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SCHOOL OF BUSINESS AND FINANCE

POTENTIAL GAINS FROM SECTOR TIMING ON THE JSE

BY

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My thesis has been prepared under the supervision of Professor Heng-Hsing Hsieh and submitted in partial fulfilment of the requirements for the Degree of Masters of Commerce at the School of Business and Finance studies of the faculty of Economic and Management Services at the University of the Western Cape

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Declaration

Apart from the assistance which is acknowledged and the quotations which are specifically referenced in the text and bibliography section of the thesis, this thesis is entirely my own work and not being submitted for degree purposes at any other university.

Mugammad Mujaheed Carlie

November 2017

Dedication

Dedicated unconditionally to my parents, Mr M.F. Carlie and Mrs K. Carlie as well as my dear friend that I have lost, M. Kalumba

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Abstract

This study investigates the effectiveness of sector timing on the JSE by evaluating the likely outcomes from switching between the resource and financial-industrial indices using Monte Carlo simulations over the period from 31 January 2002 to 31 December 2016. A market timer is assumed to have varying forecasting accuracies when switching between the sector indices on the JSE. This study is motivated by the market segmentation phenomenon on the JSE (i.e. resources can be viewed as a separate market driven by different economic forces compared to other sectors); and argues that there exists "potential gains" for sector rotation strategies rather than a buy and hold strategy in the All Share Index (ALSI).

The primary objective of the paper is to evaluate "potential gains" from “simulated” scenarios (rather than actual or hypothetical) sector timing strategies; and determine what level of forecasting accuracy a market timer must possess to outperform a buy and hold strategy in the ALSI. The sector timing strategies are implemented using the Financial (FINI), Industrial (INDI) and Resource (RESI) sector indices. The secondary objectives evaluate the impact of transaction costs and rebalancing frequencies on potential gains. The transaction costs evaluated are 1 percent and 2 percent every time there is a switch from one index to another, and vice-versa. It is assumed that 1 percent transaction costs represent large institutional investors and 2 percent transaction costs represent individual investors and small funds. In addition, the rebalancing frequencies evaluated are annual, quarterly and monthly.

The main results of the study illustrate that when the maximum transaction costs of 2 percent and monthly portfolio revisions are taken into consideration, significant forecasting accuracy (i.e. 70 percent joint forecasting accuracy or more) is required to outperform a buy and hold strategy in the ALSI. However, when 2 percent transaction costs are taken into account for both annual and quarterly market timers, a market timer requires a moderate level of forecasting accuracy (i.e. 60 percent joint forecasting accuracy) to outperform a buy and hold strategy. Results also revealed that it is more important to improve the ability in timing the industrial-dominant market on the JSE than both the resource-dominant market and the financial-dominant market. This outcome is attributed due to the fact that the industrial index is the better performing index out of the three sector indices

The results from sensitivity analysis show that the more frequently a market timer revises his/her portfolio, the greater the potential gains. However, when taking into account transaction costs, the results from sensitivity analysis also illustrate that the more frequently a market timer revises his/her portfolio, transaction costs are incurred on a greater number of transactions, thus reducing the overall potential gains. Consequently, transaction costs also caused the required forecasting accuracy to outperform a buy and hold strategy in the ALSI to increase.

Keywords: potential gains, sector timing, market segmentation, transaction costs, portfolio revision frequencies, market timer, Monte Carlo simulations, JSE, sensitivity analysis

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INTRODUCTION

1.1 Background

The Random Walk Hypothesis (RWH) begins with a premise that all major security exchanges are excellent examples of efficient markets (Fama, 1965). Fama (1970) defines an efficient market as having numerous rational investors competing in predicting future asset' prices, and where current essential information is freely available to all market stakeholders. The competition that is present between investors in an efficient market leads to a situation where at any point in time, asset prices reflect information based on both prior events and events that are expected to occur in the future. Thus, the Efficient Market Hypothesis (EMH) by Fama (1970) maintains that all assets are perfectly priced such that their market prices are good estimates of their intrinsic values at any point in time.

The EMH is centred on the following assumptions; all market participants perceive available information in the same manner and attempts made to obtain returns that are superior to the market would fail. The EMH divides capital markets into three forms of efficiency. Firstly, the weak-form EMH states that investors cannot use historical asset prices and volume data to determine future probable prices. Secondly, the semi-strong form EMH asserts that investors cannot use publically available information to outperform the market in a consistent manner. Lastly, the strong form EMH asserts that investors cannot use private information to outperform the market in a consistent manner.

The weak-form EMH concurs with RWH in stating that investors cannot outperform the market by utilising past prices and volume data as all information is already included in current asset prices. Samuelson (1965) is of the same opinion, stating that an investor cannot use past prices to predict future probable prices, and the changes in the series of asset prices are both independent and fluctuate randomly. On the contrary, proponents of technical analysis are of the belief that patterns of past price behaviours tend to recur in the future, and therefore could potentially be predicted.

According to Sharpe (1975), an investor who intends on outperforming the market, would either implement the selection of securities within a given class or allocation of assets to specific classes of securities. The latter strategy's most productive form is to purchase cash equivalents when bear markets are anticipated and to switch into risky assets when bull markets are anticipated, also known as market timing. According to Sharpe (1975), the rationale for market timing is to predict movements in capital markets as the basis of short-term shifts in and out of securities or asset classes in order to beat the buy and hold strategy in a particular asset class.

Local studies conducted by Firer, Ward and Teeuwisse (1987), Firer, Sandler and Ward (1992), Waksman, Sandler, Ward and Firer (1997) and De Chassart and Firer (2004) indicate that the potential gains of a market timing strategy on the JSE are indeed attractive. However, high levels of predictive accuracy are required to outperform the buy and hold strategy, which are unattainable to most investors.

According to Van Rensburg and Slaney's (1997) and Van Rensburg's (2002) empirical studies on market segmentation on the JSE, there exist different sets of macro-economic forces that drive the performance of different sectors on the JSE. Based on Van Rensburg's (2002) factor analytic procedure, the resource sector (RESI) and financial and industrial (FINDI) sectors are used as observable proxies in his sector based two-factor Arbitrage Pricing Theory (APT) model used to explain asset returns on the JSE. Van Rensburg (2002) suggested that the FTSE/JSE All Share Index (ALSI) previously used as the market proxy in the Capital Asset Pricing Model (CAPM) does not adequately explain the returns of the various sectors on the JSE. The unique market segmentation phenomenon on the JSE implies that the performance of different sectors on the JSE could potentially be cyclical, which provides ample room for sector timing strategies on the JSE. This motivates this study to determine whether potential gains are available to market timers who employ sector-timing strategies on the JSE.

The sector timing strategies evaluated in this study have the potential to enhance investment performance by capturing the time-varying dimensions of risk inherent in the various sectors. South Africa is regarded as one of the global leaders in the mining sector, making up a substantial proportion of world production in natural resources. In 2012, South Africa had the fifth largest mining sector globally in terms of Gross Domestic Product (GDP) value, with mineral reserves estimated at R20.3 trillion (Kearney, 2012). The South African economy was driven by the expansion of gold and diamond mining.

The raising of capital to fund mining was also the catalyst for the development of the Johannesburg Stock Exchange (JSE) in November 1887 (Falkena, Fourie and Kok, 1986). As the security exchange evolved, capital was raised for manufacturing, and so the JSE expanded from the mining sector to the industrial sector. According to Peters (2015), companies such as SABMiller were one of the first industrial companies to list their shares on the JSE. Today, South Africa has an established industrial sector with a variety of industries such as chemicals, agro-processing, automotive, information and communication technology, metals, electronic, textiles, clothing and footwear. The industrial sector increased from R180 053 million in 1993 to R282 215 million in 2010 and contributed 15.20 percent to South Africa's GDP in 2013, which made the industrial sector the third biggest contributor to the South African economy (Oosthuyse, 2016). In addition, according to Statistics South Africa (www.statssa.gov.za), the industrial sector remained the third largest contributor to the country's economy in 2016, contributing 15 percent to South Africa's GDP.

Similar to the industrial sector, the financial sector was born out of the gold rush in the late 1800's. Over the period from 1970 to 2000, South Africa's economic and political climate experienced dynamic changes; the financial sector had to move from market protection policies toward free-market principles (Gondo, 2009). In 2008, the South African economy faced another challenge after being hit by the global financial crisis, which caused a slowdown in economic growth. According to a report by the National Treasury (2011), the financial sector survived the 2008 financial crisis relatively less harmed compared to other major financial markets, (www.treasury.gov.za).

In 2008 and 2009, the financial sector still contributed 1.50 percent and 0.20 percent to the country's growth, respectively, even when South Africa's overall growth was at negative 1.50 percent (Young, 2013). In addition, the financial sector accounted for 21.60 percent of South Africa's GDP in 2016, which made the financial sector the second biggest contributor to the country's economy, (www.treasury.gov.za).

Overall, the trading of shares in the financial, resource and industrial sectors on the JSE have grown exponentially, reaching a high of 1 025 million shares changing hands in 2015; the highest trading volume in 16 years (Peters, 2015). Resource firms were the main contributor to the increase in equities, with 746 million shares traded on the day, of which, approximately 97 percent was for the purchase of Merafe Resources stock. Following the resource sector, life insurance companies had 31 million shares traded, with 21 million Old Mutual shares being traded (Peters, 2015).

1.2 Overview

The purpose of this study is to investigate whether there are potential gains available to investors who apply sector-timing strategies on the JSE, over the period from 1 January 2002 to 31 December 2016. Moreover, the study aims to determine the minimum level of forecasting accuracy required for a market timer to benefit from sector timing strategies on the JSE. The study also seeks to determine the sensitivity of potential gains to varying levels of transaction costs and portfolio revision frequencies. The research data is constituted of the monthly closing values of the following tradable indices on the JSE; FTSE/JSE Industrial 25 index (INDI), FTSE/JSE Financial 15 index (FINI), FTSE/JSE Resources 20 index (RESI), FTSE/JSE Top 40 index and the Secured Transfer of Electronic Information Call Deposit Index (STEFI).

Chapter 2 provides an overview of the theories underlying this research such as the EMH and its various forms, as well as the RWH and its relation to the weak-form EMH. The chapter goes on to explore the various approaches used by investors to outperform the market as well as the criticism of prospect theory over the expected utility theory as decision making frameworks used by investors. Finally, the chapter provides a review of behavioural finance that serves as an alternative theory to traditional finance theories such as the EMH; and discusses the behavioural biases affecting investors that often lead to market inefficiencies and even market crashes.

Chapter 3 reviews empirical literature on the potential gains from market timing strategies, over the period from 1975 to 2016. The results from these studies evaluate the level of accuracy required to obtain potential gains from successfully timing the market on the JSE and other international security exchanges. The performance of market timing strategies were often benchmarked against a buy and hold strategy in empirical literature. The research shows the effect forecasting accuracies have on potential gains while accounting for transaction costs and portfolio revisions associated with the ability to time the market successfully.

Chapter 4 presents an overview of the research objectives of the study as well as the data employed and the methodology used in order to achieve these objectives. The methodology comprises of three major tests. The first test evaluates the potential gains available to a market timer switching between equity and cash depending on whether bull and bear markets are forecasted on the JSE. The second test evaluates potential gains available to a market timer applying a sector timing strategy on the JSE. The third test evaluates the sensitivity of potential gains available to a market timer to two key variables, namely, transaction costs and portfolio revision frequencies. The chapter concludes by outlining the potential biases that may influence the results of this study and possible remedies.

Chapter 5 presents the results of the first test, which illustrates the potential gains available to a market timer who possesses perfect forecasting ability compared to a market timer who has imperfect forecasting ability. Moreover, the chapter evaluates the minimum forecasting accuracy required to obtain potential gains when switching between bull and bear markets. The impact of various transaction costs and portfolio of revision frequencies on potential gains to a market timer will also be evaluated.

Chapter 6 depicts the results of the second test, which is to determine the potential gains from sector timing for both perfect and imperfect sector timing, using three sector-timing strategies. The three sector timing strategies involve switching between RESI and INDI, RESI and FINI and lastly switching between FINI and INDI. In addition, the chapter also illustrates the impact of transaction costs and portfolio of revision frequencies on potential gains to a market timer applying a sector timing strategy. Chapter 7 highlights all the findings from the tests conducted by this research and provide recommendations based on the insights found by this research.

1.3 Contributions

The tests carried out in this research and the acquired results thereof, contribute to current literature in the applications of sector timing strategies in multiple ways. Although Hsieh (2013a) recognises the significance of sector timing due to the unique market segmentation phenomenon in the Taiwanese market, to the author's knowledge no study has considered the dominance of the resource sector when evaluating potential gains from sector timing strategies on the JSE. Noteworthy empirical literature in South Africa are limited to Firer, Ward and Teeuwisse (1987), Firer, Sandler and Ward (1992), Waksman et al. (1997) and De Chassart and Firer (2004) who evaluated the potential gains from market timing on the JSE while switching between equity and cash in bull and bear markets, respectively.

Firer, Ward and Teeuwisse (1987) employed three different indices on the JSE and two cash equivalents over the period from 1967 to 1986. Firer, Sandler and Ward (1992) evaluated the potential gains available to a market timer switching between the ALSI and the All Gold index on the JSE for the period from 1967 to 1989. Waksman et al. (1997) evaluated the potential gains on the JSE when applying a market timing strategy that uses derivative instruments for the period from 1963 to 1992.

Lastly, De Chassart and Firer (2004) evaluated the potential returns and risks associated with three market-timing strategies on the JSE for the period from 1925 to 1998. However, the abovementioned studies failed to explore sector timing on the JSE. Therefore, this research expands on the tests to explore the potential gains of sector timing on the JSE, using five different indices, and provides updated research over the period 1 January 2002 to 31 December 2016.

Contributions also come from the integration of methodologies employed by Chua, Woodward and To (1987), Kester (1990) and Hsieh (2013a) in this research. Sharpe (1975) pioneered the study of potential gains from market timing, based on the probability analysis of possible outcomes for imperfect market timing strategies between bull and bear markets. Chua et al. (1987) improved Sharpe's (1975) methodology by using various permutations of bull and bear market timing forecasting accuracies, and evaluated the potential gains available to a hypothetical market timer, employing Monte Carlo simulations. Hsieh (2013a) also used Monte Carlo simulations to evaluate potential gains from sector timing in Taiwan. In addition, Droms (1989) and Kester (1990) investigated the potential gains from switching between different categories of stocks subject to various levels of transaction costs and portfolio revision frequencies.

Similar to the studies conducted by Droms (1989) and Kester (1990), this study addresses the limitations of the research conducted by Sharpe (1975) by applying assumptions that are more realistic to the frequency of portfolio revisions and levels of transaction costs. This study assumes transaction costs of 1 percent and 2 percent, as 1 percent is representative of large institutional investors and 2 percent is representative of individual investors and small funds. In addition, empirical evidence suggests that investors who apply a market timing strategy tend to revise their portfolios more frequently. Therefore, this study assumes that a market timer revises his/her portfolio on an annual, quarterly and monthly basis. Overall, this study provides insight into the potential gains available to a market timer applying a sector timing strategy on the JSE based on assumptions that are more realistic.

2

THEORETICAL OVERVIEW

2.1 Introduction

An approach where investors study the past behaviour of asset prices to predict probable future prices is referred to as technical analysis. In an attempt to evaluate whether there is independence in the series of price changes, Kendall and Hill (1953) examined the time-series behaviour of 22 economic series employing data from the Actuaries' Index of Industrial Share Prices on the U.S. Stock Market over the period from 1883 to 1934. The results from the study revealed that series of price changes were entirely random and independent from previous asset prices. Samuelson (1965) is of the same opinion that an investor cannot use historical asset prices to predict future probable prices, and defines random walk hypothesis as the changes in prices of assets being independent and fluctuate randomly. In essence, changes in asset prices cannot be used to predict future probable prices as price changes do not have any memory.

