the effect of compound interest. Essentially, those market timing strategies achieving lower drawdowns that the associated buy and hold strategies can be thought of as successfully timing the market excluding transaction costs. Figures 62 to 70 show the absolute difference between CAR for the buy and hold strategy versus the market timing strategy. It was evident that those market timing strategies that outperformed the associated buy and hold strategies maintained the largest difference of drawdown years such as the J540 and J590. In particular, the equity/bond market timing strategy of the J590 avoided the dot.com bubble burst of early 2000 and the 2008 economic crash. Table 38 presented yearly average drawdown rates, however, maximum monthly drawdown rates varied between -27% and -114%. The difference was between the Index fund and the money market strategy.

**Figure 62: J500 drawdown**

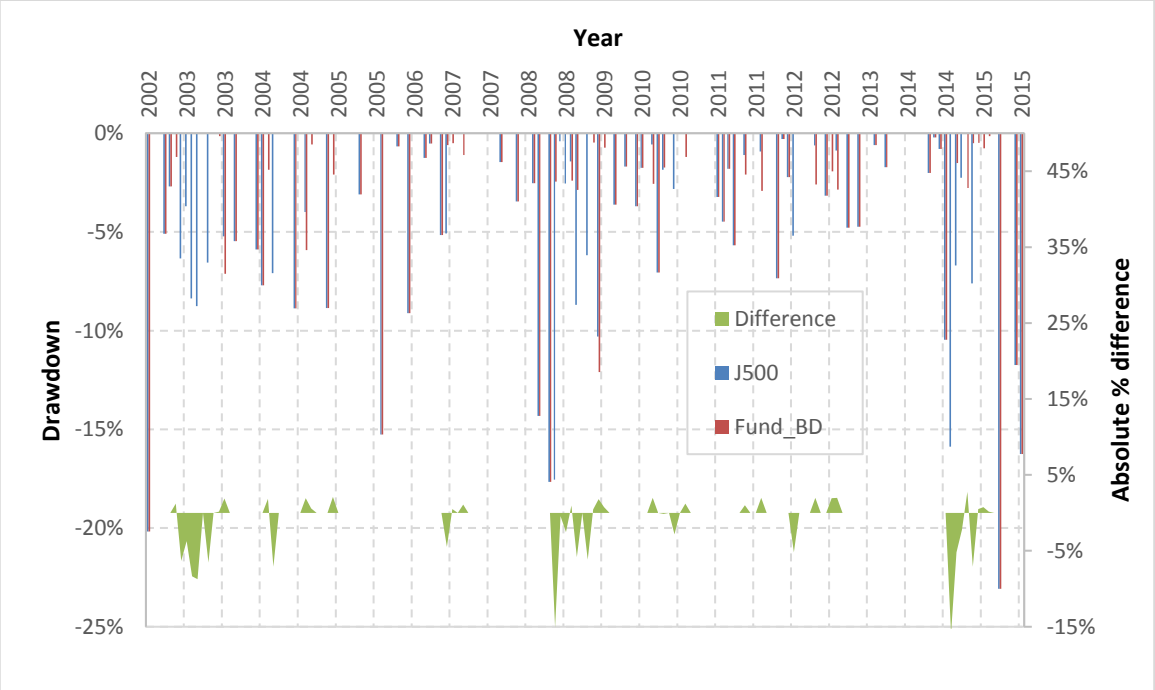


**Figure 63: J510 drawdown**

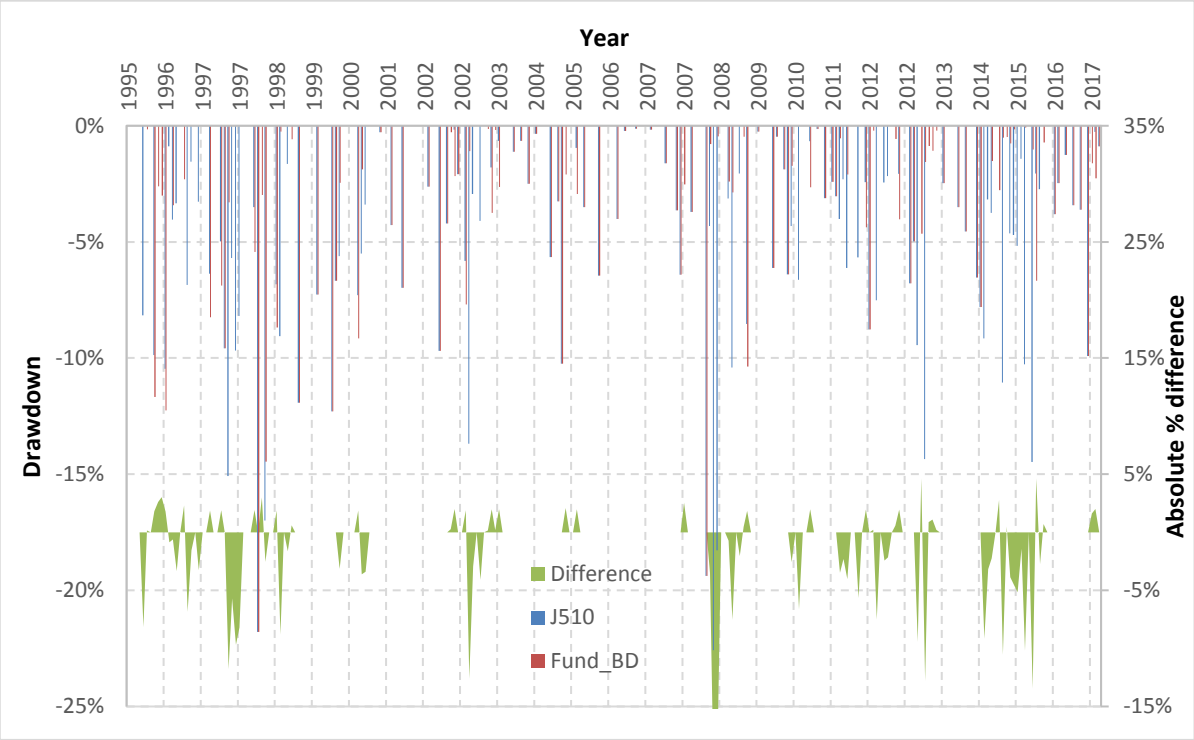



**Figure 64: J520 drawdown**

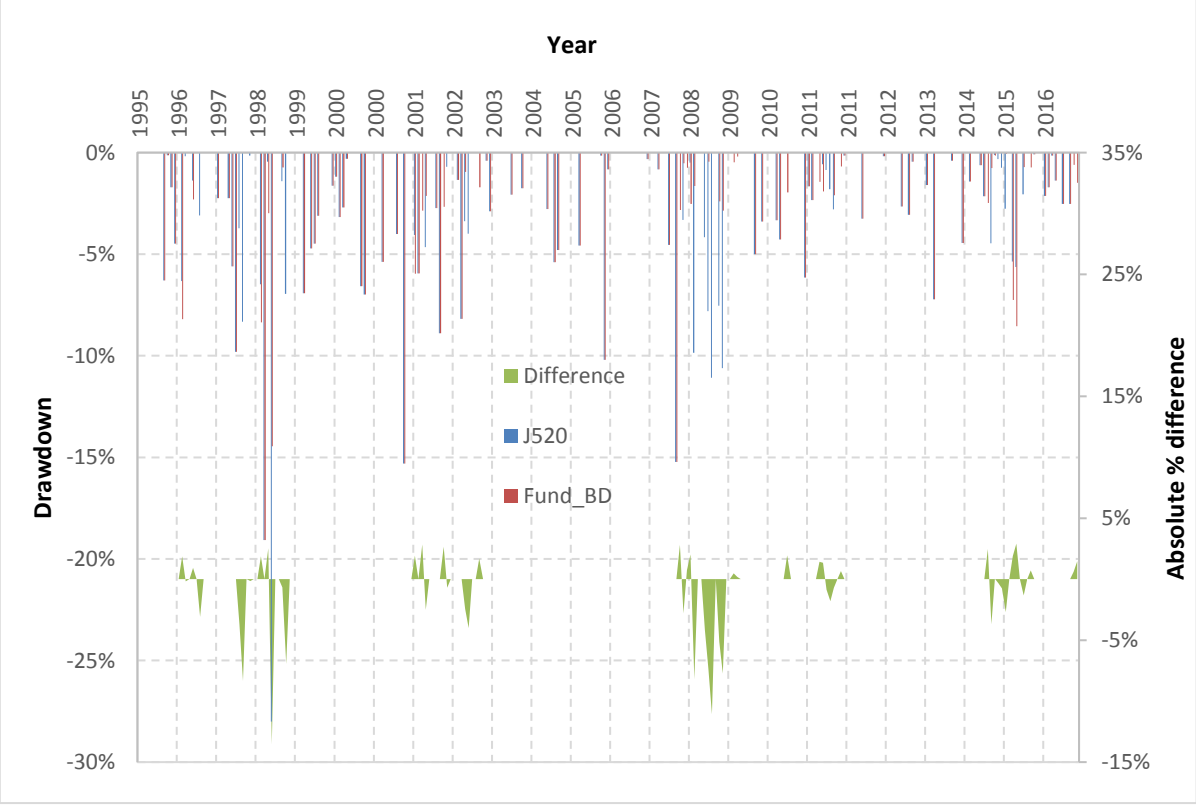