According to Fama (1970), an efficient market is one where assets are fairly priced and fully reflect all available information; therefore, an investor cannot outperform the market in a consistent manner. Fama (1970) proposed the Efficient Market Hypothesis (EMH) which divides an efficient market into three forms. These forms of efficiency include the weak-form EMH, semi-strong form EMH and strong-form EMH.

The weak-form EMH concurs with random walk hypothesis, which asserts that investors cannot outperform the market by utilising past prices and volume data as it is already incorporated in current asset prices. Semi-strong form EMH is interpreted as a market where investors cannot use publicly available information to outperform the market in a consistent manner. The strong-form EMH, states that investors cannot use private information to outperform the market in a consistent manner. Private information is referred to as inside information that has not been made publically available and by using it would be illegal and known as insider trading. Von Neumann and Morgenstern (1944) are of the belief that investors are risk averse and rational in their decision making. On the other hand, behavioural finance as an alternative school of thought asserts that investors are irrational and prone to make systematic errors.

Prospect theory pioneered by Kahneman and Tversky (1979) criticises the expected utility theory to be a normative model of rational choice and a descriptive model of economic behaviour. Prospect theory describes several classes of choice problems in which preferences systematically violate the axioms of expected utility theory. Prospect theory views decision making under risk, which can be portrayed as a choice of prospects or gambles. Behavioural finance further seeks to understand the behaviour of investors when faced with certain risks, and how they react to uncertain events when new information arises.

2.2 The concept of an efficient market

Random walk hypothesis states that a series of price changes have no memory, therefore, trends of past prices cannot be used to predict future probable prices. The random walk hypothesis inaugurates with a premise that asset markets are good examples of an efficient market (Fama, 1965). An efficient market is defined as a capital market with a large number of rational investors who actively compete but fail to outperform their rivals by consistently generating risk-adjusted returns (Fama, 1965). These rational investors use current information which is available to all participants in an attempt to predict future probable prices of assets.

The logic behind random walk hypothesis is that if information is available to all participants in a capital market, and the information is immediately reflected in asset prices, then the following day's price change will only reflect the news of that day and is independent of the price changes today (Malkiel, 2003). Random walk hypothesis opposes technical analysis whereby stating that future prices of an asset are no more predictable than a path series of random cumulated numbers. In statistical terms, random walk hypothesis states that successive changes in asset prices are independent and are identical distributed random variables (Malkiel, 2003).

In the instance where new information becomes available, market participants react rapidly to the spread of news, thus it is incorporated in asset prices immediately. In a market where there are many sophisticated and active investors capable of identifying discrepancies between the market prices and intrinsic values of assets, the market becomes efficient as investors assist in narrowing the gap between market prices and intrinsic values through their trading activities. This implies that the market conforms closely to the random walk hypothesis. Therefore, if random walk hypothesis is a true representation of capital markets, then the various technical price indicators and charting tools which are used by technical analysts to forecast future prices of assets are invalid and of no value to investors.

Contrary to the random walk hypothesis, technical analysts are of the opinion that there is dependence in a series of successive price changes, and maintain that the patterns of historical price behaviours tend to recur in the future. Otherwise stated, asset prices do not follow a 'random walk' and price changes cannot be independent over time. Therefore, by analysing historic price trends and volume data, investors could develop an understanding of the the past behaviour of price series to predict probable future prices assets and outperform the market.

According to Fama (1965), there are two approaches that are used to test the random walk hypothesis. The first approach tests whether the patterns in past asset prices are repetitive and can thus be predicted by technical analysts. An example of such tests includes Kendall and Hill's (1953) study on the time series behaviour of 22 economic series over the period from 1883 to 1934 using data from the Actuaries' Index of Industrial Share Prices on the U.S. Stock Market. The results from Kendall and Hill's (1953) study illustrated that there were no significant serial correlations within the economic time-series and minuscule lag correlation between the economic time-series, implying that asset prices are unpredictable. Consequently, if the statistical tests support the fact that asset prices are independent then the use of technical tools, which are primarily based on the history of past prices, cannot be used to outperform the market in a consistent manner.

The second approach used to test the random walk hypothesis, is the evaluation of various technical trading rules as to determine whether it yields risk-adjusted returns greater than the returns generated by a buy and hold strategy. An example of such tests include Brock, Lakonishok and LeBaron (1992), who evaluated two technical rules on the Dow Jones Industrial Average (DJIA) over the period from 1897 to 1986. The two technical trading rules included the trading-range break and the average-oscillator. With the average-oscillator technique, buy and sell signals were generated by moving average crossovers. On the other hand, the trading-range break technique generates indicators as security prices hit new highs and lows. These trading rules were evaluated by their abilities to forecast future asset price changes.

Evaluation of the two techniques over a period of 10 days indicated that the risk-adjusted returns are significantly greater than that of a buy and hold strategy. The results favour predicting future changes using technical trading rules. However, Brock, Lakonishok and LeBaron (1992) stated that transaction costs were not included in the study, which could have significantly decreased the risk-adjusted returns.

In addition to technical analysis, investors could attempt to outperform the market by employing fundamental analysis, also known as intrinsic value analysis. The assumption of the fundamental analysis approach is that at any point in time an asset has a given intrinsic value, which is dependent on the earning potential of the asset. In the case of an equity, the intrinsic value of a company's security is dependent on fundamental factors such as, inter alia; annual earnings, economic events, the quality of management, the outlook for the industry, managerial commentary as well as stock splits. These fundamental factors are publicly available information which could be found in company announcements or financial statements. In order for a fundamental analyst to outperform the market in a consistent manner, he/she should possess the ability to determine whether the market price of an asset is undervalued or overvalued, in comparison to its intrinsic value.

Fama (1965) suggests that, if market prices tend to move towards intrinsic values, attempting to determine the intrinsic value of an asset is equivalent to predicting the future price of that asset. In order for a fundamental analyst to outperform the market in a consistent manner, he/she should be able to identify inconsistencies between market prices and intrinsic values of assets quicker than other analysts. As previously mentioned, the presence of many analysts in a market assists in narrowing inconsistencies between market prices and intrinsic values through their competitive trading activities. Therefore in an efficient market, market prices of assets would adjust immediately to the changes in intrinsic values (Fama, 1965).

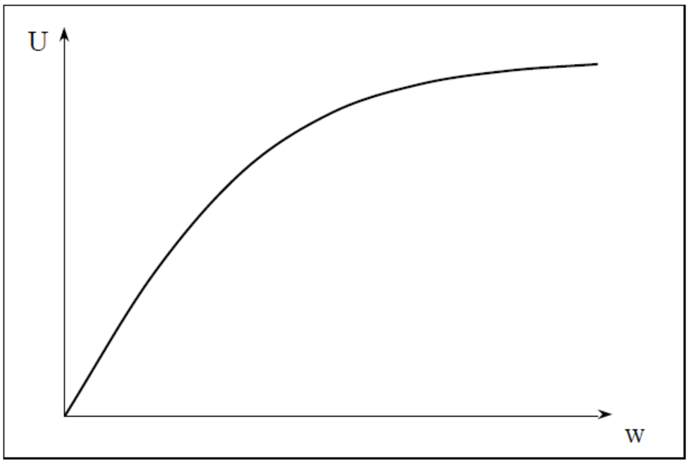
Fama (1970) developed the Efficient Market Hypothesis (EMH) based on the framework of the levels of information efficiency in the market. Firstly, when a market is efficient of a weak-form, all historical prices and volume data are reflected in asset prices. Thus, technical analysis would be futile, as an investor will not be able to utilise historic asset prices and volume data to outperform the market in a consistent manner. Secondly, a market is efficient of a semi-strong form, if all asset prices efficiently adjust to information that is publicly available. Therefore, fundamental analysis would be fruitless when the market is efficient of a semi-strong form. Lastly, when a market is efficient of a strong-form, investors cannot outperform the market in a consistent manner using both public and private information as it would have already been incorporated in the asset prices. In a strong-form efficient market all relevant information includes private information which only company insiders would know; the use of any insider information would be illegal.

According to Fama (1991: 383), "*the primary role of the capital market is the allocation of the economy's capital stock*". Ideally, a perfectly efficient market is where asset prices should provide investors with accurate indications for resource allocation. This allows firms and individual investors to make intelligent investment decisions based on securities that represent ownership of the firm's activities. This operates under the assumption that asset prices fully reflect all available information at any given point in time. Therefore, a market where asset prices fully reflect all available information is defined as efficient.

An efficient market is where investors are actively competing in asset markets, causing a rise in new information on intrinsic values to immediately reflect in market prices. In an efficient market, investors are presumed to be rational and risk averse in evaluating the probable outcomes of investment alternatives. An investor is perceived to be risk-averse when he/she is given two investment options which yield similar expected returns but different risks, and prefers the investment with the lower risk. Moreover, risk-averse investors will accept assets or a portfolio with a high expected return for a given level of risk, as well as accept a lower risk for a given level of expected return.

The concept of risk aversion branches from the expected utility theory which is illustrated by the conventional utility curve in Figure 2.1 below. Utility is defined as the satisfaction one acquires from an additional consumption of a good. In this case it would be the satisfaction that an investor gets from an additional unit of wealth created from his/her investment. Using the asset position as an indication of wealth, the positive slope indicates that as the asset increases, the utility of an investor increases, but at a diminishing rate as the curve is concave and the curve flattens. Essentially, as an investor increases his/her wealth, his/her utility increases, however at a rate less than the increase in wealth. According to Rabin (2000), this implies that an investor will reject a risky venture without adequate compensation for the additional risk taken. An investor stands to lose more in a fair gamble than he stands to gain. Thus, investors will not accept fair gambles because they will lose satisfaction of utility (Rabin, 2000).

Figure 2.1: Marginal Utility Curve, Von Neumann and Morgenstern (1944)



Source: Figure adapted from Bodie and Kane (2008: 267)

2.3 Behavioural Finance and Prospect Theory

A fundamental of modern finance is built on the EMH as it assumes that investors are rational utility-maximisers and that the market is efficient and reflects all relevant information in assets (Fama, 1965, 1970 and 1991). On the contrary, behavioural finance assumes that markets are informationally inefficient and that investors are irrational (Ritter, 2003). The premise of behavioural finance is that conventional finance ignores how investors make decisions in reality. In addition, behavioural finance states that the market is inefficient due to investor's cognitive biases such as overconfidence, overreaction, representative biases and other errors when making investment decisions. Kahneman and Tversky (1979) question the principles underlying the expected utility theory; and introduce prospect theory to describe investment decisions influenced by cognitive psychologies.

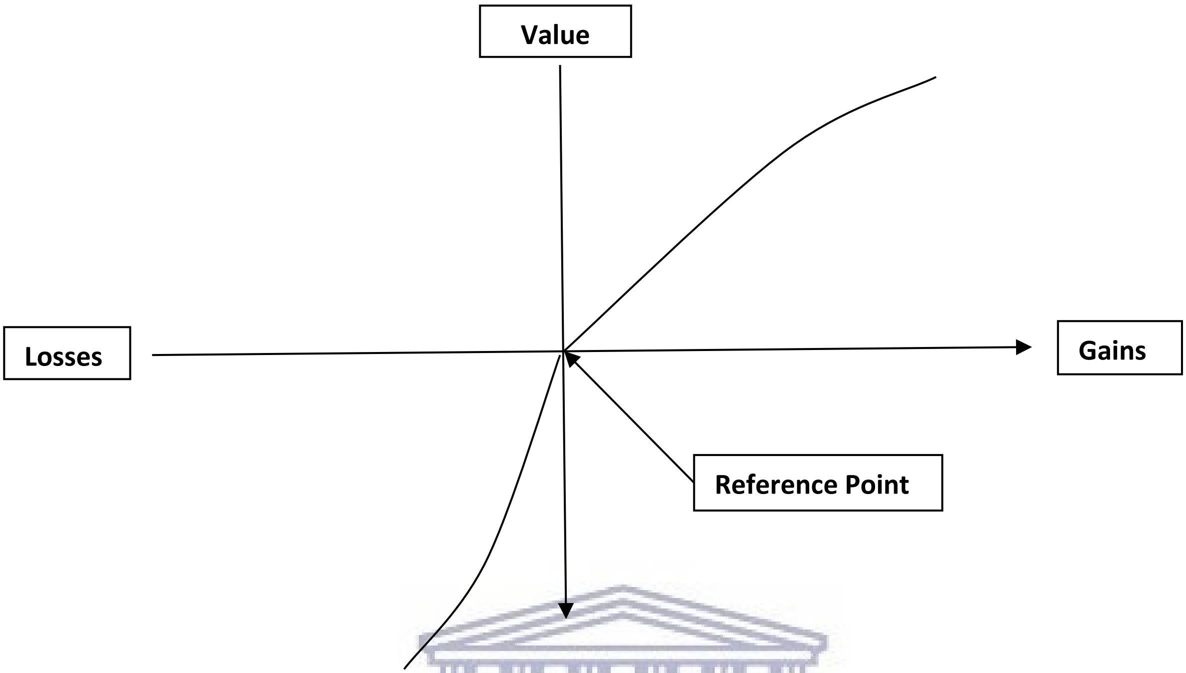
2.3.1 Prospect Theory

Kahneman and Tverky's (1979) prospect theory states that when individuals are faced with risk, their behaviours tend to be inconsistent with the basic principles of the expected utility theory. Prospect theory examines the decision making process of individuals under uncertainty based on cognitive psychology as opposed to investor rationality. As discussed in Section 2.2, expected utility theory states that individuals tend to be risk-averse when making investment decisions.

Kahneman and Tversky (1979) found that when faced with a choice of several risky investments, individuals exhibit behaviour that displays loss aversion, which is inconsistent with the basic principles of the expected utility theory. As a result, an alternative theory was developed, which introduces the concept of loss aversion and suggests that individuals would prefer to avoid losses than acquire gains. Furthermore, prospect theory mentions that certain behaviours are displayed by individuals whilst making an investment decision.

In order to demonstrate the concept of loss aversion, prospect theory proposes that individuals view the gains and losses of an investment relative to a specific reference point which may represent the price of an asset. In comparison to the conventional utility curve in Figure 2.1, Figure 2.2 below shows the utility derived from an investment that can be seen in the value function, which is both asymmetric and S-shaped. According to Kahneman and Tversky (1979), utility depends on changes in wealth from current levels; and not on the level of wealth as explained by the expected utility theory. Kahneman and Tversky (1979) propose that the value function is defined on deviations from the reference point, whereby deviations are concave for gains and convex for losses, and also steeper for losses than for gains. In other words, the sorrow felt by individuals when losses are incurred outweigh the pleasure felt when gains are incurred. This is known as the concept of loss aversion, which contradicts the expected utility theory, where an individual would be indifferent to the reference point.

Figure 2.2: A hypothetical value function, Kahneman and Tversky (1979)



Source: Figure adapted from Kahneman and Tversky, (1979)

In Figure 2.2 above, the reference point denotes that there is no change in current wealth. To the right of the reference point the function is concave for gains, implying that the marginal utility from additional gains increases at a decreasing rate, which is consistent with the expected utility theory. To the left of the reference point, the curve is convex and suggests that the marginal utility for losses is decreasing. Due to the fact that the curve is steeper for losses, the disutility obtained from incurring a loss is greater than the utility derived from making an equivalent gain. Expected utility theory implies that individuals may become risk averse as wealth increases, however, the convex curvature to the left of the value function causes individuals to be risk seeking as opposed to being risk averse with regards to losses.

Shefrin and Statman (1985) state that loss aversion is the consequence of seeking pride and avoiding regret by investors. As a result, investors tend to sell securities which have increased in value (winners) too soon and hold shares which have decreased in value (losers) for too long. This tendency is referred to as the disposition effect. In addition to loss aversion, Kahneman and Tversky (1979) also state that individuals will underweight the probability of a positive outcome occurring compared to a negative outcome that is obtained with certainty; also known as the certainty effect. For example, an individual would choose a guaranteed option of $2 000 to an alternative that has a 70 percent probability of paying out $3 000 and a 30 percent probability of paying out nothing. The expected value of the individuals ideal choice is $100 ($2000 – 0.7*$3000), which is lower than the alternative choice.

In contrast to the certainty effect, the reflection effect occurs when an individual's preferences are reversed i.e. the 70 percent probability of losing $3 000 is preferred to the option of an individual guaranteed losing $2 000. Similar to the option posed in the positive domain, the expected loss is still $100 more than the alternative choice. Although the reflection effect illustrates that an individual is risk seeking when there is a high probability of loss, Kahneman and Tversky, (1979) also show that individuals tend to be risk-averse when there is a small probability of loss. This can be demonstrated by the price individuals pay for insurance, which far exceeds the expected cost of the event actually occurring (Kahneman and Tversky, 1979).

Prospect theory also points out an error made by individuals when he/she rejects components that are common to all prospects. In other words, if the same choices are presented in different forms, individuals will display different preferences each time a choice is made. This is known as the isolation effect. Another cognitive error illustrated by Kahneman and Tversky (1979), an investor will often separate individual investments in their portfolio in order to track the gains and losses made by each investment. This practice introduced by Thaler (1985), known as mental accounting, ignores the importance of portfolio diversification.

2.3.2 Behavioural biases

Behavioural finance is described by Ritter (2003) as a concept whereby financial markets are studied by making use of models that are not limited by arbitrage assumptions nor Von Neumann and Morgenstern's (1944) EUT. Furthermore, two concepts are applicable to behavioural finance, namely; cognitive psychology and limits to arbitrage. The first concept, cognitive psychology refers to an individual's ability and tendency to be able to make a coherent decision (Ritter, 2003). Several psychological literature explain that investors are inclined to make systematic errors in the way they think, in which they are overconfident and put too much weight on recent experiences. Limits to arbitrage, is predicting instances in which arbitrages will be effective in, and when they will not be.

Behavioural finance utilises models where investors are not completely rational; either due to the investor's preferences or due to their incorrect beliefs. Therefore, many investors are thought of as poor Bayesian decision makers, due to their mistaken beliefs (Hirshleifer, 2001). Proponents of behavioural finance is of the belief that not all investors are rational and their decision making process is subject to behavioural biases. There are several biases which largely affect the way investors make investment decisions as outlined below.

Heuristics

Hirshleifer (2001) maintains that people share similar heuristics, which leads to a rule of thumb being applied to decision making when investors are faced with uncertainty. According to Peerbhai (2011), this process may work well in certain situations, particularly when one is faced with time limitations, however when heuristics fail to produce a proper judgement, it could result in cognitive biases, especially in instances where things change. This could potentially lead to suboptimal decisions. An example of this is when an investor is faced with multiple options (*N*) to invest his/her retirement money; he/she would simply use the 1/*N* rule (Ritter, 2003).

Overconfidence

According to Ritter (2003), investors tend to be overconfident in their abilities. Additionally, investors do not always analyse information available to them, instead they rely on their own judgement when making decisions. According to Grind (2013), overconfidence is related to pride, stating that investors hold too high opinions of themselves. Ritter (2003) stated that men tend to be more overconfident than women. As a result, they traded more, whereby they did worse than women investors.

Framing

Ritter (2003) defines framing as the idea of how a concept is presented to individuals, which was implemented in Kahneman and Tversky's (1979) prospect theory. According to Kahneman and Tversky (1979), framing is when an individual's decision is affected by how choices are posed. Sewell (2010) states that, individuals react differently to a particular choice, depending on how it is presented. An example of framing is where an individual may be risk averse when an investment option is posed in terms of the risk surrounding possible gains. However, he/she may be risk seeking when an investment option is posed in terms of the risk surrounding losses. In other words, investors may act as risk averse in terms of gains and risk seeking in terms of losses (Kahneman and Tversky, 1979).

Mental accounting

Mental accounting is where individuals tend to separate decisions which in principal should be mutual (Ritter, 2003). An example of such is where an investor would have an investment portfolio where he/she would take a conservative approach and invest in cash equivalents which are low-risk investments for his/her child's education. On the other hand, an investor may also have another investment portfolio in high risk investments such as equities. A rational approach would be viewing the investor's investments as part of an overall portfolio with the risk-return profiles of each portfolio into a combined framework (Phung, 2014).

Conservatism

Conservatism bias is where individuals tend to react slowly to new information that becomes available (Ritter, 2003). In other words, individuals do not react immediately to the new information and tend to adhere to the way things have always been done. An example of conservatism is that when new information becomes available, investors tend to underreact due to their conservatism bias. However, over the long run investors would eventually react to the new information, thus, causing momentum as investors overreact to the information (Ritter, 2003).

Disposition effect

According to Ritter (2003), the disposition effect refers to where investors tend to avoid paper losses and seek paper gains. An example of such is where an investor purchases a security at $30. The security then decreases to $22 before rising to $28. An investor would not sell the security unless it increases above $30 (Ritter, 2003).

Representativeness bias

Representativeness bias is where individuals are of the opinion that a small sample is a representative of a broad population (Ritter, 2003). This is known as the ‘law of small numbers’. Individuals may infer patterns too quickly based on past experiences and extrapolate apparent trends far into the future. An example of such is where the past performance of security has been doing well; investors may assume that the security will continue to do well without evaluating the fundamentals and determining if it will continue to do well (Ritter, 2003).

Regret avoidance

According to Bailey and Kinerson (2005), regret avoidance is where individuals may have previously made a decision that did not produce favourable results, so they would avoid the feeling of regret by not making the same decision again. An example of such would be where an investor regrets a particular investment, which reduced his/her tendency to make a similar investment (Bailey and Kinerson, 2005).

Availability Bias

Investors tend to overreact to recent events that have occurred in the market and base their decisions on the recent occurrences (Phung, 2014). An example of availability bias is where the prices of securities dropped significantly during the 2008 financial crisis. Therefore, investors will choose not to invest in the security market as they believe that the probability of another market crash is considerably high (Phung, 2014).

Herd Behaviour

Herding behaviour is defined as investors who imitate others when making investment decisions (Bikhchandani and Sharma, 2001). In other words, an investor is considered to be herding when their actions are influenced by other investors whom they are observing. In order for an investor to imitate others, he/she would have to be conscious of and be influenced by other investor's actions (Bikhchandani and Sharma, 2001). Intuitively, an investor would be considered herding if he/she were to make an investment without knowing other investors' decisions, however, changes their decision when he/she finds out other investors have decided not make the particular investment. Comparatively, an investor is also considered herding when he/she acquires knowledge that investors are investing in a particular investment, and then changes his/her decision from not investing to making the particular investment. Bikhchandani and Sharma (2001) state that herding by investors causes volatility, destabilises markets and increases the fragility of the financial system.

2.4 Overreaction Hypothesis

According to De Bondt and Thaler (1985), overreaction hypothesis is based on investors' psychological behaviour and implies that investors overreact to unanticipated information. Additionally, investors put too much weight on dramatic news which in turn affects their behaviour and investment decisions. De Bondt and Thaler (1985) explain that overreaction causes investors to overweight the arrival of new information and underweight historical information. De Bondt and Thaler (1985) explored a simple stock market investment strategy motivated by work in cognitive psychology on intuitive prediction**.** The investment strategy was based on the notion that investors are poor Bayesian decision makers. Bayes rule proposes that the reaction to an event is predictable, as it describes the degree of the reaction to new information which is considered to be appropriate and truthful. However, Kahneman and Tversky (1982) opposes Bayes rule by stating that individuals react differently.

De Bondt and Thaler (1985) state that due to an overreaction by investors to the arrival of new information such as earnings, security prices may deviate temporarily from their underlying fundamental values. De Bondt and Thaler (1985) examined the overreaction hypothesis on the New York Stock Exchange (NYSE), using monthly returns data over the period from 1926 to 1982**.** De Bondt and Thaler (1985) formed portfolios consisting of the 50 most extreme winners and 50 most extreme losers, which were measured by cumulative excess returns over successive five-year formation periods.

Results indicated that the loser portfolios outperformed the market on average by 19.60 percent; while winner portfolios on average underperformed the market by 5 percent over the 50 year period. This result supports the findings of Basu (1977), whereby securities with low P/E ratios outperformed securities with high P/E ratios. Basu (1977) stated that securities with low P/E ratios tend to be undervalued due to negative future prospects about the company based on recent bad earnings or negative news relating to the company. Comparatively, securities with high P/E ratios are overvalued due to positive future prospects based on recent positive earnings or positive news related to the company. Using two simple hypotheses, De Bondt and Thaler (1985) found considerable evidence. The first hypothesis is that extreme movements in security prices will be followed by subsequent price movements in the opposite direction. The second hypothesis is that the greater the initial price movement, the greater the subsequent price adjustment. De Bondt and Thaler (1985) are of the belief that these hypotheses are a violation of the weak-form EMH.

Page and Way (1992 and 1993), investigated the overreaction hypothesis on the JSE over the period from July 1974 to June 1989, using a similar methodology to that of De Bondt and Thaler (1985). Results revealed that the winner portfolio underperformed the market by 4.50 percent; while the loser portfolio outperformed the market by 10 percent. Additionally, results revealed that the loser portfolio outperformed the winner portfolio on average by 15 percent. Thus, the findings on the JSE are consistent with the results found by De Bondt and Thaler (1985).

Page and Way's (1992 and 1993) results indicated that the loser portfolio yielded abnormal returns around 15 months after portfolio formation. Moreover, results illustrate that the longer the examination period the greater the loser portfolio will outperform the winner portfolio.

Schiereck, De Bondt & Weber (1999) evaluated the profitability of value-based contrarian (long-term) investing and price momentum (short-term) trading strategies using data on the Frankfurt Stock Exchange (FSE) over the period from 1961 to 1991. According to Schiereck et al. (1999), a contrarian strategy is where securities that previously performed poorly (losers) for the past 2 to 5 years were purchased and securities that previously performed well (winners) were sold. On the contrary, momentum strategies is the purchase of securities that have previously performed well and selling securities that previously did poorly. Overall results revealed that contrarian strategies earn an excess return of about 8 percent per year in comparison to momentum strategies.

Forner and Marhuenda (2003) conducted a study on the Spanish stock market for the period from January 1963 to December 1997. The study aimed to determine the performance of contrarian (long-term) strategies and momentum (short-term) strategies, whereby both loser and winner portfolios were developed, respectively. Results revealed that a 5 year contrarian strategy achieved significant positive risk–adjusted returns. This illustrated that over the examination period loser's outperformed winners, and thus, one can observe stock market overreaction.

Hsieh and Hodnett (2011) conducted a study on the JSE over the period from 1 January 1993 to 31 March 2009. Hsieh and Hodnett (2011) attempted to find evidence of investor overreaction on the JSE as well as to determine whether mean reversion is cyclical. In addition, Hsieh and Hodnett (2011) examined the performance of a possible reverse relative strength strategy. The top and bottom 20 shares were selected in order to form winner and loser portfolios, respectively. The results revealed that loser portfolios outperformed winner portfolios 36 months after the portfolio was formed. Results revealed that the Momentum 60 (MOM60) loser portfolios outperformed the market by 34.06 percent, while the winner portfolios underperformed the market by 11.32 percent. In addition, mean reversion was documented to be greater for loser portfolios as compared to winner portfolios. Hsieh and Hodnett (2011) concluded that reversals are more prone to occur after a crash, and a reverse relative strength strategy may be a profitable strategy during financial downturn.

2.5 Major bubbles in history

According to Jimenez (2011), a bubble or mania occurs when the price of an asset or product increases within a specific market, above its average market price, at a dramatic scale and on a current basis. In the last two decades the world has experienced two of the greatest economic bubbles in history, known as the Dot Com bubble and the Securitisation bubble (Jimenez, 2011). Other well-known bubbles also include The Tulip mania, South Sea bubble, The Great Crash of 1929 and Hesei Boom.

2.5.1 The Tulip Mania

The first bubble or mania occurred in Netherlands in 1637 in the tulip market. The tulips gained major popularity when a virus known as mosaic caused the tulip to look like flames. A market was created where tulips could be purchased in advance by means of future contracts, which allowed buyers to make a down payment with delivery taking place at a future date. Initially only merchants speculated the future prices of tulips, purchasing significant amounts of tulips in advance for the subsequent season. Originally, only the wealthy purchased tulips, however, as the price of tulips increased, many people started speculating prices of tulips, including the poor. This caused the price of tulips to rise due to the increase in demand. The price of tulips began to increase excessively as of December 1636 up until before the crash which occurred in early February 1637. According to Jimenez (2011), in January 1637 the price of a tulip had increased twenty fold. Due to the overreaction in the market, the price of a tulip was 6000 Florins, while the average salary of a citizen was 150 Florins.

In February 1637, the first major sales of tulips began; causing panic in the market, and thus the large sales of tulips began. The government attempted to halt the sales of tulips through re-purchases and positive propaganda, however, their attempt was futile. Eventually, a tulip was worth the equivalent to that of an onion, and a few tulips could be purchased for just 1 Florin. The collapse in Netherlands lead to economic distress from which Netherlands took years to recover (Garber, 1990). It was concluded that the tulip bubble essentially lead to the market crash in 1637 which was due to irrational exuberance.

2.5.2 South Sea Bubble

The South Sea bubble revolved around the South Sea company, established in the year 1711 by Lord Treasurer Robert Harley and John Blunt. According to Temen and Voth (2004), Robert Harley created a trading company to fund the British government debt after the Spanish war. Thus, the company was given trading rights as a trade-off to take over government debt. South Sea bought 10 million pounds of government debt in exchange for a monopoly to trade to the South Seas. The company created positive propaganda resulting in a dramatic increase in share prices. In 1720, the directors offered to fund the government's entire debt of 31 million pounds, which initiated the speculation of the security price (Temin and Voth, 2004). Furthermore, on the 7 April 1720 the 'Bubble Act' was introduced which prevented other companies from competing with South Sea which essentially increased the security from 130 pounds to 300 pounds, creating a huge demand for the security (Jimenez, 2011). Within a span of a month, the security increased to 550 pounds and ultimately increased to approximately a 1000 pounds; which was no indication of the true fundamentals of the company.

South Sea began lending money to investors who wished to purchase shares. However, investors could not afford to make payment on the loans and had to sell shares. In addition, banks and other financial institutions who lent money went bankrupt as investors could not repay their loans. The news of South Sea security being sold came to the attention of the public which lead to a decline in stock prices due to a spread of panic. Within a month the market value of South Sea declined by 103 million pounds (Jimenez, 2011).