**Figure 65: J530 drawdown**

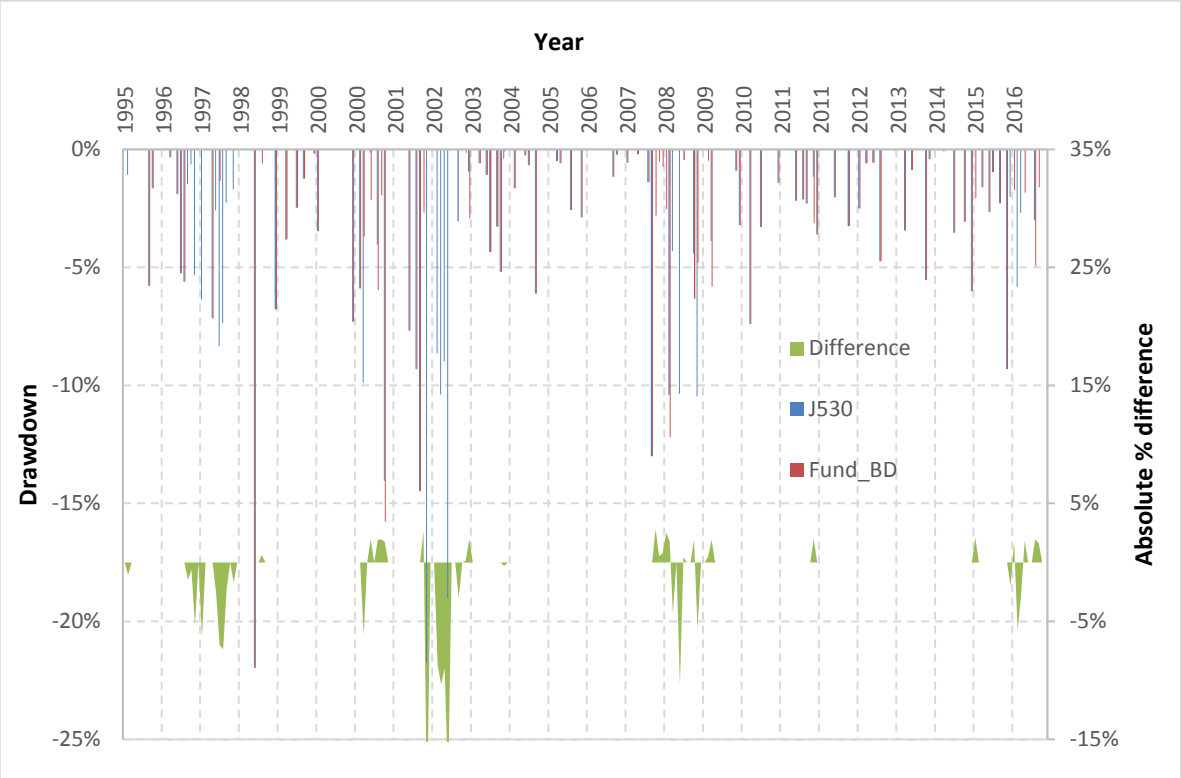



**Figure 66: J540 drawdown**

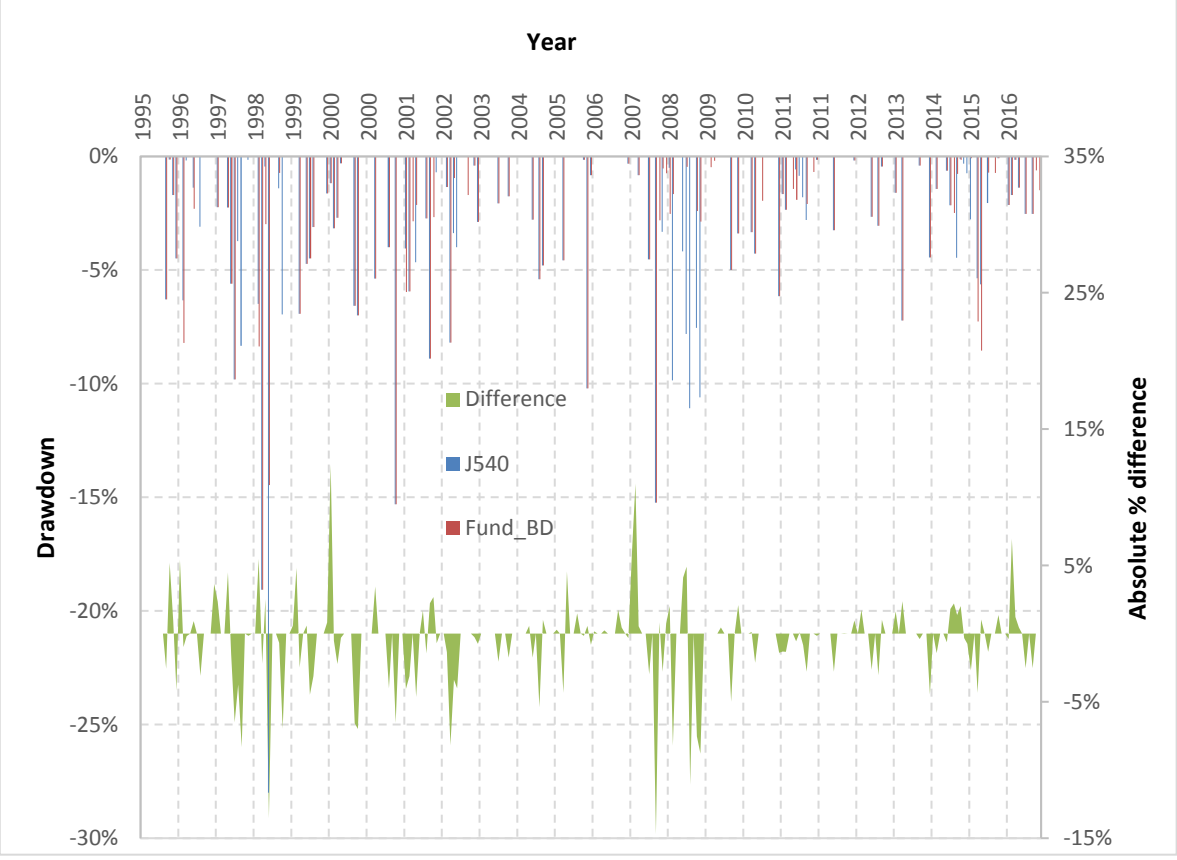


**Figure 67: J550 drawdown**

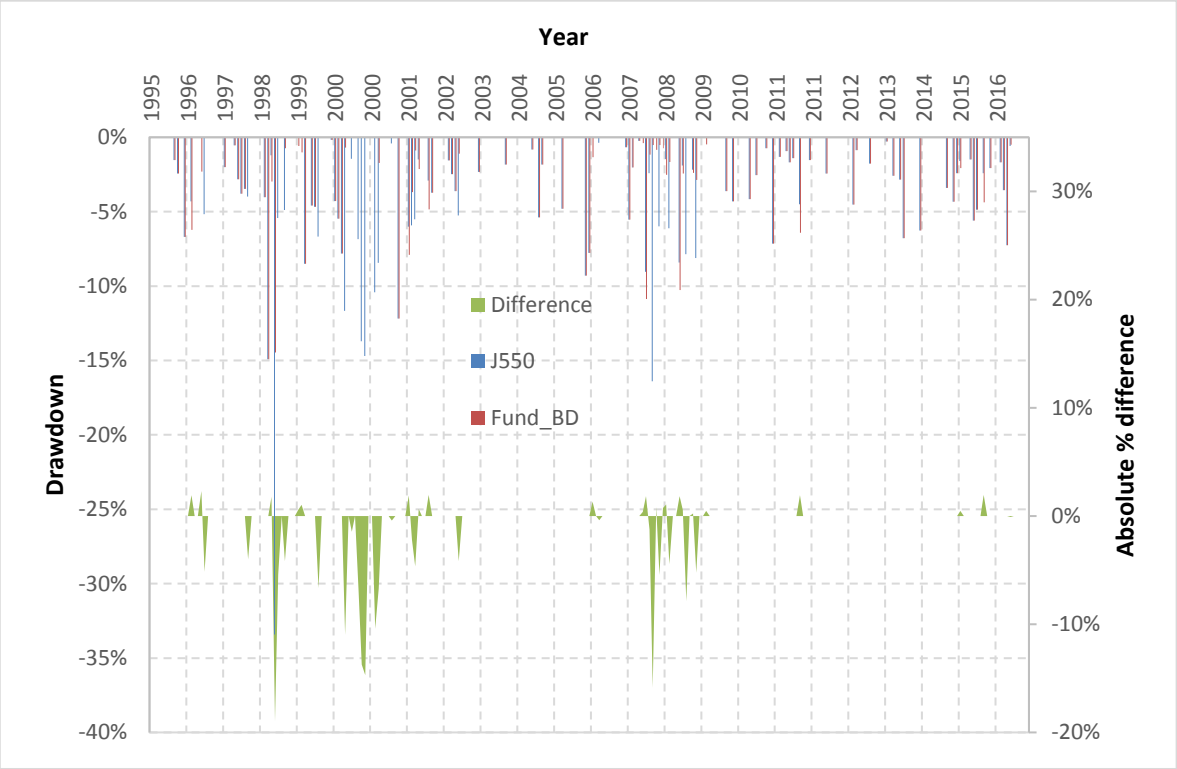



**Figure 68: J560 drawdown**

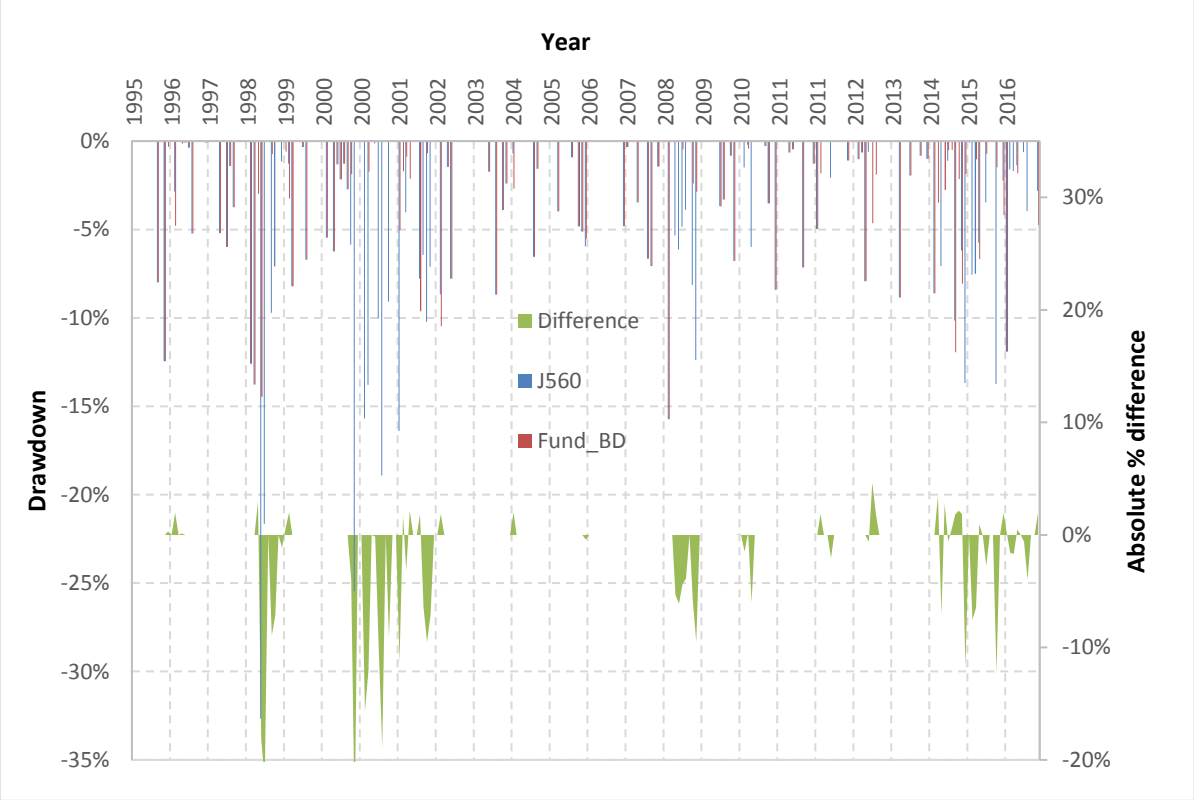


**Figure 69: J580 drawdown**

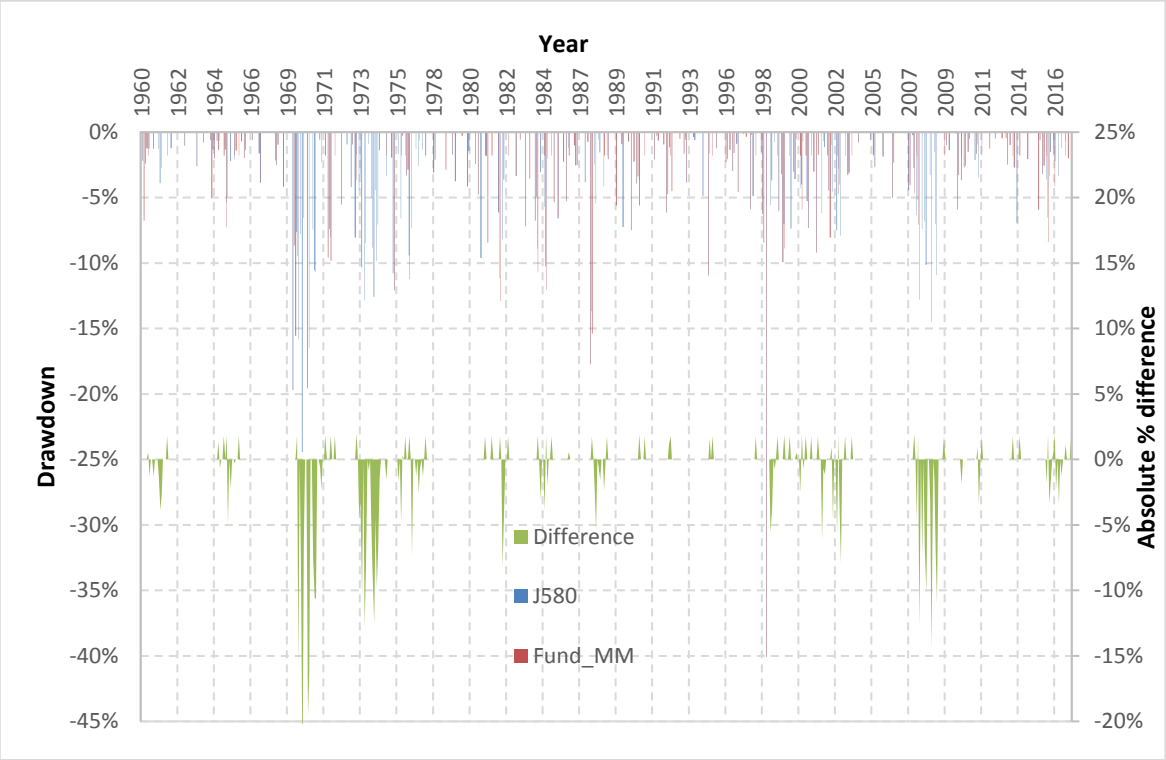
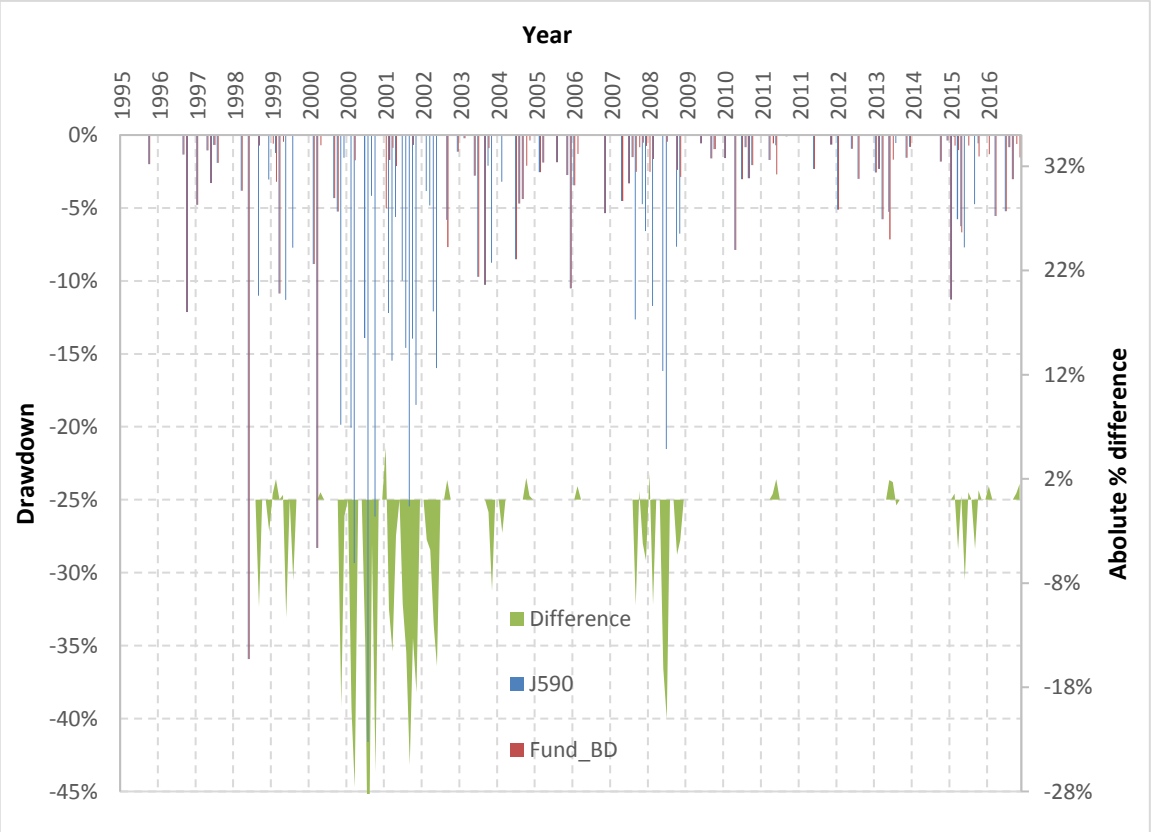