2.5.3 The Great Crash of 1929

Galbraith (1954) states in his book titled the 'The Great Crash 1929', the U.S. stock market bubble formed due to the rapid expansion of the 1920's market. Additionally, Galbraith (1954) states that the irrationality of investors ignoring the fundamentals of securities and brokers' loans that leveraged investors were causes of the bubble. According to Jimenez (2011), the U.S. Gross National Product (GNP) grew at an annual rate of 4.70 percent and the unemployment rate grew at an average of 3.70 percent per annum over the period from 1922 to 1929. These great economic conditions resulted in large scale industrial and commercial enterprises emerging. Both new and old corporations started issuing stocks to finance development. In addition, commercial banks moved into investment banking, creating affiliates; which grew from 10 to 114 between 1922 and 1931 (Peach, 1941). Carosso (1970) stated that during the same period investment trusts grew from 40 to 750. According to Carosso (1970), many of the new investors who entered into the security market lacked experience, thus causing the bubble.

According to White (1990) and Pierce (1986), the trend between security prices and dividends were shared over the period from 1922 to 1927, however, between 1928 and 1929 security prices increased much more above dividends. Malkiel (1973) stated that between 3 March 1928 and 3 September 1929, the percentage increases in major securities traded on Wall Street ranged from 87 percent to 434.5 percent. According to White (1990), a crucial factor of the 1929 crash was the credit system, and that the credit was not cheap. The bubble can be explained by first stating that there was a change in the business cycle, whereby a recession may have been plausible. In July 1929 the Federal Reserve's index declined and in August and September other indices began to drop. According to Jimenez (2011), the data arrived at the market with increases in interest rates in both US and European countries. These occurrences caused investors to panic, leading to the collapse of the security market.

2.5.4 Japan: 1980's Asset Price Bubble (Hesei Boom)

Hamada (2003) explains that during the 1980's, Japan experienced a period of continued growth and stable inflation. However, during the period from 1987 and 1990, the 1980's Asset Price bubble (Hesei Boom) occurred due to fundamentals which were not in relation with real estate prices, security prices and land prices. According to Jimenez (2011), there is a certain similarity between the Hesei Boom and the 'Great Crash of 1929'. The similarities include the aggressive behaviour of financial institutions, inadequate risk management by financial institutions, progress of financial deregulation, protracted monetary easing, introduction of the capital accord, taxation and regulations biased towards accelerating the rise in prices, euphoria and overconfidence to name but a few.

Shiratsuka (2003) stated that these causes were the factors that augmented the bullish expectations in the economy and triggered the bubble. Additionally, interest rates were low despite economic expansion which contributed to cheap credit that leveraged agents. The security market and real estate market collapses occurred when a decline in profitability took place and investors revised their expectations.

2.5.5 Dot Com Bubble

A study conducted by Weale and Amin (2003) outlined that the Dot Com bubble occurred around 1999 to 2001 peaking on the 10^{th} of March 2000, in which new technological innovations were introduced to the market, with high hopes of creating many profitable opportunities for investors. During the 1990's, software companies performed extremely well. The reasoning behind the sudden over-investment in internet firms was attributed to investment analysts declaring these stocks to be huge growth potentials and profitable investments. Thus, behavioural biases such as herd behaviour and overconfidence, lead to investors making an over-investment in internet firms. According to Geier (2015), during 1996 to 2000, the National Association of Securities Dealers Automated Quotations (NASDAQ) index grew from 600 to 5000 points. Many investors realised that technology stocks developed into a speculative bubble and thus they began to sell their securities. When the bubble burst and investors realised their misjudgment and irrationality, they began pulling out of the shares, leading to the market crashing.

2.5.6 The Housing Bubble

A well renowned real estate bubble is that of the recent bubble that led to the 2008 global financial crisis. This crisis was a catastrophic event that was caused by the bursting of the housing bubble (Holt, 2009). Outlined below are the various contributing factors which lead to the bursting of the housing bubble.

Low mortgage interest rates

The combination of low interest rates followed by high mortgage rates led to the build-up and subsequent burst of the bubble. The decline in the interest rate was probably due to herd behaviour. Home seekers noticed others acquiring mortgages and decided to benefit from this as well. The low interest rates and low monthly repayments were the incentive behind the high demand for loans even though home prices were increasing. The Federal Reserve saw this as an incentive to lower interest rates further to feed the demand of the population whilst actively contributing towards economic growth (Holt, 2009).

Low short term interest rates

The low short term interest rates contributed to the housing bubble in two ways. Firstly, short term interest rates were lower than long term interest rates. Long term interest rates crippled homeowners as they battled with repayments because the values of their properties were less than the value of their mortgages (Holt, 2009). Secondly, leveraging was encouraged i.e. to borrow at the low interest rate and reinvest at higher yielding long term investments. This was aimed at mortgage-backed securities which increased the amount that was available to loan out as mortgages, and as a result increased the price of homes.

Relaxed standards for mortgage rates

Criteria for obtaining a mortgage loan were highly standardised prior to the bubble. It required a thorough screening of whether income was sufficient to meet monthly repayments as well as the condition of paying 20% of the mortgage as a deposit. However, new governmental policies were introduced in the mid-1990's which contributed towards the drop of standards for mortgage loans. In addition, borrowing was no longer limited to local markets as home-owners could search the internet to find more affordable mortgage providers. Due to the higher competition, all mortgage providers lowered their mortgage fees to attract home-seekers.

2.6 Conclusion

This chapter explored the various models within the traditional finance paradigm which made the assumption that investors act rationally by taking into consideration all available information when making decisions. As a result, markets conform to the efficient market hypothesis, and asset prices reflect the true intrinsic value. Moreover, traditional finance paradigms assume that investors are rational and respond rapidly to new information by making appropriate adjustments to security prices to restore market equilibrium.

Fama (1965) stated that, asset prices follow a random walk pattern and are unpredictable. Additionally, the research in this study has also illustrated the origins of behavioural finance and the development of this theory in order to understand the implications of investors' irrationality when making investment decisions in financial markets. Behavioural finance phenomena outlines the impact of human emotions and cognitive errors on the investment decision process, ultimately leading to arbitrage opportunities and miscalculations on the markets as opposed to traditional paradigms such as the Expected Utility Theory (EUT) and the Efficient Market Hypothesis (EMH).

3

LITERATURE REVIEW

3.1 Introduction

Market timing refers to an attempt to predict the future movements of markets or asset prices in order to identify their timing points. De Chassart and Firer (2004) define market timing as a switch between asset classes in anticipation of major turning points in the market. Random Walk Hypothesis (RWH) takes an opposing view to the practice of market timing, stating that the movements in asset prices are random and thus are unpredictable. The Efficient Market Hypothesis (EMH) of Fama (1970) explains that it is impossible to beat the market consistently due to market efficiency; meaning that security prices reflect all relevant information in the market at any given time. Empirical studies on market timing strategies investigate the levels of predictive accuracy required to benefit from market timing and examine the practicality of market timing strategies. This chapter reviews the literature on the potential gains from market timing by examining various local and international studies over the period from 1975 to 2016. International studies by Sharpe (1975), Droms (1989), Kester (1990), Hsieh (2013a) and Hallerbach (2014) to name a few review the potential gains of market timing in the global markets. Local studies such as Waksman, Sandler, Ward and Firer (1997), De Chassart and Firer (2004), and Ward and Terblanche (2009) evaluate the level of accuracy required to time South African markets and potential gains available to a market timer on the JSE. The above mentioned literatures also considers the superiority of a market timing strategy over that of a buy and hold strategy and how forecasting accuracy affects potential gains from market timing in both bull and bear markets; while accounting for transaction costs associated with the ability to time the market successfully.

3.2 Literature Review

Sharpe (1975) pioneered the study of potential gains from market timing by actively switching between U.S. Stock and Treasury bills over the period from 1929 to 1972. Sharpe (1975) defines potential gains as the incremental returns of a market timing strategy above that of a buy and hold strategy. Results reveal that over the period from 1929 to 1972 a perfect market timing strategy yields an average return of 14.86 percent per annum compared to 10.64 percent yielded by a buy and hold strategy over the same period. Moreover, the standard deviation for a perfect market timing strategy is 14.58 percent compared to 21.06 percent yielded by a buy and hold strategy.

The results show that a market timer with perfect forecasting accuracy yields a greater return with less risk when compared to that of a buy and hold strategy. However, in reality, it is unlikely that a market timer possesses perfect forecasting accuracy; therefore it is more reasonable to assume that a market timer possesses imperfect forecasting accuracy. According to Sharpe (1975), it is more realistic to evaluate potential gains from less than perfect market timing by assigning various forecasting accuracies using a bivariate probability model. A hypothetical market timer was assigned various levels of forecasting accuracy in order to evaluate the minimum level of forecasting accuracy required to outperform a buy and hold strategy (Sharpe, 1975). The forecasting accuracy begins at 50 percent (i.e. no forecasting accuracy) increasing up until where the investor has 100 percent forecasting accuracy (i.e. perfect forecasting accuracy).

On a risk-adjusted basis, results revealed that a market timer requires a minimum forecasting accuracy of 74 percent in order to outperform a buy and hold strategy. Sharpe (1975) also stated that attempting to time the market will not yield potential gains of more than 4 percent per annum on average. Sharpe (1975) concluded that the potential gains from market timing are indeed appealing, however in reality; the forecasting accuracy required for an effective market timing strategy is unlikely to be achievable and should be avoided altogether.

Jeffrey (1984) evaluated the potential gains available to a market timer who revises their portfolio on a quarterly basis, using data on the S&P 500 and Treasury bills for the period from 1926 to 1982. The results revealed that a market timer who possesses perfect forecasting accuracy would yield a maximum return of 10.80 percent per annum above that of a buy and hold strategy in the S&P 500. Alternatively, if a market timer had imperfect forecasting accuracy and continuously timed the market incorrectly, he/she would underperform a buy and hold strategy by 17.60 percent. Using a loss/gain ratio, Jeffrey's (1984) study also illustrated that a market timer was 2.2 times more likely to underperform a buy and hold strategy than to outperform it. The loss/gain ratio also revealed that the risk undertaken by a market timer was not proportionate to the potential rewards. Jeffrey (1984) concluded that there were more bull markets than bear markets in the examination period. However, if a market timer missed a few of the bull periods, he/she would be better off with a buy and hold strategy, even if he/she correctly timed the market on a consistent basis.

Firer, Ward and Teeuwisse (1987) replicated Jeffrey's (1984) study in order to evaluate the forecasting accuracy required to time the market within a South African context. The study accounts for asset choices, transaction costs and portfolio revision frequencies on the overall performance of a market timer on the JSE. Firer, Ward and Teeuwisse (1987) employed three different indices on the JSE and two cash equivalents over the period from 1967 to 1986. The three indices employed were the All Share index (ALSI), Industrial Holdings index and the Banks and Financial Services index. Additionally, the Treasury bill and Bankers Acceptances were employed as the cash equivalents. Results illustrated that a market timer who possesses perfect forecasting accuracy when switching between Treasury bills and the ALSI yielded on average potential gains of 5.50 percent per annum. Alternatively, if a market timer always incorrectly timed the market, he/she would have underperformed a buy and hold strategy by 17.70 percent, resulting in a win/loss ratio of 3.2. The results concur with Jeffrey (1984), whereby the downside risk substantially outweighs the upside.

Results also revealed that a market timer required a forecasting accuracy of 69 percent in order to have an equal opportunity of either outperforming or underperforming a buy and hold strategy. Moreover, results revealed that a market timer required a forecasting accuracy of 86.90 percent in order to outperform a buy and hold strategy.

Firer, Ward and Teeuwisse (1987) also used the compression ratio in order to evaluate the risk that is associated with applying a market timing strategy. The compression ratio indicates the number of good periods a market timer may forego, relative to the total number of periods, before the returns are below that of a buy and hold strategy. The results revealed that the average compression ratio was 14 percent. The compression ratio indicated that if a market timer incorrectly forecasted 14 percent of the bull periods, he/she would be worse off than that of an investor applying a buy and hold strategy. Therefore, similar to the results of Jeffrey (1984), a few great periods influence the total returns of a market timing strategy.

Chua, To and Woodward (1987) utilised data on the Canadian Stock Exchange and Treasury bills from 1950 to 1983 in order to evaluate the forecasting accuracy required to outperform a buy and hold strategy. As opposed to Sharpe (1975), Chua, et al. (1987) did not assume that a market timer has equal forecasting accuracy in both bull and bear markets. In order to evaluate the potential gains available to a hypothetical market timer on the Canadian Stock Exchange, Chua et al. (1987) used a series of Monte Carlo simulations of various bull and bear market forecasting accuracies. There were 10 000 iterations simulated for each variation of bull and bear forecasting accuracies. Additionally, win/loss ratios were computed for each variation of bull and bear timing accuracies in order to evaluate the probability of a market timing strategy outperforming a buy and hold strategy.

Chua, et al. (1987) stated that the win/loss ratio, when compared to a standard median estimate, provides more useful information as it overlooks the frequent situations in which the market timer and an investor applying a buy and hold strategy are holding securities. A win/loss ratio of less than 1 illustrates that a market timer has less than 50 percent probability of outperforming a buy and hold strategy. Similarly, a win/loss ratio of greater than or equal to 1 indicates that a market timer has a 50 percent probability or more of outperforming a buy and hold strategy.

Results revealed that a market timer required a joint forecasting accuracy of 80 percent in both bull and bear markets in order to outperform a buy and hold strategy. The win/loss ratios illustrated that the significant gains forgone in the bull markets far outweighed the benefits of avoiding losses in the bear markets. In addition, if a market timer can only forecast bull markets accurately 50 percent of the time, then he/she should not participate in market timing. Furthermore, a market timer will yield returns less than that of a buy and hold strategy, even if he/she is able to forecast bear markets perfectly. Chua, et al. (1987) concluded that it is more important for a market timer to forecast bull markets correctly than it is to forecast bear markets correctly.

Droms (1989), extending on Sharpe's (1975) study, evaluated the potential gains available to a market timer switching between the S&P 500 and Treasury bills for the period 1926 to 1986. Droms (1989) criticised Sharpe's (1975) study in that he only evaluated the potentials gains from annual timing. Therefore, Droms (1989) evaluated the potentials gains from annual, quarterly and monthly market timing. In addition, Droms (1989) implemented three sub periods. Firstly, the post-World War II period, this was from 1946 to 1986. The second sub period was from 1969 to 1986 and the third sub period was from 1973 to 1986. Results revealed that for the post World War II period, a market timer who possessed perfect forecasting accuracy yielded on average potential gains of 4 percent per annum, similar to that of Sharpe (1975). For the period from 1973 to 1986, a market timer who possessed perfect forecasting accuracy outperformed a buy and hold strategy by 4.69 percent per annum. For the period 1926 to 1986, a perfect market timing strategy would have yielded potential gains of 6.47 percent per annum.

Droms (1989) results also indicated that a market timer who did not possess perfect forecasting accuracy required the following forecasting accuracies in order to outperform a buy and hold strategy; 60 percent bull forecasting accuracy and 30 percent bear forecasting accuracy, 70 percent bull forecasting accuracy and 40 percent bear forecasting accuracy, 80 percent bull forecasting accuracy and 50 percent bear forecasting accuracy and 100 percent bull forecasting accuracy and any bear market forecasting accuracy.

The results also revealed that if a market timer did not possess a minimum of 60 percent bull forecasting accuracy, he/she would underperform a buy and hold strategy even if they possessed perfect bear forecasting accuracy. Droms (1989) results concurred with that of Chua et al. (1987) study, stating that it is more important for a market timer to forecast bull markets correctly than it is to forecast bear markets correctly. The results overall revealed that without considering transaction costs, the more frequent a market timer revises their portfolio the greater the potential gains available to a market timer and the level of forecasting accuracy required decreases. However, when taking transaction costs into account, the potential gains available to a market timer decreases and the required forecasting accuracy increases.

Clarke, FitGerald, Berent and Statman (1989) employing the same data used by Sharpe (1975), investigated the level of information a market timer requires in order to outperform a buy and hold strategy, by developing a single factor model. The single factor model developed included the changes in Gross National Product (GNP) as the predictor of stock returns. Clarke, et al. (1989) employed the single factor model that gives the market timer the option to switch between Treasury bills and stocks on the S&P 500. The level of information required to outperform a buy and hold strategy was not researched in previous empirical studies, as prior literature focused on determining the level of forecasting accuracy required for an effective market timing strategy in the various global markets. In addition, previous empirical studies assumed that market timers did not have access to information relating to forecasting market trends.

Results revealed that there are significant potential gains achieved when applying a market timing strategy based on indicators that are generated by the single factor model. Moreover, a market timer applying the market timing strategy could obtain greater returns at a lower risk than that of a buy and hold strategy. Clarke et al. (1989) concluded that a market timer, who even possesses a modest level of information, has a substantial advantage over a buy and hold investor.

The results of previous empirical studies were all based on market timing with stock market indices that are dominated by large caps. Kester (1990) on the other hand, evaluated potential gains from market timing with large caps, cash equivalents and included small caps over the period from 1934 to 1988 in the U.S. stock market. According to Banz (1981), small caps are referred to as companies with relatively low market capitalisation that outperform companies with high market capitalisation on a risk-adjusted basis. Kester (1990) also evaluated the sensitivity of potential gains to two key variables, namely, frequency of portfolio revisions and transaction costs. The transaction costs assumed by Kester (1990) for various market timers are 0.25 percent, 0.50 percent, 1 percent and 2 percent. Additionally, the portfolio revisions evaluated were annual, quarterly and monthly which are similar to that of Droms (1989).

Results revealed that the potential gains available to a market timer with perfect forecasting accuracy who revises their portfolio on a monthly basis, switching between small caps and Treasury bills and incurred transaction costs of 0.25 percent yielded potential gains of 28.26 percent. Results also revealed that a market timer who revised their portfolio on a quarterly basis and incurred transaction costs 0.25 percent required a forecasting accuracy of 56 percent in order to outperform a buy and hold strategy. However, for a quarterly market timer, the required forecasting accuracy increases to 62 percent when transaction costs increase to 0.50 percent and 70 percent when transaction costs are 2 percent.

The results from sensitivity analysis indicate that transaction costs are an essential factor for a successful market timing strategy. Kester (1990) stated that when more accurate and less restrictive assumptions are taken into account, with regards to the frequency of portfolio revisions and transaction costs, the potential gains available to a market timer substantially increases. Kester (1990) concluded that a market timer yields greater potential gains when switching between small caps and Treasury bills than a market timer switching between large caps and Treasury bills.

Shilling (1992), used data from the Dow Jones Industrial Average (DJIA) and Treasury bills in order to evaluate the potential gains from market timing for the period from January 1946 to December 1991. Shilling (1992) used a different methodology to previous empirical studies whereby he evaluated shorting securities in bear markets.

According to Shilling (1992), shorting securities in a bear market could potentially be a value-adding strategy. The 50 strongest months over the examination period were classified as bull markets. Whereas the 50 weakest months were used as bear markets. Results revealed that an investor, who applied a buy and hold strategy and reinvested their dividends, yielded a mean return of 11.20 percent per annum. Results also revealed that a market timer who missed 50 of the strongest months underperformed a buy and hold strategy by 7.20 percent per annum. Comparatively, an investor who applied a buy and hold strategy, and was out of the market for the 50 weakest months, he/she would yield an annual return of 19 percent.

Shilling (1992) also illustrated that if a market timer shorted securities in the 50 weakest months, he/she would yield a return of 26.90 percent per annum compared to a buy and hold strategy which yields 11.20 percent per annum. Shiller (1992) stated that if a stock falls by 50 percent and an investor is invested in the market, the stock has to double in order for the security to revert back to the original market price. However, if a market timer was out of the market when security prices decline, he/she would have twice the money to invest when they foresee a bull market. Shilling (1992) concluded that it is indeed profitable to be in securities in bull markets. However, it is even more profitable to short securities during bear markets, even if many of the major bull markets are entirely foregone.

Firer, Sandler and Ward (1992) updated the Firer, Ward and Teeuwisse (1987) study of market timing on the JSE. Firer, et al. (1992), used data obtained from the All Share index (ALSI), All Gold index and Treasury bills on the JSE for the period from 1967 to 1989. Firer, et al. (1992) investigated the effect of a major stock market crash such as the one of 1987 on market timing strategies. The study assumed annual, quarterly and monthly portfolio revisions with an average transaction cost of 1.38 percent. Results revealed that a market timer who possesses perfect forecasting accuracy when switching between the All Gold index and Treasury bills, he/she would outperform a buy and hold strategy in the ALSI by 34 percent per annum. However, if a market timer always incorrectly timed the market, he/she would underperform a buy and hold strategy by 31 percent per annum.

Results also revealed that on average, a market timer is required to make a switch approximately 45 percent of the periods, regardless of the timing intervals. Furthermore, if a market timer had missed two of the best years, he/she would underperform a buy and hold strategy. Firer et al. (1992) stated that a market timer required a forecasting accuracy between 87 percent and 90 percent in order to outperform a buy and hold strategy. Comparatively, in order for a market timer to equal that of a buy and hold strategy, he/she requires a forecasting accuracy between 65 percent and 79 percent accuracy. Firer et al. (1992) concluded that the crash of 1987 had little impact on the probability of successfully using a market timing strategy to outperform a buy and hold strategy.

Waksman, Sandler, Ward and Firer (1997) evaluated the potential gains on the JSE when applying a market timing strategy that uses derivative instruments for the period from 1963 to 1992. Two timing strategies were considered; a bear timing strategy and a bull timing strategy. When a market timer purchases put options to protect securities from market downturns, it is referred to as a bear timing strategy. Whereas, a bull timing strategy is when a market timer purchases call options when a bull market is forecasted. Black-Scholes Option Pricing and Fair Value Models were employed to price both call and put options on both the All Share index (ALSI) and the ALSI future. Results revealed that perfect bull and bear market timing strategies yield mean returns of 38.10 percent and 35.40 percent respectively, above that of a buy and hold strategy. Comparatively, a traditional market timing strategy yields a mean return of 43.20 percent.

Results also revealed that a market timer who purchased one month put options on the ALSI when a bear market was anticipated, he/she requires a 50 percent forecasting accuracy in order to outperform a buy and hold strategy. Overall, results revealed that market timers, who make use of derivatives on the JSE, reduce the downside risk and decrease the required forecasting accuracy. Waksman et al. (1997) concluded that, market timers who possess high degree of forecasting accuracy may obtain extraordinary results when applying bull and bear market timing strategies on the JSE.

De Chassart and Firer (2004) study investigated the potential returns and risks associated with three market timing strategies on the JSE for the period from 1925 to 1982. The three market timing strategies evaluated in the study included traditional market timing, bull market timing and bear market timing. Traditional market timing involves purchasing securities when a bull market is forecasted and switching into money market instruments when a bear market is forecasted. A bull market timing strategy involves holding money market instruments and purchasing call options on the market index when a bull market is forecasted. Lastly, a bear market timing strategy involves holding the market index and purchasing put options when a bear market is forecasted. Results illustrated that a traditional market timing strategy yielded the lowest return out of the three strategies. The bear market timing strategy yielded the greatest return, however, the level of risk was almost double that of a traditional market timing strategy.

On a risk-adjusted basis, all three of the timing strategies require a minimum forecasting accuracy of 55 percent in order to outperform a buy and hold strategy, which is significantly lower than the previous empirical studies. Results also indicate that during bull markets, a market timer requires greater forecasting accuracy. Comparatively, during bear markets the required forecasting accuracy is below 50 percent. In other words, a market timer does not require any forecasting accuracy in order to outperform a buy and hold strategy. De Chassart and Firer (2004) concluded that the volatility of the returns and in essence the risk of a portfolio can be reduced by applying any of the three market timing strategies, when compared to that of a buy and hold strategy.

Muller and Mutooni (2007) investigated various equity style timing strategies on the JSE from December 1986 to May 2006. An equity style is defined as an investment philosophy followed by certain investors who believe that their style of investing will add value, (Christopherson and Williams, 1997). According to Barberis and Shleifer (2003), style investing is the study of asset prices, in which some investor's categorise a broad set of assets in the financial market and move these assets among various styles depending on their risk or performance. The various equity style investment strategies investigated by Muller and Mutooni (2007) are value, growth, market orientated and size investing. According to Muller and Mutooni (2007), market orientated investors do not have a strong preference for a specific equity style investment strategy, however, they prefer to hold a well-diversified portfolio. According to Banz (1981), the size effect refers to smaller firms achieving higher average returns than larger firms.

The results of Muller and Mutooni (2007) indicated that a market timer, who possesses perfect forecasting accuracy when applying an equity style investment strategy, would yield an average return of 43 percent per annum. In addition, a market timer who was only able to determine five major turning points would have yielded a return of 26.30 percent per annum. A market timer who always timed the market incorrectly would have yielded a negative return of 5.20 percent per annum. In contrast, a buy and hold strategy in either the Industrial index or the All Share index (ALSI) would have yielded a return of 13.50 percent and 12.80 percent per annum respectively.

Muller and Mutooni (2007) indicated that over the period from 1986 to 2006, growth stocks underperformed value stocks on the JSE. Moreover, the economic model used to forecast style turning points revealed that timing the style spreads is possibly a more profitable strategy than a buy and hold strategy.

Ward and Terblanche (2009) evaluated the potential return and risk associated with applying a market timing strategy which uses portfolios of 'Rand-play' and 'Rand-hedge' shares. It is assumed that a market timer switches between the 'Rand-play' and 'Rand-hedge' shares, based on the fluctuations in the exchange rates on the JSE. According to Ward and Terblanche (2009), three exchange-rate sensitive portfolio sets were identified. The three portfolios were the Investec-z 'Rand-hedge' and 'Rand-play', BKH 'Rand-hedge' and BKH 'Rand-play' and lastly the Nominal Effective Rand Exchange Rate (NEER) 'Rand-hedge' and NEER 'Rand-play'.

A market timer would increase the weight of 'Rand-hedge' shares when the rand was expected to weaken and the weights of 'Rand-play' were increased when the rand was expected to strengthen. The market timing strategies between the portfolios were evaluated on a monthly basis over the period from 1998 to 2008. Results indicated that a market timer who possesses perfect forecasting accuracy and invested R1, he/she would have yielded a R250 return for both the Investec-z and BKH portfolios. However, if a market timer always incorrectly timed the market, he/she would have yielded R0.08 and R0.25 respectively.

A market timer who invested R1 when switching between the NEER portfolios, he/she would have yielded a maximum of R63 and minimum of R0.25. Comparatively, an investor applying a buy and hold strategy and invested R1 in the ALSI would have yielded R4.09 over the same period. Results also revealed that a market timer requires a minimum forecasting accuracy of 75 percent to outperform a buy and hold strategy, similar to that of Sharpe (1975). However, the forecasting accuracy required by a market timer may drop to as low as 40 percent to equal the return of a buy and hold strategy. The overall results suggest that a market timing strategy may outperform a buy and hold strategy by approximately 35 percent per annum. Similar to that of previous empirical studies, Ward and Terblanche (2009) concluded that the success of a market timing strategy is strongly dependent on a market timer's forecasting accuracy.

Hsieh, Hodnett and Van Rensburg (2012) developed market timing strategies that protected a market timer from bear markets by decreasing equity exposure or by using a derivative overlay to create a synthetic cash position. Hsieh, Hodnett and Van Rensburg (2012) focused on creating these protection-based market timing strategies which are resistant during market crashes such as the oil crisis which occurred in 1973, the Dot-com bubble of 2001 and the global financial crisis of 2008. There were two market timing strategies developed in order to protect a market timer from bear markets. The first strategy is the filter rule strategy which triggers and releases protection that is based on drawdowns (DD) and draw ups (DU) of the fund value which is projected from the fund's latest peak and trough.

The second strategy developed was the exponential moving average (EMA) strategy which triggers and releases protection that is based on the crossover of the fast moving average (FMA) and the slow moving average (SMA) of the fund value. Both these strategies were tested on the Morgan Stanley Capital International World index (MSCI World) over the period from 1 January 1970 to 31 December 2008. When comparing the historical risk-return characteristics of the two strategies, results indicated that the signals generated by the optimal filter rule strategy were less accurate than the signals that were generated by the optimal EMA strategy. Additionally, the optimal EMA strategy had a Sharpe ratio of 42.84 percent compared to the optimal filter rule strategy which had a Sharpe ratio of 38.26 percent. Hodnett, Hsieh and Van Rensburg (2012) concluded that the outperformance of the optimal EMA strategy is attributed to the risk reduction resulted from timely predictions regarding peaks and troughs, therefore, resulting in the optimal EMA strategy being more resilient during market crashes.

Hsieh (2013a) investigated the effectiveness of sector timing by assessing probable outcomes when switching between the financial and electronic indices on the Taiwanese Stock Exchange over the period from 16 December 1999 to 19 December 2012. The hypothetical sector timing strategy evaluated monthly switching between financial and electronic indices based on the prediction of sector-dominance in the upcoming month. Transaction costs of 1 percent were assumed every time a market timer switched between the indices. Additionally, various permutations of forecasting accuracies between the two indices were evaluated using Monte Carlo simulation.

Results overall revealed that it is more important to forecast the financial dominant market than it is to forecast the electronic dominant market. The win/loss ratios indicated that a market timer requires a significant forecasting accuracy in order to benefit from the sector timing strategy. Moreover, when transaction costs are taken into account, a market timer requires a high degree of forecasting accuracy in order to outperform a buy and hold strategy. Hsieh (2013a) concluded that there are potential gains available to market timers who possess significant forecasting accuracy.

Hsieh (2013b) investigated the effectiveness of market timing between prior winners and prior losers in the global equity markets using data from the Dow Jones Sector Titans Composite constituents over the period from 1 January 1999 through to 31 December 2009. Hsieh (2013b) employed various permutations of persistence and mean reversion prediction accuracies based on Monte Carlo simulations. Persistence is referred to as where securities are overbought and oversold due to investors' overreaction causing it to go in an upward or downward trend. Mean reversion is where the market price of a security reverts back to the intrinsic value. Results revealed that a market timer who possesses perfect forecasting accuracy and does not incur transaction costs, yields potential gains of 5.99 percent per annum. However, when taking into account transaction costs of 1 percent, the potential gains decreases to 5.32 percent per annum.

Results also revealed that the maximum drawdown for a perfect market timing strategy, taking into account transaction costs of 1 percent, is -28.34 percent compared to a buy and hold strategy of -42.31 percent. Results overall revealed that there are potential gains available to market timers with moderate forecasting accuracy. Hsieh (2013b) concluded that it is more important to predict the timing of mean reversion correctly than persistence in the global equity market.

Hallerbach (2014) applied Grinold's (1989) Fundamental Law of Active Management (FLAM) in order to evaluate the minimum success ratio required to outperform a buy and hold strategy, over the period from January 1926 to December 2010. In order to evaluate the minimum success ratio to outperform a buy and hold strategy in a fixed-income portfolio, Hallerbach (2014) simulated three market timing strategies, using Monte Carlo simulations. The first simulated strategy evaluated monthly switching between the S&P 500 and Treasury bills. The second simulated strategy evaluated monthly switching between U.S. long-term government bonds (GB) and Treasury bills, and the last simulated strategy evaluated monthly switching between GB and U.S. long-term corporate bonds (CB). According to Hallerbach (2014), FLAM is a key analysis tool for active strategies and not an operational tool; therefore it is designed to provide insight into active management.