**Figure 70: J590 drawdown**



## Table 38: Portfolio drawdown summary

| Indexname | J500 | | J510 | | J520 | | J530 | | J540 | | J550 | | J560 | | J580 | | J590 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fundname | B&H Min yearly drawdown | Fund_BD min yearly drawdown | B&H Min yearly drawdown | Fund_BD min yearly drawdown | B&H Min yearly drawdown | Fund_BD min yearly drawdown | B&H Min yearly drawdown | Fund_BD min yearly drawdown | B&H Min yearly drawdown | Fund_BD min yearly drawdown | B&H Min yearly drawdown | Fund_BD min yearly drawdown | B&H Min yearly drawdown | Fund_BD min yearly drawdown | B&H Min yearly drawdown | Fund_MM min yearly drawdown | B&H Min yearly drawdown | Fund_BD min yearly drawdown |
| Year | | | | | | | | | | | | | | | | | | |
| 1960 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -7% | -7% | - | - |
| 1961 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -4% | -2% | - | - |
| 1962 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -1% | -1% | - | - |
| 1963 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -3% | -3% | - | - |
| 1964 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -5% | -5% | - | - |
| 1965 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -5% | -7% | - | - |
| 1966 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -2% | -2% | - | - |
| 1967 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -4% | -4% | - | - |
| 1968 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -4% | -4% | - | - |
| 1969 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -20% | -20% | - | - |
| 1970 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -24% | 0% | - | - |
| 1971 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -10% | -10% | - | - |
| 1972 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -6% | -6% | - | - |
| 1973 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -13% | -8% | - | - |
| 1974 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -13% | 0% | - | - |
| 1975 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -12% | -12% | - | - |
| 1976 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -9% | -11% | - | - |
| 1977 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -3% | -2% | - | - |
| 1978 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -3% | -3% | - | - |
| 1979 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -4% | -4% | - | - |
| 1980 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -5% | -5% | - | - |
| 1981 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -10% | -10% | - | - |
| 1982 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -11% | -13% | - | - |
| 1983 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -7% | -7% | - | - |
| 1984 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -9% | -11% | - | - |
| 1985 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -10% | -12% | - | - |
| 1986 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -5% | -5% | - | - |
| 1987 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -18% | -18% | - | - |
| 1988 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -5% | -2% | - | - |
| 1989 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -7% | -7% | - | - |
| 1990 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -7% | -7% | - | - |
| 1991 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -2% | -2% | - | - |
| 1992 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -6% | -6% | - | - |
| 1993 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -4% | -4% | - | - |
| 1994 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -5% | -5% | - | - |
| 1995 | - | - | -8% | 0% | 3% | 3% | -1% | 3% | 3% | 3% | 0% | 3% | 1% | 3% | -11% | -11% | 2% | 3% |
| 1996 | - | - | -10% | -12% | -6% | -8% | -6% | -6% | -6% | -5% | -7% | -7% | -12% | -12% | -5% | -5% | -2% | -2% |
| 1997 | - | - | -15% | -10% | -10% | -10% | -8% | -7% | -10% | -7% | -4% | -4% | -6% | -6% | -6% | -6% | -12% | -12% |
| 1998 | - | - | -22% | -22% | -28% | -19% | -22% | -22% | -28% | -17% | -33% | -15% | -33% | -14% | -40% | -40% | -36% | -36% |
| 1999 | - | - | -12% | -12% | -7% | -7% | -7% | -7% | -7% | -5% | -8% | -8% | -8% | -8% | -10% | -10% | -11% | -11% |
| 2000 | - | - | -12% | -12% | -7% | -7% | -7% | -7% | -7% | -14% | -15% | -8% | -25% | -6% | -7% | -7% | -28% | -28% |
| 2001 | - | - | -7% | -7% | -15% | -15% | -14% | -16% | -15% | -9% | -12% | -12% | -19% | -5% | -9% | -9% | -42% | -5% |
| 2002 | -20% | -20% | -10% | -10% | -9% | -9% | -22% | -14% | -9% | -11% | -6% | -5% | -10% | -10% | -8% | -8% | -25% | -2% |
| 2003 | -9% | -7% | -14% | -8% | -8% | -8% | -19% | -3% | -8% | -2% | -5% | -4% | -8% | -8% | -8% | -5% | -16% | -8% |
| 2004 | -9% | -9% | -2% | -2% | -2% | -2% | -5% | -5% | -2% | -1% | -2% | -2% | -9% | -9% | -1% | -1% | -10% | -10% |
| 2005 | -9% | -9% | -10% | -10% | -5% | -5% | -6% | -6% | -5% | -6% | -5% | -5% | -7% | -7% | -3% | -3% | -9% | -9% |
| 2006 | -15% | -15% | -6% | -6% | -10% | -10% | -3% | -3% | -10% | -11% | -9% | -9% | -6% | -6% | -5% | -5% | -11% | -11% |
| 2007 | -5% | -5% | -6% | -6% | -5% | -5% | -1% | -1% | -5% | -11% | -9% | -11% | -7% | -7% | -6% | -7% | -5% | -5% |
| 2008 | -18% | -18% | -23% | -19% | -15% | -15% | -13% | -13% | -15% | -13% | -16% | -10% | -16% | -16% | -14% | 0% | -22% | -3% |
| 2009 | -10% | -12% | -10% | -10% | -11% | -5% | -10% | -6% | -11% | -2% | -8% | -4% | -12% | -4% | -11% | -2% | -8% | -3% |
| 2010 | -7% | -7% | -7% | -6% | -4% | -4% | -7% | -7% | -4% | -5% | -4% | -4% | -7% | -7% | -6% | -6% | -8% | -8% |
| 2011 | -6% | -6% | -6% | -3% | -6% | -6% | -4% | -4% | -6% | -5% | -7% | -7% | -8% | -8% | -3% | -2% | -2% | -3% |
| 2012 | -7% | -7% | -9% | -9% | -3% | -3% | -3% | -3% | -3% | -1% | -2% | -2% | -5% | -5% | -1% | -1% | -5% | -5% |
| 2013 | -5% | -5% | -14% | -7% | -3% | -3% | -5% | -5% | -3% | -3% | -5% | -5% | -8% | -8% | -3% | -3% | -3% | -3% |
| 2014 | -16% | -10% | -9% | -8% | -7% | -7% | -6% | -6% | -7% | -10% | -7% | -7% | -9% | -9% | -7% | -7% | -6% | -7% |
| 2015 | -23% | -23% | -14% | -7% | -6% | -9% | -6% | -6% | -6% | -7% | -4% | -4% | -14% | -12% | -7% | -8% | -11% | -11% |
| 2016 | - | - | -4% | -4% | -2% | -2% | -9% | -9% | -2% | -9% | -7% | -7% | -14% | -12% | -3% | -4% | -8% | -6% |
| 2017 | - | - | -10% | -10% | -3% | -3% | -3% | -5% | -3% | 0% | 0% | 0% | -4% | -5% | -2% | -2% | -5% | -5% |

### 6.5.4 Frequency in intervals

A market timing strategy that avoids bear markets minimises losses, however, this has to be tempered by avoiding frequent switching. A 2% transaction cost per switch places a premium per swop. Consequently, the less asset switches occur in a long-term investment, reduces the impact of transaction cost. Figure 71 shows the frequency of distribution for holding periods per equity/bond money market fund (equity/money market fund for J580).