Hallerbach (2014) defines a success ratio as the probability of a market timer correctly forecasting an increase in an asset for the upcoming period, as well as the magnitude of the returns of the asset for the upcoming period. The overall results revealed that a monthly market timer switching between the S&P 500 and Treasury bills requires a success ratio of approximately 60 percent to equal a buy and hold strategy on a risk-adjusted basis. Comparatively, a market timer switching between GB and Treasury bills and a market timer switching between CB and GB requires a success ratio of 55 percent and 51.60 percent respectively.

As opposed to previous empirical studies, Khokhlov (2016) evaluated the practicality of three different strategies for portfolio rebalancing suggested by Perold and Sharpe (1988) over the period from 2007 to 2015. The three strategies evaluated were a buy and hold strategy, constant weights (CW) and constant-proportion portfolio insurance (CPPI), over three different time periods. The three strategies all started off with a split of 60 percent invested in securities and 40 percent in a risk-free asset. SPY exchange traded fund was used as a proxy for the risky asset (securities) and the TLT exchange traded fund as a proxy for the risk-free asset. Khokhlov (2016) used Monte Carlo simulations on actual prices and transaction costs. Moreover, Monte Carlo simulations were used to evaluate the behaviour of strategies over various time periods (60 months, 36 months and 18 months), the returns of the strategies and the effect of transaction costs on the strategies.

Results overall revealed that over the short-term (18 months) that any strategy may be chosen as there were no statistical significance in the mean returns. However, over the long-term (36 months and 60 months), CPPI outperformed CW and CW outperformed a buy and hold strategy. Khokhlov (2016) also stated that in the study that transaction costs were not a factor when choosing a strategy, however, the transaction costs considered were 0.10 percent and 0.50 percent. An increase in transaction costs would have decreased the returns of the CPPI and CW strategies. In conclusion, a buy and hold strategy makes yields the lowest return out of the strategies over the long-term, and there is a 95 percent probability that CPPI will outperform both CW and a buy and hold strategy. Moreover, it is more important for a market timer to forecast bull markets correctly than it is to forecast bear markets correctly when applying the CPPI strategy.

Opposed to previous empirical studies, Dichtl, Drobetz and Kryzanowski (2016) did not only evaluate the potential gains from market timing based on risk and return measures, but also evaluated the effectiveness of a market timing strategy using expected and non-expected utility models. The two models used were the Quiggin's (1982) anticipated utility concept and Tversky's and Kahneman's (1992) cumulative prospect theory respectively. Using bootstrap-based simulations, Dichtl et al. (2016) seek to determine whether market timing is potentially desirable to some investors or whether it is not an advisable strategy over a buy and hold strategy in a constant mix portfolio. The constant mix portfolio consisted of 71 percent of capital invested in securities and 29 percent in cash equivalents.

3.3 Conclusion

The empirical evidence from the studies in this chapter reveals that a market timer requires a high level of forecasting accuracy in order to outperform a buy and hold strategy. Most studies indicate that a market timer requires 70 percent or more forecasting accuracy in order to outperform a buy and hold strategy, which according to Sharpe (1975) is unattainable to most investors. In addition, the empirical evidence from the studies reveal that there are potential gains available to market timers who apply a market timing strategy and that it is indeed attractive. However, the success of a market timing strategy is highly dependent upon their forecasting ability. According to Jeffrey (1984, 102), 'no one can predict the markets ups and downs over a long period, and the risk of trying outweigh the rewards'. Additionally, if a market timer misses the bull periods, they could substantially decrease their potential gains. The empirical studies also reveal that it is more important to forecast bull markets correctly than it is to forecast bear markets correctly. Moreover, if a market timer cannot forecast bull markets with considerable accuracy, he/she should rather avoid market timing. Results also reveal that the more frequent a market timer revises their portfolio, then the more the forecasting accuracy decreases and the potential gains available to a market timer increases. However, when taking into account transaction costs, the forecasting accuracy required increases and the potential gains decrease. In conclusion, considering all empirical studies in this chapter, there are potential gains available for market timers who have considerable forecasting accuracy. Moreover, the success of market timing is largely dependent on low transaction costs and the more frequently a market timer revises their portfolios.

4

DATA AND METHODOLOGY

4.1 Introduction

Van Rensburg and Slaney's (1997) as well as Van Rensburg's (2002) empirical studies on market segmentation on the JSE illustrated that there are various macro-economic forces that drive the performance of the different sectors on the JSE. According to Van Rensburg and Slaney (2002), the mining sector is influenced by various macro-economic variables that may not necessarily affect the industrial and financial sectors. For example, the performance of gold mining shares depends on gold prices that are primarily influenced by political and economic events that are detached from the South African economy. The authors suggested that the FTSE/JSE All Share Index (ALSI), which was commonly employed as the market proxy in the application of asset pricing and asset allocation, cannot adequately explain the returns of securities from different sectors on the JSE.

Van Rensburg and Slaney (1997) stated that, in contrast to many global security markets, gold and diamond-mining companies dominate the JSE in terms of their market capitalisations. However, according to the data provided by the National Treasury (2017), post 1990, South Africa's industrial and financial sectors have developed vastly and displayed potential to compete in the global economy. The financial, real estate and business service sector accounted for 21.60 percent of South Africa's GDP in 2016. Additionally, in 2016, the industrial sector contributed 15 percent to South Africa's GDP, making it the third largest contributor to South Africa's economy.

Due to the cyclical performance of the sectors on the JSE, there are potential gains that a market timer could possibly obtain through sector timing. Potential gains from sector timing are defined as the returns of a sector timing strategy in excess of a buy and hold strategy in the ALSI. Motivated by the implication of the market segmentation phenomenon on the cyclical nature of the prominent sectors on the JSE, this research undertakes to determine whether there are potential gains available to a market timer applying a sector timing strategy on the JSE. To the author’s knowledge in the presence of writing, there are no empirical studies on the potential gains from sector timing on the JSE. Prior significant studies by Firer, Ward and Teeuwisse (1987), Firer, Sandler and Ward (1992) and De Chassart and Firer (2004) evaluated the potential gains from market timing on the JSE while switching between equity and cash in bull and bear markets, respectively. Additionally, Waksman, Sandler, Ward and Firer (1997) investigated the potential gains from market timing on the JSE using derivative instruments for the period from 1963 to 1992. However, the above-mentioned studies did not explore sector timing on the JSE. Therefore, the studies on market timing could be expanded to explore potential gains from sector timing on the JSE.

According to Fama (1970, 1991), in a perfectly efficient capital market, any attempt to outperform the market consistently by picking and choosing securities would be futile. Additionally, Fama (1970, 1991) stated that when a market is efficient of a weak-form, investors cannot use past asset prices and volume data to predict future probable prices. Thus, potential gains from market timing strategies provide evidence against the weak-form EMH.

The primary objective of this study is to investigate whether the market segmentation phenomenon on the JSE provides potential opportunities for profitable sector timing strategies. The study adopts the methodologies of Chua, Woodward and To (1987), Kester (1990) and Hsieh (2013) to evaluate potential gains available to market timers on the JSE. Sharpe (1975) pioneered the study of potential gains from market timing based on probability analysis of possible outcomes for imperfect market timing strategies between bull and bear markets. Chua et al. (1987) improved Sharpe's (1975) methodology by using various permutations of bull and bear market timing forecasting accuracies for a hypothetical market timer, and evaluated the potential gains using Monte Carlo simulations. Kester (1990) investigated the potential gains from switching between large caps, small caps and Treasury bills subject to various levels of transaction costs and revision frequencies in order to determine the sensitivities of potential gains to changes in these two variables. Hsieh (2013) revised the methodology of Chua et al. (1987) in order to evaluate the potential gains from sector timing in Taiwan. This chapter also describes the rationale behind the database and sample selection, as well as the challenges and biases that may potentially affect the research.

4.2 Problem Statement and Research Objectives

Kester (1990) states that in a perfectly efficient market, attempts to earn abnormal returns from security selection will not result in superior investment performance in a consistent manner. In addition, attempting to predict market movements incurs non-recoverable transaction costs, which exposes market timers to larger losses when errors are made.

This study attempts to determine whether there are potential gains available to a market timer who applies a sector timing strategy on the JSE for the period from 1 January 2002 to 31 December 2016. In addition, if there are potential gains, then what is the minimum level of forecasting accuracy a market timer should possess in order to benefit from sector timing on the JSE? Kester (1990) defines forecasting accuracy as the assumed proportion of correct predictions of good and bad periods for a given market timing strategy. Previous empirical studies such as Sharpe (1975), Jeffrey (1984), Chua et al. (1987), Firer et al. (1992) and De Chassart and Firer (2004) stated that the forecasting accuracy required by a market timer in order to outperform a buy and hold strategy is unattainable to most investors.

It is important to note that empirical studies such as Sharpe (1975), Jeffrey (1984), Chua et al. (1987), Kester (1990), Firer et al. (1992) and De Chassart and Firer (2004) generally focused on the minimum level of forecasting accuracy required by market timers in order to benefit from market timing strategies when switching between equities and Treasury bills in bull and bear markets respectively. With the different dimensions of sector risks offered by the JSE based on the market segmentation phenomenon, the performance that can be achieved by applying sector timing strategies could be potentially better than the results obtained in prior empirical studies.

The ultimate objective of this study is to investigate the effectiveness of a sector timing strategy on the JSE by evaluating the likely outcomes from switching between sector indices for the period from 1 January 2002 to 31 December 2016. The goals of this study are to be achieved by accomplishing the following objectives:

1. Evaluate the potential gains available to a market timer who possesses perfect forecasting accuracy when switching between the FTSE/JSE Top 40 (ALSI) and the STEFI call deposit Index (STEFI) in bull and bear markets respectively. It is assumed that if a bull market is anticipated, a market timer is invested in the ALSI. On the other hand, if a bear market is anticipated, a market timer is invested in the STEFI.

2. Evaluate the potential gains available to a market timer who possesses less than perfect market timing ability when switching between bull and bear markets. Following the Monte Carlo simulation methodology originally designed by Chua et al. (1987), various levels of forecasting accuracies are assigned to a hypothetical market timer. Thus, the minimum level of forecasting accuracy required for an effective market timing strategy when switching between the ALSI and STEFI on the JSE can be established. In addition, the study aims at determining whether it is more effective to be able to forecast bull markets correctly than bear markets when applying a market timing strategy that switches between ALSI and STEFI.

3. Evaluate sector performance of the JSE tradable sector indices over the examination period from 1 January 2002 to 31 December 2016. These indices include; the Resources 20 index (RESI), FTSE/JSE Industrial 25 index (INDI), FTSE/JSE Financial 15 index (FINI) and the FTSE/JSE Top 40 index (ALSI).

4. Evaluate the potential gains from sector timing on the JSE based on various levels of forecasting accuracies, by using a series of Monte Carlo simulations as proposed by Hsieh (2013a). The sector timing strategies are constructed using the JSE tradable sector indices. This process aims at identifying the minimum level of forecasting accuracy required by a market timer to derive potential gains from sector timing strategies based on the cyclical nature of the JSE sector indices.

5. Examine the sensitivity of potential gains of market timing strategies on the JSE to changes in transaction costs. The study assumes that a market timer will incur transaction costs of 1 percent and 2 percent respectively, each time there is a switch from one sector index to another, and vice-versa.

6. Examine the sensitivity of potential gains from market timing and sector timing strategies on the JSE to annual, quarterly and monthly portfolio revisions. The impact of transaction costs and the market timer's forecasting accuracy are also assessed in conjunction with different portfolio revision frequencies.

4.3 Research Database and Sample Selection

Tradable indices are designed to achieve similar levels of performance to existing benchmark indices using a smaller number of securities in order to reduce the cost of replicating the index. In 2001, an agreement was made between the London Stock Exchange (LSE) and the JSE which enabled cross-dealing between the two exchanges. This partnership led to the implementation of the FTSE/JSE Africa Index series in 2002, which initiated a change in the philosophy and methodology of calculating indices and sector classifications on the JSE. Due to the unique nature of the methodology used by the FTSE, this meant that the indices on the JSE were tradable, liquid, free float market caps and of a relevant market size (www.jse.co.za). The FTSE/JSE Resources 10 index (RESI), FTSE/JSE Financial 15 index (FINI), FTSE/JSE Industrial 25 (INDI) and FTSE/JSE Top 40 index (ALSI) are examples of tradable indices on the JSE. According to the JSE website (www.jse.co.za), in addition to the FTSE/JSE Top 40 index (ALSI), there are five other tradable indices which are based on the classification of companies under the Industry Classification Board (ICB), however, the study will only employ the following indices below.

The monthly closing values of INDI, FINI and RESI, were extracted from INet BFA database for the examination period from 1 January 2002 to 31 December 2016. Additionally, two other indices are utilised. Firstly, the FTSE/JSE Top 40 index (ALSI) which comprises of the 40 largest companies trading on the JSE based on their market values. The ALSI is utilised as the benchmark for the market proxy. Secondly, the STEFI is utilised as the benchmark for the risk-free asset.

The short descriptions of the tradable indices employed by this research are provided as follows:

1. FTSE/JSE Resources 10 index (J210): This index consists of the top 10 largest resource companies on the JSE following the market value-weighting methodology.

2. Industrial 25, FTSE/JSE Industrial 25 index (J211): This index consists of the 25 largest industrial companies on the JSE following the market value-weighting methodology.

3. Financial 15, FTSE/JSE Financial 15 index (J212): This index consists of the 15 largest financial companies on the JSE following the market value-weighting methodology.

4. FTSE/JSE Top 40 index (Market Return) (J200): This index consists of 40 of the largest companies on the JSE following the market value-weighting methodology. This index is used as a measure of the overall activity of the South African market.

5. The STEFI Call Deposit Index (STFCAD): This is a proprietary index that measures the performance of short term fixed interest or money market instruments in South Africa. This index is used as the benchmark for the banker portfolio. For the purpose of this study, STEFI will be utilised as the Risk-Free Rate (Rfr) proxy.

4.4 Methodology

This study consists of three primary tests in order to evaluate the potential gains from sector timing on the JSE. The first test's objective is to evaluate the potential gains available to a hypothetical market timer with various forecasting accuracies, switching between equity and cash equivalents, depending on whether a bull or bear market is forecasted respectively. The second test's objective is to evaluate the potential gains available to a hypothetical market timer with various forecasting accuracies, switching between various tradable sector indices on the JSE based on market conditions being forecasted. The third test evaluates the sensitivity of potential gains to the changes in two key variables, namely, transaction costs and frequency of portfolio revisions.

The **first test** in the study seeks to evaluate the potential gains available to a hypothetical market timer who switches between the ALSI and the STEFI on the JSE when bull and bear market conditions are forecasted respectively; as well as to determine the minimum forecasting accuracy required to outperform a buy and hold strategy in the ALSI. In this research, a bull market is defined as the market state where the total return of the ALSI is greater than that of the STEFI. On the other hand, a bear market period is defined as the market state where the total return of the STEFI exceeds that of the ALSI.

A market timer is assumed to assess the outlook of the market at the beginning of each period, and then place assets under management (AUM) into the ALSI in the event where the ALSI is expected to outperform the STEFI. On the other hand, a market timer is assumed to switch into the STEFI in the event where the STEFI is expected to outperform the ALSI. Therefore, a market timer aims to hold the ALSI in a bull market and holds the STEFI in a bear market. In order to evaluate the potential gains from market timing when switching between the ALSI and the STEFI in bull and bear markets respectively, the first test evaluates the performance of four simulated investment strategies. In order to evaluate the potential gains from market timing, the Monte Carlo simulation methodology is used to evaluate the potential gains of a set of potential market timing scenarios.

The aim of the **second test** seeks to evaluate potential gains available to a market timer, as well as determine the minimum forecasting accuracy required by a market timer applying a sector timing strategy in order to outperform a buy and hold strategy in the ALSI. Similar to the first test, the Monte Carlo simulation methodology is adopted to evaluate the potential gains from a set of potential sector timing strategies illustrated in Table 4.1.

Table 4.1: Sector timing strategies

Sector Timing Strategies	Index A	Index B
Sector Timing Strategy 1	*FINI*	*INDI*
Sector Timing Strategy 2	*RESI*	*INDI*
Sector Timing Strategy 3	*RESI*	*FINI*

In order to evaluate the potential gains from sector timing on the JSE, assumptions are made regarding the method of forecasting and switching. For example, a hypothetical market timer is assumed to switch between Index A and Index B depending on whether Index A or Index B is forecasted to be the superior index for the coming period. A market timer is assumed to have different forecasting abilities when forecasting the superior indices. A market timer is assumed to move all AUM into Index A (in the event where index A is forecasted to be the superior index); or switch out of Index A and into Index B (in the event index B is forecasted to be the superior index).

Lastly, the objective of the **third test** is to determine the sensitivity of potential gains and the required forecasting accuracy to outperform a buy and hold strategy in the ALSI to changes in transaction costs and frequency of portfolio revisions respectively. A hypothetical market timer's strategy calls for monthly, quarterly and annual portfolio revisions of switches between the indices based on the predicted sector dominance for the upcoming period. In addition, the transaction costs of 1 percent and 2 percent are assumed for the value of the AUM when there is a switch from one index to another, and vice-versa.

These more realistic and less restrictive assumptions evaluated in the study regarding the frequency of portfolio revisions and transaction costs, were first implemented by Droms (1989) and Kester (1990) in their studies. It is assumed that 1 percent transaction costs represent the transaction costs that would be incurred by large institutional investors; and 2 percent transaction costs represent the transaction costs that apply to individual investors and smaller funds. Under the sensitivity analysis, the frequencies of portfolio revisions are fixed, with the transaction costs increasing from 0 percent to 1 percent; to 2 percent. By increasing transaction costs and keeping portfolio revisions fixed, the study determines the negative impact of an increase in transaction costs on potential gains. In addition, when increasing transaction costs and keeping portfolio revisions fixed the study also evaluates the required forecasting accuracy to outperform a buy and hold strategy in the ALSI. When a market timer revises his/her portfolio more frequently, higher transaction costs would be expected. Comparatively, the transaction costs incurred are fixed, with the portfolio revision frequencies increasing from annually to quarterly; to monthly. By increasing portfolio revisions and keeping transaction costs fixed, the study determines whether increasing portfolio revisions leads to an increase in potential gains taking into account the necessary increases in transaction costs.

4.5 Monte Carlo Simulations

Monte Carlo simulation is named after the Monte Carlo Casino and is a computerised mathematical technique that generates hypothetical scenarios or observations from a predetermined probability distribution (Raychaudhuri, 2008). In order to determine the effectiveness of the sector timing strategy that switches between the various sectors based on a market timer's predictions, there are several assumptions made regarding the method of forecasting and switching. Firstly, the level of forecasting accuracy is defined as the percentage of correct forecasts out of the total number of forecasts made by the market timer. Secondly, the market timer is assumed to have different abilities in predicting the various sectors in the upcoming period. Lastly, the market timer's call of the various sectors depends on a variety of factors. These factors may include, inter alia the market timer's views on the current and future state of the economy, the turning points observed from charts and indicators, the market timer's experiences, heuristics and signal indicators generated by quantitative models (Hsieh, 2013a).

Chua et al. (1987) stated that simulations of investment strategies invariably involve a non-optimal behaviour strategy as opposed to an optimal behaviour strategy. Therefore, this study is no different and does not take into account detailed multi-period analysis required for an optimal market timing strategy. This study, as most simulation studies, takes into account single period forecasts.

A market timer engaged in market timing must forecast whether Index A will outperform Index B for the upcoming period. If a market timer forecasts Index A to outperform Index B, he/she stays invested in the index. On the contrary, if the market timer predicts that Index B is to outperform Index A, he/she switches out of Index A and switches into Index B. It is assumed that a market timer with perfect forecasting ability avoids every decrease in an index and switches into an index when it increases. However, in reality it is unlikely that a market timer would be 100 percent accurate in his/her forecasting performance. Thus, the performance of an actively managed portfolio is simulated to allow for various degrees of forecasting accuracies.

In order to assess the efficacy of the market timing strategies, there are a series of index returns aside from varying degrees of assumed forecasting accuracies. The empirical tests in this study will not include results with less than 50 percent forecasting accuracies because it is considered that a market timer who achieves predictions correctly 50 percent of the time does not possess any forecasting ability, similar to tossing a coin. The Monte Carlo simulation technique is designed to evaluate the effectiveness of the market timing strategy for all permutations of prediction accuracies between the various sectors varying from 50 percent to 100 percent, with a 10 percent incremental increase similar to the sector timing simulation conducted by Hsieh (2013a).

Using Monte Carlo simulation, the study will also determine the importance of predicting Index A versus Index B. The forecasting accuracy of Index A will be fixed at 50 percent (i.e. no forecasting ability), with the forecasting accuracy of Index B increasing at 10 percent increments, starting at 50 percent, and vice-versa. The gradual improvements in potential gains when the forecasting accuracy of Index A is fixed at 50 percent are compared to the gradual improvements in potential gains when Index B is fixed at 50 percent. Therefore, if potential gains are more sensitive to the increase in Index B forecasting accuracy compared to the increases in Index A forecasting accuracy, the results will illustrate that it is more important to forecast Index B than it is to forecast Index A.

A series of Monte Carlo simulations using various combinations of index forecasting accuracies are used in order to evaluate the potential gains from perfect and less than perfect market timing. The use of simulated data as opposed to actual historical data to evaluate potential gains from market timing was first proposed by Chua et al. (1987). According to Chua et al. (1987), the number of observations from actual historical data is very limited compared to simulated data; and thus the interpretation of the results is restricted based on one set of historical events. On the other hand, simulated data allows for analysis on the potential events that may have, or yet to occur. Below is a detailed description of the probability distribution and the procedures used to generate the returns for a hypothetical market timer with various sector timing abilities.

In order to generate returns for Index A and Index B, there are two sets of 10 000 random numbers to be generated from the standard normal distribution with a mean of 0 and a standard deviation of 1. The first set of random numbers, Z_1 will be employed to estimate Index A's returns and the second set of random numbers, Z_2 will be employed to estimate Index B's returns as shown in Equation 4.1 and Equation 4.2 respectively.

$$\text{Index } A = \exp(Z_1\sigma_1 + \mu_1) - 1 \tag{4.1}$$

Where σ_1 is the standard deviation and μ_1 is the mean

$$\text{Index } B = \exp(Z_2\,\sigma_{2.1} + \mu_{2.1}) - 1 \tag{4.2}$$

Where $\sigma_{2.1}$ is the standard deviation and $\mu_{2.1}$ is the mean

$$R_t = \exp(R_m) \tag{4.3}$$

Where R_m is the average market return (ALSI)

In order to generate a market timer's returns for the various forecasting accuracies, there are 10 000 random numbers selected from the (0, 1) uniform distributions. Forecasting accuracy is defined as the probability that a market timer forecasts either Index A or Index B to be the superior index for the period, given that the market state is either Index A or Index B (i.e. PIndexA and PIndexB). In other words, forecasting accuracy is a percentage of the number of correct forecasts out of the total number of forecasts made by the market timer. The forecasting accuracies of a market timer are restricted to the following ranges:

$0.5 < \text{Index } A < 1$, indicating graduate improvements when Index A is outperforming markets and;

0.5 < Index B < 1, indicating graduate improvements when Index B is outperforming markets.

As illustrated above, the forecasting accuracy of a market timer starts at 50 percent, whereby a market timer does not possess any forecasting ability and has a 50/50 chance of making a correct prediction. However, this does not mean a market timer has a 50/50 chance of making a correct prediction as when flipping a coin. The latter case involves unconditional probability, which depends on the frequency of Index A markets versus Index B markets. The 50/50 chance of a market timer making the correct prediction is conditional on the pre-observed Index A and Index B market.

Based on the comparison between the sector indices returns, each of the 10 000 iterations is classified as either an Index A market or Index B market. A set of 10 000 normally distributed random numbers (N_1 to $N_{10\,000}$) between 0 percent and 100 percent are generated to determine whether a market timer forecasts the superior index in each of the 10 000 iterations correctly. If there is a period where Index A outperforms Index B and the assigned level of prediction accuracy for Index A is greater than the assigned random number (N_1) for the period, a hypothetical market timer is assumed to have a successful prediction and will invest in the superior index for that period. Otherwise, the market timer will invest in the inferior index that yields the lower return for the period. On the other hand, when Index B outperforms Index A in a particular period, then Index B's timing accuracy is compared to the assigned number (N_1) for the period. The hypothetical timer will invest in the superior index if the prediction accuracy for Index B is greater than the assigned random number (N_1), and vice-versa.

Since *N* represents a normally distributed random number with a mean of 50 percent, a market timer has a higher probability of earning a greater return in the iteration if he/she possesses a forecasting accuracy of greater than 50 percent in the superior sector.

The simulation design is supported by the fact that a market timer who gets their prediction correct 50 percent of the time does not possess any forecasting accuracy. The market timer's returns, with various forecasting abilities, are compared to the return from a buy and hold strategy in the ALSI. There are 10 000 iterations simulated for each variation of index forecasting accuracies. In each of the 10 000 iterations simulated the forecasting accuracies, the average returns for the periods, standard deviation for the periods, potential gains, number of switches and the win/loss ratio are estimated with their average values computed to provide an indication of the effectiveness of the strategies under each permutation.

The overall expected return for any given degree of predicted accuracy is simply the arithmetic values of the returns in the 10 000 iterations shown in equation 4.4:

$$\mu\ (overall\ expected\ return) = \sum_i p_i \mu_i \qquad (4.4)$$

Where p_i = the probability of outcome *i*, and μ_i = the return for *i*.

Standard deviation is the standard deviations of the returns in the 10 000 iterations shown in Equation 5:

$$\sigma^2 = \sum_i \rho_i \sigma_i^2 + \sum_i \rho_i (\mu_i - \mu)^2 \quad (4.5)$$

Where σ = the overall standard deviation of the return, p_i = probability of the scenario and σ_i = standard deviation of return for outcome *i*.

Potential gains are measured as the return yielded by the market timing strategy in excess of the ALSI returns, and the effectiveness of the market timing strategy can be determined by evaluating the minimum forecasting accuracy required to yield the potential gains. The win/loss ratio measures the number of periods that the simulated returns are greater than the ALSI returns relative to the number of periods where the simulated strategy's returns are less than the ALSI returns. In other words, the win/loss ratio indicates the probability that a market timing strategy will yield greater returns than that of a buy and hold strategy in the ALSI.

A win/loss ratio provides greater insight than a standard median estimate, as it does not take into account the numerous situations in which the buy and hold investor and the market timer are holding the ALSI. A win/loss ratio of one or more indicates that a market timer has a 50 percent probability or more of outperforming a buy and hold strategy in the ALSI. On the other hand, a win/loss ratio of less than one illustrates that there is less than 50 percent chance that a market timer will outperform a buy and hold strategy in the ALSI. Therefore, a market timing strategy is only effective when the win/loss ratio is greater than one.

4.6 Potential Biases

The biases that may possibly influence the research outcomes include survivorship bias, look-ahead bias, data snooping bias and time-period bias. When the data availability leads to certain assets being excluded from analysis, it is called sample selection bias. An example of sample selection bias is called survivorship bias. Survivorship bias occurs when researchers use a database that has existing historical information and exclude data that no longer exists (Gilbert and Strugnell, 2010). Survivorship bias is not introduced in this research since the data employed only includes certain indices over the period from 1 January 2002 to 31 December 2016, and the index performance is calculated based on the actual membership of the index at each point in time.

According to Baquero, Horst and Verbeek (2005), look-ahead bias refers to use of data in a study that was not previously available or known during the examination period being tested, usually resulting in an upward shift of the results. Look-ahead bias may lead to inaccurate results for the study. An example of look-ahead bias is tests of trading rules that employ security market returns and balance sheet data and must account for look-ahead bias. With such tests, the book value per share of a company is commonly used to determine the price to book (P/B) ratio. Even though the market price of a security is available for all market participants at the same point in time; the fiscal year-end book equity per share might not be available to the public until a later stage. This study will not be affected by look-ahead bias as the index data is provided timeously in the public domain. This is normally done with only a 15 minute delay.

According to Barret and Brodeski (2006), research is subject to time-period bias if it is based on a period that may influence the results as time-period specific. A short time series, such as this study is likely to give period specific results that may differ to results when using a longer time-period. A longer time series may give a more accurate depiction of true investment performance. However, its disadvantage lies in the potential for a structural change occurring during the period that would result in two different return distributions. The time-period for this study is specifically used after the reclassification of the JSE, which occurred in March 2000.

This study employs historical data for the period 1 January 2002 to 31 December 2016, which means time-period bias could possibly influence research outcomes. However, the inclusion of the index performance prior to the major restructurings that took place before 2002 will be irrelevant in a practical sense. In addition, the examination period covers material structural changes such as the 2008 global financial crisis and the 2009 to 2012 European debt crises in order to mitigate the time period bias.

Data mining or data snooping refers to errors that occur due to the misuse of data. Data mining is continuously going through the same data until there are favourable results (DeFusco, McLeavey, Pinto and Runkle, 2004). A typical example would involve determining statistical significance. A statistical significance would be set, which represents the probability of rejecting a hypothesis when it is in fact correct.

Since it is undesirable to reject the true hypothesis, a researcher may set significant levels that are relatively small such as 5 percent. This study will not be subject to data mining or data snooping as the study attempts to include an exhaustive number of statistical measures to evaluate the potential benefits of market timing compared to prior studies.

5

POTENTIAL GAINS FROM BULL AND BEAR MARKET TIMING

5.1 Introduction

Empirical evidence from previous studies conducted on global markets such as Sharpe (1975); Chua, Woodward and To (1987); Kester (1990); Dichtl, Drobetz and Kryzanowski (2016); Khoklov (2016) as well as studies conducted on local markets such as Firer, Sandler and Ward (1992), and De Chassart and Firer (2004) suggest that very few market timers yield greater average returns than that of a buy and hold strategy when switching between bull and bear markets.

Empirical studies also illustrated that a market timer switching between bull and bear markets requires a joint forecasting accuracy of 70 percent or above, should not even attempt to time the market. Moreover, the empirical evidence provided by Chua et al. (1987), Khokhlov (2016) in developed markets and De Chassart and Firer (2004) in developing illustrates that it is more important to possess the ability of forecasting bull markets correctly than it is to forecast bear markets correctly.

The empirical studies which evaluated the potential gains available to market timers were based on hypothetical market timing strategies. This chapter illustrates the potential gains available to a market timer who possesses perfect forecasting accuracy when switching between the ALSI and the STEFI in bull and bear markets on the JSE. This chapter also provides results for a market timer who attempts to time the market but at times fail, also known as imperfect market timing.