**Figure 71: Portfolio holding period frequency**

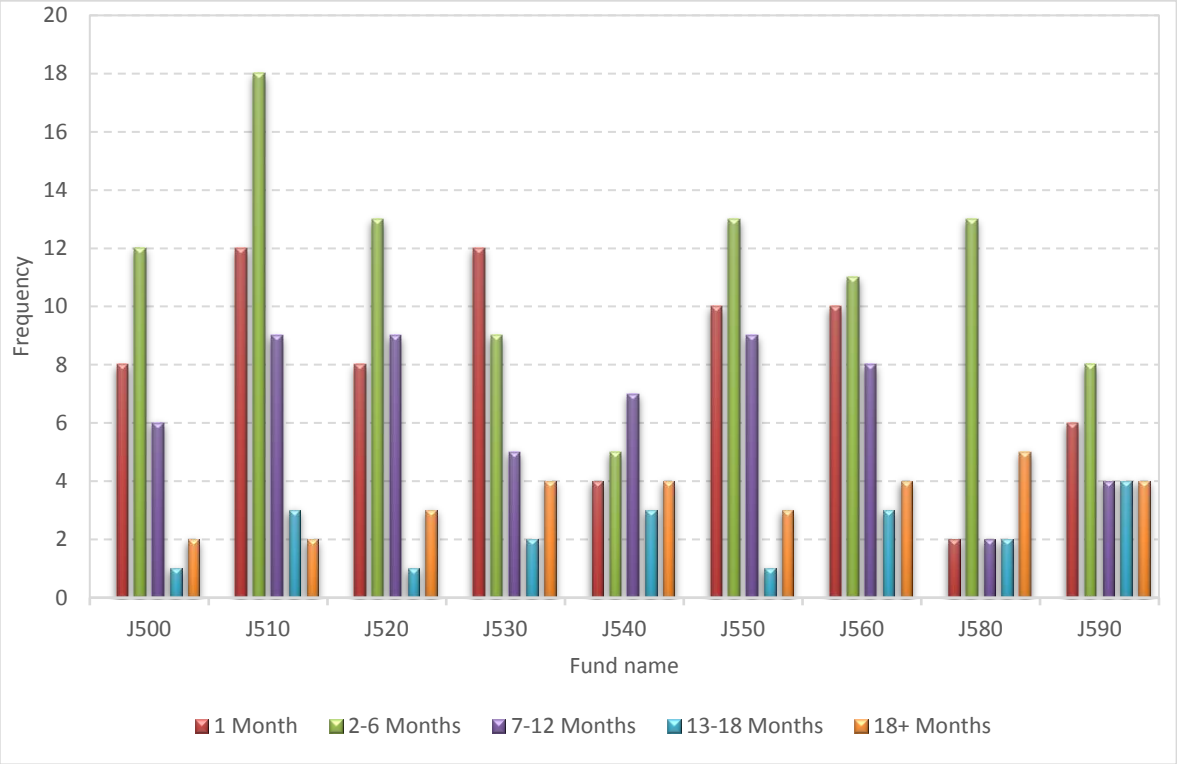



**Table 39: Portfolio holding period summary**

| *Fund* | *J500* | *J510* | *J520* | *J530* | *J540* | *J550* | *J560* | *J580* | *J590* |
|---|---|---|---|---|---|---|---|---|---|
| ***Time*** | | | | | | | | | |
| 1 Month | 8 | 12 | 8 | 12 | 4 | 10 | 10 | 2 | 6 |
| 2-6 Months | 12 | 18 | 13 | 9 | 5 | 13 | 11 | 13 | 8 |
| 7-12 Months | 6 | 9 | 9 | 5 | 7 | 9 | 8 | 2 | 4 |
| 13-18 Months | 1 | 3 | 1 | 2 | 3 | 1 | 3 | 2 | 4 |
| 18+ Months | 2 | 2 | 3 | 4 | 4 | 3 | 4 | 5 | 4 |

Coupling the CAR of the market timing strategies with those portfolios that outperformed the associated buy and hold strategy had a positive skewness. The J590 and J540 market timing strategies achieved holding periods greater than 12 months more than 31% and 30% of study range respectively. Conversely, the J500 had the lowest representation, 10%, in these periods.

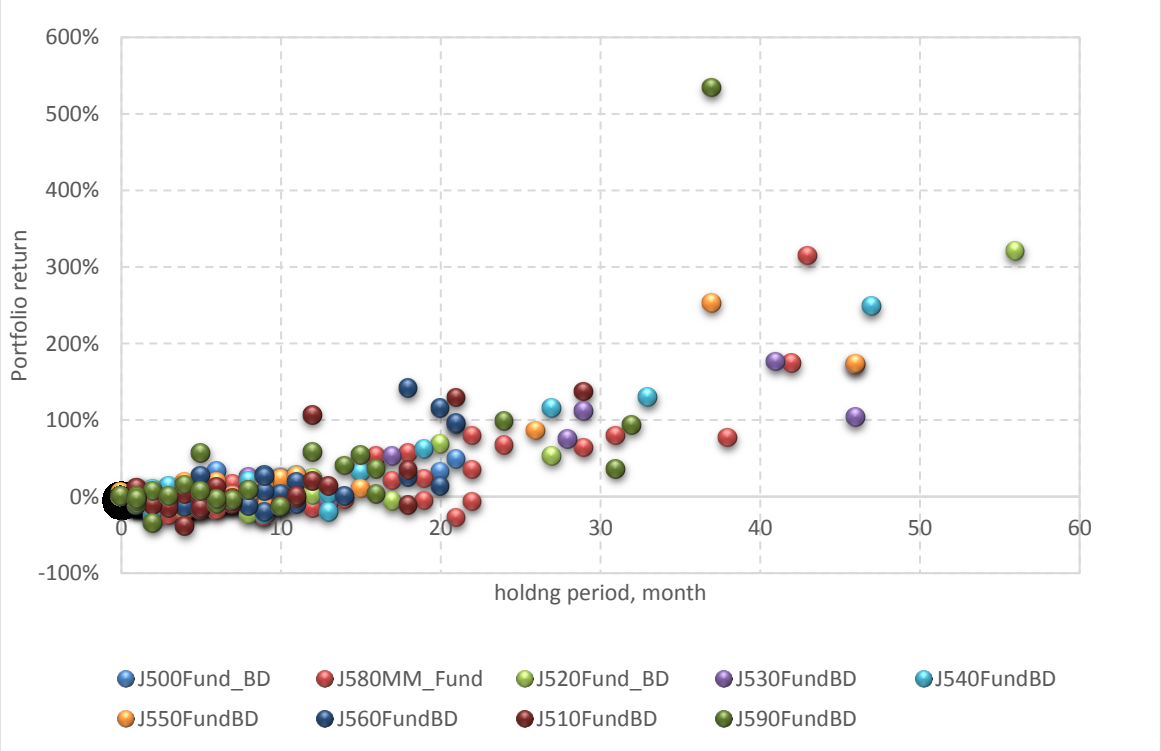
The J500 and the J590 equity/bond market timing strategies had a total of 28 and 26 switches respectively. Number of switches in isolation is not a clear indication of superior fund performance. The key insight is a low number of switches and more frequent holding periods, longer than 12 months. While an investor may be tempted to increase the switching period from one month to one year, this insight remains relative.

Further investigation is required to determine the effect of increasing the switching period. This concept of risk/reward, when considering transaction cost, is in line with the findings of De Kock (2016) and was a central theme for Glabadanisdis (2016).

### 6.5.5 Holding period versus return

An astute investor may argue that longer holding periods catch bull periods, which an efficient market timing strategy should avoid. Intuitively, a market timer must switch into the highest returning asset class. Hence, an investor must expect a positive association between trade length and return. By collectively plotting every holding period and the absolute return achieved for each market timing strategy confirms this. This notion is shown in Figure 72. The trend corresponds to trade length calculations performed by Faber (2007). In general, a positive relation is displayed, as trade length increases so does the portfolio return.

**Figure 72: Holding period versus return**




Grouping the three measures together, drawdowns, holding periods and payback per trade length an investor can adequately gauge which market timings strategy achieved superior performance. Overall, the J590 equity/bond market timing strategy out-performed the other market timing strategies with superior results per category.

Intuitively the J590 performance can be explained as successfully avoiding periods of excessive drawdowns and achieved holding periods larger than 12 months. This in a market which displays a positive association between trade length a portfolio return.

### 6.5.6 Portfolio period

Seven out of nine portfolios were investigated for a 22-year period from 1995-2017, one for a 57-year period and the last portfolio for a 13-year period. No discernible period effects were noticed between the different ranges of study. Based on the movements of the J203 with large dips in 2002 and 2008, portfolio timeframes shorter than eight years may display selection bias.

Atsalakis and Valavanis (2009) noted market timing strategies generally being investigated for periods longer than nine years. Work on the JSE, by Muller and Ward (2010), further advocate for research periods over 20 years.

## 6.6 Sensitivity analysis

Proposition one excluded sensitivity analysis cost as it provided the investment risk/return landscape. It illustrated the gains possible for a successful market timing strategy. Proposition two investigated the effects of market timing strategies. Adjusting two parameters independently (transaction costs and fixed rate), had a significant impact on CAR, and was investigated. Sensitivity analysis such as this tests the conclusions derived from data analysis.

### 6.6.1 Transaction costs

Intermediaries such as stock brokers and other online platforms charge a fee to administer share trades. These activities which, may not be comparable, can be aggregated as transaction costs. Results indicate that an increase in transaction cost reduces CAR and has a pronounced effect on those with more switches. A 3% cost per transaction had the effect of reducing CAR of the J510 equity/bond portfolio by 5.6%.

The net effect of increasing transactions fees results in a buy and hold strategy outperforming certain market timing strategies, which is in accordance with Strugnell et al. (2011) and De Kock (2016). Market timing studies of Terblanche (2010) and Jeffrey (1984) further quantified the detrimental effect of transaction costs with the increased

required forecasting accuracy. The notion is clear, engage with intermediaries that charge the lowest transaction fees and limit the number of switches. Active managers accomplish this by adding buffers and dead zones such as that applied to mechanical equipment.

### 6.6.2 Money market fixed rate

The fixed monthly rate for the money market funds was conservative at 2.5% in the South African financial industry. The aim was to remove selection bias based on higher returns possible for exotic and varying products available on the market such as minimum balances or those employing non-standard fee structures.

As expected, the results indicate the larger the fixed fee the larger the CAR for the equity/money market portfolios. Portfolios with larger absolute rand value benefited over those with more frequent switches.

The superior performance of the equity/bond over the equity/money market timing strategies can be attributed to the ALBI yielding a CAR of 12.4% at a standard deviation of 7.4%. Few banks in South Africa can provide fixed one month rates in excess of this and is a peculiar situation that a major bond index outperforms the market equity benchmark (J203) during the investigated period.

## 6.7 Summary

The data collected and analyses performed were adequate to answer the research propositions and provide an investor with a definitive index to invest into, with an associated market timing strategy. The approach calculated the superior CAR possible with each index along with associated forecasting accuracy. The literature presented and the results show evidence of predictability with the JSE industry indices, effect of transaction costs and CAR achievable, more than the associated buy and hold strategy. These findings are concisely presented in the following chapter.

# CHAPTER 7: CONCLUSION AND RECOMMENDATIONS

This study investigated the performance of market timing strategies on the JSE by quantitatively assessing the performance headline differences in JSE industry indices in a market timing strategy, by switching between a risky and risk-free investment. This was accomplished using historic daily closing share price data, dual data analysis to determine highest portfolio CAR and sensitivity assessments.

This chapter provides an overview of the study's conclusion, limitations and further recommendations for an investor, and proposes future research topics. The principal findings are organised to tie-in all aspects of this study.

## 7.1 Principal findings

The premise of a successful market timing strategy, using historic share price, hinges on inefficiencies in the EMH resulting in a level of predictability. Although widely accepted, this study provides evidence of market predictability. Specifically, short term predictability using the ten-month moving average approach. Further research supporting this was presented by Jefferis and Smith (2004), Terblanche (2010), De Kock (2016) and Glabadanisdis (2016). De Kock (2016) further showed the successful use of a ten-month moving average market timing strategy on the JSE.

This study's sample data was extracted from the JSE, which has been in operation for over 150-years and regarded as mature in Africa. Data gathered was verified against two independent sources and tested for reliability and validity. The study aimed to further literature by investigating the market timing strategies by using JSE industry indices, calculating the maximum potential returns with forecasting accuracy. Data gathered was limited to closing daily share price data to reduce combination errors by collecting the actual indices' share price in-lieu of constructing and rebalancing each index. To increase the reach of the findings, sensitivity analysis was used by altering fixed monthly interest rate and transaction costs. Taxation was excluded from this study.

The data analysis calculated the largest potential CAR for each of the nine indices to be in the range 36.7% to 62.4%. These CAR were associated with a 100% forecasting accuracy which is far from the reach of normal investors. However, the calculated predictability of beating the associated buy and hold strategy ranged from 80.5% to

87.45%. The key finding was the large CAR possible and the forecasting accuracies required with a successful market timing strategy.

Two market timing strategies were investigated using a simple ten-month moving average. Two riskless assets were examined, being bond (ALBI) and a conservative fixed monthly deposit rate. After including transaction costs, four out of nine equity/bond market timing strategy outperformed the associated buy and hold strategy. The largest CAR calculated for the equity/bond J590 portfolio beat the associated buy and hold strategy by 13% CAR. Further sensitivity analysis calculated the detrimental effect of high transaction costs and the enhanced CAR of the equity/money market timing strategy. By decreasing the transaction costs to 1%, seven out of nine equity/bond market timing strategies outperformed the associated buy and hold strategy.

### 7.2 Implications for investors

With the increase take up of ETFs and reduced reliance on fund managers, investors are enticed by superior gains and the next evolution would be undertaking a simple market timing strategy. The study approach was taken from the point of view of an investor requiring a definitive answer of which index and market timing strategy to employ. For an investor aiming to maximise CAR the following is evident:

- The JSE nine industry sector indices can yield abnormally large CAR, up to 62.37%, that makes it an attractive asset class
- Evidence provided indicates in-efficiencies relating to information dissemination within the JSE and supported by Jefferis and Smith (2004). This, coupled with the potential CAR calculated, suggests an amicable investing environment
- Employing a simple ten-month moving average market timing strategy between equity and bonds can beat the associated buy and hold strategy
- An investor should opt for reputable intermediaries offering the lowest transactions costs
- A market timing strategy of switching between equity/bonds between the J590 and ABLI should be employed. Using historic share price data, the calculated CAR over the period was 24% at a standard deviation of 23%.

Based on the previously given market timing strategy, it is recommended that an investor employ an equity/bond market timing strategy using the J590 which achieved the highest CAR over the investigated period.

### 7.3 Limitations of this study

Following on from the anticipated study limitations given in chapter four, the following research limitations were discovered:

- The sample set was limited to the JSE and no parametric or non-parametric tests for weak form efficiency were calculated
- Taxation was ignored in this study. The effect would have been minimal for a equity/bond market timing strategy used in conjunction with a tax free savings account available in South Africa
- Various platforms and administrators had varied fees and these were lumped as a single fixed transaction cost fee per switch. Multiple sensitivity analyses were conducted on various transaction cost percentages
- The use of JSE industry indices in-lieu of re-balancing periodically can increase transaction fees and increase complexity
- It was impossible to completely remove look-ahead bias. To reduce the effect, this study's methodology was tested using previous findings by De Kock (2016) and Terblanche (2010).
- Share slippage was ignored as holding periods of 12 months and greater were calculated hence negating high frequency day trading.

### 7.4 Future research

This study endeavoured to plug all the possible gaps but it can be improved in the following ways:

- Include taxation. South African law charges a corporate gains tax when shared are cashed in and may have an effect of altering an investor's broader tax position
- To further reduce look ahead bias by performing out of sample testing and possible testing this with ongoing live data during the research period
- To conclusively refute weak form efficiency and determine predictability on the JSE, conduct parametric and non-parametric tests
- Include constituent shares in-lieu of JSE industry indices. This can be conducted by continually re-balancing or stitching various index trackers such as the Satrix Indi
- Extend the J500 sample set to include a period of at least 20-years.

Including the following listed, it would provide an investor with recommendations free of look ahead bias; quantify taxation effects, identify evidence refuting weak form

efficiency and any further complexities associated with re-balancing.

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# APPENDICES

## Exhibit one: ICB classification

| Industry | Super Sector | Sector | Sub-Sector |
|---|---|---|---|
| 0001 Oil & Gas | 0500 Oil & Gas | 0530 Oil & Gas Producers | 0533 Exploration & Production |
| | | | 0537 Integrated Oil & Gas |
| | | 0570 Oil Equipment, Services & Distribution | 0573 Oil Equipment & Services |
| | | | 0577 Pipelines |
| | | 0580 Alternative Energy | 0583 Renewable Energy Equipment |
| | | | 0587 Alternative Fuels |
| 1000 Basic Materials | 1300 Chemicals | 1350 Chemicals | 1353 Commodity Chemicals |
| | | | 1357 Specialty Chemicals |
| | 1700 Basic Resources | 1730 Forestry & Paper | 1733 Forestry |
| | | | 1737 Paper |
| | | 1750 Industrial Metals & Mining | 1753 Aluminium |
| | | | 1755 Nonferrous Metals |
| | | | 1757 Iron & Steel |
| | | 1770 Mining | 1771 Coal |
| | | | 1773 Diamonds & Gemstones |
| | | | 1775 General Mining |
| | | | 1777 Gold Mining |
| | | | 1779 Platinum & Precious Metals |
| 2000 Industrials | 2300 Construction & Materials | 2350 Construction & Materials | 2353 Building Materials & Fixtures |
| | | | 2357 Heavy Construction |
| | 2700 Industrial Goods & Services | 2710 Aerospace & Defence | 2713 Aerospace |
| | | | 2717 Defence |
| | | 2720 General Industrials | 2723 Containers & Packaging |
| | | | 2727 Diversified Industrials |
| | | 2730 Electronic & Electrical Equipment | 2733 Electrical Components & Equipment |
| | | | 2737 Electronic Equipment |
| | | 2750 Industrial Engineering | 2753 Commercial Vehicles & Trucks |
| | | | 2757 Industrial Machinery |
| | | 2770 Industrial Transportation | 2771 Delivery Services |
| | | | 2773 Marine Transportation |
| | | | 2775 Railroads |
| | | | 2777 Transportation Services |
| | | | 2779 Trucking |
| | | 2790 Support Services | 2791 Business Support Services |
| | | | 2793 Business Training & Employment Agencies |
| | | | 2795 Financial Administration |
| | | | 2797 Industrial Suppliers |
| | | | 2799 Waste & Disposal Services |
| 3000 Consumer Goods | 3300 Automobiles & Parts | 3350 Automobiles & Parts | 3353 Automobiles |
| | | | 3355 Auto Parts |
| | | | 3357 Tires |
| | 3500 Food & Beverage | 3530 Beverages | 3533 Brewers |
| | | | 3535 Distillers & Vintners |
| | | | 3537 Soft Drinks |
| | | 3570 Food Producers | 3573 Farming, Fishing & Plantations |
| | | | 3577 Food Products |
| | 3700 Personal & Household Goods | 3720 Household Goods & Home Construction | 3722 Durable Household Products |
| | | | 3724 Nondurable Household Products |
| | | | 3726 Furnishings |
| | | | 3728 Home Construction |
| | | 3740 Leisure Goods | 3743 Consumer Electronics |
| | | | 3745 Recreational Products |
| | | | 3747 Toys |
| | | 3760 Personal Goods | 3763 Clothing & Accessories |
| | | | 3765 Footwear |
| | | | 3767 Personal Products |
| | | 3780 Tobacco | 3785 Tobacco |

| Industry | Super Sector | Sector | Sub-Sector |
|---|---|---|---|
| 4000 Health Care | 4500 Health Care | 4530 Health Care Equipment & Services | 4533 Health Care Providers |
| | | | 4535 Medical Equipment |
| | | | 4537 Medical Supplies |
| | | 4570 Pharmaceuticals & Biotechnology | 4573 Biotechnology |
| | | | 4577 Pharmaceuticals |
| 5000 Consumer Services | 5300 Retail | 5330 Food & Drug Retailers | 5333 Drug Retailers |
| | | | 5337 Food Retailers & Wholesalers |
| | | 5370 General Retailers | 5371 Apparel Retailers |
| | | | 5373 Broadline Retailers |
| | | | 5375 Home Improvement Retailers |
| | | | 5377 Specialized Consumer Services |
| | | | 5379 Specialty Retailers |
| | 5500 Media | 5550 Media | 5553 Broadcasting & Entertainment |
| | | | 5555 Media Agencies |
| | | | 5557 Publishing |
| | 5700 Travel & Leisure | 5750 Travel & Leisure | 5751 Airlines |
| | | | 5752 Gambling |
| | | | 5753 Hotels |
| | | | 5755 Recreational Services |
| | | | 5757 Restaurants & Bars |
| | | | 5759 Travel & Tourism |
| 6000 Telecommunications | 6500 Telecommunications | 6530 Fixed Line Telecommunications | 6535 Fixed Line Telecommunications |
| | | 6570 Mobile Telecommunications | 6575 Mobile Telecommunications |
| 7000 Utilities | 7500 Utilities | 7530 Electricity | 7535 **Conventional Electricity** |
| | | | **7537 Alternative Electricity** |
| | | 7570 Gas, Water & Multi-utilities | 7573 Gas Distribution |
| | | | 7575 Multi-utilities |
| | | | 7577 Water |
| 8000 Financials | 8300 Banks | 8350 Banks | 8355 Banks |
| | 8500 Insurance | 8530 Nonlife Insurance | 8532 Full Line Insurance |
| | | | 8534 Insurance Brokers |
| | | | 8536 Property & Casualty Insurance |
| | | | 8538 Reinsurance |
| | | 8570 Life Insurance | 8575 Life Insurance |
| | **8600 Real Estate** | **8630 Real Estate Investment & Services** | **8633 Real Estate Holdings & Development** |
| | | | **8637 Real Estate Services** |
| | | **8670 Real Estate Investment Trusts** | **8671 Industrial & Office REITs** |
| | | | **8672 Retail REITs** |
| | | | **8673 Residential REITs** |
| | | | **8674 Diversified REITs** |
| | | | **8675 Specialty REITs** |
| | | | **8676 Mortgage REITs** |
| | | | **8677 Hotel & Lodging REITs** |
| | 8700 Financial Services | 8770 **Financial Services** | 8771 Asset Managers |
| | | | 8773 Consumer Finance |
| | | | 8775 Specialty Finance |
| | | | 8777 Investment Services |
| | | | 8779 Mortgage Finance |
| | | 8980 Equity Investment Instruments | 8985 Equity Investment Instruments |
| | | 8990 Non-equity Investment Instruments | 8995 Non-equity Investment Instruments |
| 9000 Technology | 9500 Technology | 9530 Software & Computer Services | 9533 Computer Services |
| | | | 9535 Internet |
| | | | 9537 Software |
| | | 9570 Technology Hardware & Equipment | 9572 Computer Hardware |
| | | | 9574 Electronic Office Equipment |
| | | | 9576 Semiconductors |
| | | | 9578 Telecommunications Equipment |

** ICB changes effective in 2009 are in Bold*

**Exhibit two: Ethical clearance**

Gordon Institute of Business Science
University of Pretoria

31 May 2017

Rinay Bhownath

Dear Rinay Bhownath,

*Please be advised that your application for Ethical Clearance has been approved.*

*You are therefore allowed to continue collecting your data.*

*We wish you everything of the best for the rest of the project.*

*Kind Regards*

GIBS MBA Research Ethical Clearance Committee

Gordon Institute of Business Science
Reg. No. 99/19816/08
26 Melville Road, Illovo, Johannesburg
PO Box 787602, Sandton, 2146, South Africa
telephone (+27) 11 771 4000
fax (+27) 11 771 4177
website gibs.co.za
University of Pretoria