It is important to note that this study looks at the potential gains, therefore the objective of the chapter is to assess the probability of a market timing strategy outperforming a buy and hold strategy, based on simulated results, as opposed to evaluating actual gains from a particular market timing strategy. This chapter also seeks to determine the sensitivity of potential gains to changes in various transaction costs and portfolio revision frequencies. It is also important to note that the quarterly and monthly results, for both perfect market timing and less than perfect market timing, have been annualised for comparative purposes.

5.2 Potential Gains from Perfect Market Timing

In order to assess the potential gains available to a market timer who possesses perfect foresight, a market timer is assumed to have perfect forecasting accuracy when switching between two different markets. It is assumed that if a bull market is anticipated, a market timer is invested in the FTSE/JSE Top 40 (ALSI). On the other hand, if a bear market is anticipated, a market timer is invested in the STEFI Call Deposit Index (STEFI). The hypothetical market timer is assumed to call every market turn with perfect forecasting accuracy. When a market timer sees a change in the market great enough to cover transaction costs, he/she will move all assets under management (AUM) into the ALSI in the event where the ALSI is expected to outperform the STEFI, or switch into the STEFI in the event where the STEFI is expected to outperform the ALSI.

A market timer is assumed to assess the outlook of the market at the beginning of each period, and then place AUM either in the ALSI or in the STEFI (risk free asset) for the remainder of the period. Each period can be categorised as either a bull or bear market period. For a bull market period, the total return of the ALSI is greater than that of the STEFI. To the contrary, a bear market period is one where the STEFI returns exceed that of the ALSI. Therefore, successful market timing implies holding the ALSI in a bull market and holding the STEFI in a bear market.

In order to evaluate the potential gains from perfect market timing when switching between bull and bear markets, the study looks at three simulated investment strategies. The first simulated strategy involves holding cash equivalents, whereby an investor solely invests in the STEFI. The second simulated strategy involves solely investing in the ALSI. The third simulated strategy involves market timing between bull and bear markets, where a market timer possesses perfect forecasting accuracy. For each period, a perfect market timer is assumed to have the ability to place capital in the highest investment medium (ALSI or STEFI) for the period.

The market timing strategy assumes no withdrawals or additions into the investment. In order to assess the returns for the strategies, there are two performance measures used for each strategy, namely the average return and standard deviation. The average return is simply the arithmetic average of the periodic returns. The standard deviation of the return measures the extent to which actual returns deviate from the average.

5.2.1 Simulated Buy and Hold Strategies

Table 5.1 below shows the historical monthly, quarterly and annual returns and standard deviations of the ALSI versus the STEFI over the period from 31 January 2002 to 31 December 2016. As illustrated in Table 5.1 below, the ALSI generates greater annual returns than that of the STEFI over the examination period. The historical results illustrate that the annual return for an investor holding the STEFI is 8.26 percent with a standard deviation of 2.54 percent. On the contrary, an investor holding the ALSI yields an annual return of 17.04 percent with a standard deviation of 20.59 percent. Table 5.1 below illustrates that an investor holding the ALSI yields more than twice the annual return of an investor holding the STEFI, however, with much greater variability of returns.

Table 5.1: Historical Buy and Hold Performance: STEFI and ALSI

	Asset Classes	
	STEFI	*ALSI*
Monthly		
Average Returns	0.61%	0.94%
Standard Deviation	0.20%	4.90%
Quarterly		
Average Returns	2.04%	3.39%
Standard Deviation	0.59%	9.86%
Annual		
Average Returns	8.26%	17.04%
Standard Deviation	2.54%	20.59%

Table 5.2 below illustrates the simulated buy and hold returns, based on Equation 5 in Section 4.4.1.2 for the ALSI versus the STEFI as opposed to Table 5.1, which illustrates the actual (historical) returns. Furthermore, Table 5.2 also illustrates the standard deviations of returns, which are calculated using Equation 6 in Section 4.4.1.2. As illustrated by both Table 5.1 and Table 5.2, the simulated results do not differ much from the actual returns and standard deviations generated by the ALSI and the STEFI. As expected, the results in both Table 5.1 and Table 5.2 illustrates that an investor solely invested in the STEFI, yielded the lowest average return with the lowest variability of return, as indicated by the standard deviations. The second strategy solely invested in the ALSI yields a greater return on average, however, with much greater variability of return.

Table 5.2: Overall Simulated Buy and Hold Performance: STEFI and ALSI

	Asset Classes	
	STEFI	***ALSI***
Monthly		
Average Returns	0.61%	0.99%
Standard Deviation	0.20%	4.87%
Quarterly		
Average Returns	2.05%	3.43%
Standard Deviation	0.58%	9.95%
Annual		
Average Returns	8.21%	16.93%
Standard Deviation	2.52%	20.80%

5.2.2 Simulated Perfect Market Timing Strategy

Table 5.3 below summarises the simulated results for a hypothetical market timer with perfect forecasting accuracy who revises his/her strategy on a monthly, quarterly and annual basis with different assumptions for the transaction costs incurred (2 percent, 1 percent and 0 percent) respectively. It is important to note that the simulated buy and hold strategy does not rebalance; therefore the table only indicates the annual average return and standard deviation of return. In order to demonstrate the effect transaction costs have on average returns and the standard deviation of returns when switching between markets, it is assumed that a market timer incurs a cost of 2 percent or 1 percent respectively of the value of the AUM, every time there is a switch from the ALSI to the STEFI and vice versa.

In addition to the average returns and standard deviations to the perfect market timing strategies, Table 5.3 below illustrates the simulated potential gains available to a hypothetical market timer with perfect forecasting accuracy who revises their strategy on a monthly, quarterly and annual basis with different assumptions for the transaction costs incurred (2 percent, 1 percent and 0 percent) respectively. As previously mentioned in Section 3.1, potential gains from market timing is defined as the incremental returns of the market timing strategy in excess of a buy and hold strategy in the ALSI.

Table 5.3: Overall Simulated Performances: Perfect Market Timing Strategy

Frequency of portfolio revisions	Simulated Buy and Hold strategy	Perfect Market Timing with the various Transaction Costs		
		0%	1%	2%
Monthly				
Average Returns	-	41.09%	34.53%	27.35%
Standard Deviation	-	10.14%	10.36%	10.84%
Potential Gains	-	24.16%	17.60%	10.42%
Quarterly				
Average Returns	-	30.05%	27.61%	25.81%
Standard Deviation	-	12.38%	12.48%	12.66%
Potential Gains	-	13.12%	10.68%	8.88%
Annual				
Average returns	16.93%	22.68%	22.33%	21.78%
Standard Deviation	20.80%	14.94%	15.05%	15.17%
Potential gains	-	5.75%	5.40%	4.85%

Note: *The quarterly and monthly results in Table 5.3 above have been annualised for comparative purposes*

As illustrated in Table 5.3 above, a buy and hold strategy in the ALSI yielded an annual return of 16.93 percent and a standard deviation of 20.80 percent. Comparatively, a perfect market timer who revised his/her portfolio annually and did not incur transaction costs would have yielded an average return of 22.68 percent with a standard deviation of 14.94 percent. Moreover, the overall simulated results reveal that if a market timer had perfect forecasting accuracy when switching between bull and bear markets, he/she would have significantly improved on the buy and hold returns in the ALSI. Section 5.2.2.1 below will evaluate the sensitivity of potential gains to monthly, quarterly and annual portfolio revision frequencies. On the other hand, Section 5.2.2.2 will evaluate the sensitivity of potential gains to various transaction costs (0 percent, 1 percent and 2 percent).

Sensitivity analysis: the effect of portfolio revision frequency

As illustrated in Table 5.3 above, if a market timer with perfect forecasting accuracy had revised their portfolio annually with no transaction costs, he/she would have yielded an average annual return of 22.68 percent with a standard deviation of 14.94 percent. This implies that the market timer would have yielded potential gains of 5.75 percent above that of a buy and hold strategy in the ALSI, with a lower standard deviation. The standard deviations for the perfect timing strategy and buy and hold strategy are 14.94 percent and 20.80 percent respectively.

The results also indicate that if a market timer had revised their portfolio on a monthly basis, ignoring transaction costs, he/she would have realised an annual mean return of 41.09 percent with a standard deviation of 10.14 percent. On the other hand, a perfect market timing strategy with least rebalancing frequency (annual), a market timer would have only yielded a return of 22.68 percent and with a standard deviation of 14.94 percent, as previously illustrated. This implies that a market timer, who revises his/her portfolio on a monthly basis, would have yielded almost twice the return of a market timer who revises his/her portfolio annually, with less variability of return. Additionally, a market timer who revised his/her portfolio on a monthly basis and incurred no transaction costs would have improved upon a buy and hold strategy's average returns by an impressive 24.16 percent per annum.

Results reveal that if a market timer revises his/her portfolio more often, ignoring transaction costs, he/she will yield greater potential gains. These results concur with Droms (1987); Kester's (1990); Hsieh (2013a); Dichtl et al. (2016), and Khokhlov (2016) in developed markets; as well as Ward and Terblanche (2009) in developing markets findings regarding portfolio revisions which state that if a market timer revises his/her portfolio more often, they will yield greater potential gains. It is evident that a market timer, who possesses perfect forecasting accuracy when switching between the ALSI and the STEFI on the JSE, would have earned substantial returns with less variability than that of a buy and hold strategy.

In respect to global markets, the results also concur with Shape's (1975), Shilling (1992), Hsieh (2013a) and Khoklov (2016) studies. According to Sharpe (1975), a perfect market timing strategy has two advantages; firstly, the strategy yields greater returns on average, and secondly has less risk compared to that of a buy and hold strategy. These results are further supported by De Chassart and Firer (2004) and Ward and Terblanche (2009) studies in the local market. De Chassart and Firer (2004) and Ward and Terblanche (2009) stated that a market timer who switched between bull and bear markets received significant returns relative to a buy and hold strategy, provided that the market timer had perfect forecasting accuracy. However, it is important to note that transaction costs have not been taken into account thus far.

Sensitivity analysis: the effect of transaction costs

When taking into account transaction costs, a market timer who perfectly switched between the ALSI and the STEFI annually and incurred transaction costs of 1 percent would have yielded on average an annual return of 22.33 percent with a standard deviation of 15.05 percent. Additionally, if a market timer incurred 2 percent transaction costs their average return would have reduced to 21.78 percent per annum with a standard deviation of 15.17 percent. As previously illustrated, a perfect market timer who switched between the ALSI and the STEFI would have yielded an annual average return of 5.75 percent more than a buy and hold strategy, provided that the market timer revised their portfolio annually and did not incur transaction costs. However, a 1 percent transaction cost would have decreased the potential gains to 5.40 percent per annum and a 2 percent transaction cost would have further decreased the potential gains to 4.85 percent per annum.

When taking into account transaction costs of 1 percent or 2 percent for a perfect market timer who revised their portfolio quarterly, his/her annual average returns would have been 27.61 percent and 25.81 percent respectively. A market timer who revised their portfolio on a quarterly basis, without any transaction costs being incurred, he/she would have outperformed a buy and hold strategy by 13.12 percent with a standard deviation of 12.38 percent. However, if a market timer incurred transaction costs of 1 percent and 2 percent, he/she would have yielded potential gains of 10.68 percent and 8.88 percent respectively.

A market timer who revised their portfolio monthly and incurred transaction costs of 1 percent or 2 percent would have reduced their average returns to 34.53 percent and 27.35 percent respectively, from 41.09 percent (no transaction costs). Similarly, 1 percent and 2 percent transaction costs incurred by a market timer who revises their portfolio on a monthly basis would have decreased the market timer's potential gains to 17.60 percent and 10.42 percent respectively, from 24.16 percent (no transaction costs).

In summary, when comparing the loss of potential gains due to increases in transaction costs; the results reveal that for monthly market timers, an increase in transaction costs from 0 percent to the maximum assumption of 2 percent, the potential gains decreases from 24.16 percent to 10.42 percent. On the other hand, increasing transaction costs from 0 percent to 2 percent for a quarterly market timer, the potential gains decrease from 13.12 percent to 8.88 percent. Furthermore, when increasing the transaction costs from 0 percent to 2 percent for an annual market timer, the potential gains decreases from 5.75 percent to 4.85 percent. The negative impact of transaction costs on potential gains is greater for market timers that revise their portfolio more frequently as more transaction costs are incurred. Even though the potential gains are greater for a market timer who increases their portfolio frequency, the potential for loss is also greater due to the transaction costs that may be incurred. Therefore, there is greater risk of a market timer to underperform a buy and hold strategy if he/she incurs transaction costs of 2 percent and revises their portfolio more frequently, even if he/she possesses perfect forecasting accuracy.

The above results support developed markets findings by Droms (1989); Kester (1990); Hsieh (2013a); Dichtl et al. (2016) and Khokhlov (2016) in that a market timer achieves greater returns with lower transaction costs when switching between markets, and the more frequently he/she revises their portfolio. It is evident that under all three portfolio revision periods, a market timer with perfect forecasting accuracy yields a greater return with less variability than that of an investor who buys-and-holds the ALSI even when taking into account transaction costs of 1 and 2 percent respectively. According to Sharpe (1975), when the value of stocks decrease in prolonged bear markets, investors use market timing strategies to avoid further losses in the value of their stocks and portfolios. Therefore, market timers who had superior forecasting accuracy by moving into the STEFI during the real estate bubble, which subsequently led to the 2008 global financial crisis, avoided losses while other investors may have seen declines in the market values of their stocks and portfolios.

5.3 Potential Gains from Less than Perfect Timing

As stated in previous empirical studies, it is not possible for a market timer to possess perfect forecasting ability. Therefore, this study evaluates the potential gains for market timers who attempt to time the market when switching between bull and bear markets and occasionally fail, using the bivariate normal distribution model described in Section 4.4.5. At the beginning of each period, a market timer is assumed to forecast a bull or bear market, leaving his/her funds unchanged or move his/her funds to an alternative investment medium, depending on his/her forecast. Similarly to perfect timing, funds are assumed to be invested in either the ALSI or the STEFI.

A series of Monte Carlo simulations are implemented, using various combinations of the ALSI and the STEFI forecasting accuracies in order to evaluate the potential gains from less than perfect market timing strategies. Due to the fact that market timers do not have perfect foresight, it is more appropriate to make use of simulation results that assume imperfect forecasts, (Chua et al., 1987 and Hsieh, 2013a). Similar to perfect timing accuracy, the potential gains of market timers with various forecasting accuracies are evaluated by comparing them to the return of a buy and hold strategy in the ALSI. It is important to note that a negative mean return does not necessarily imply that a market timer has zero probability of outperforming a buy and hold strategy. This however does imply that the probability of outperforming a buy and hold strategy is highly unlikely.

5.3.1 Annual Revision Frequency

As previously illustrated, no market timer has perfect forecasting accuracy when timing the market; therefore, simulation results assuming imperfect forecasts are more relevant. Table 5.4 below summarises results of a market timer who revises his/her portfolio annually and incurs no transaction costs, when switching between bull and bear markets on the JSE. The rows in Table 5.4 represent the potential gains available to a market timer with the same accuracy in forecasting bear markets (i.e. 50 percent bear forecasting accuracy) but with differing accuracies in forecasting bull markets, from 50 percent to 100 percent. Similarly, each column represents the potential gains available to a market timer with the same accuracy in forecasting bull markets but with differing accuracies in forecasting bear markets, from 50 percent to 100 percent.

Table 5.4: Imperfect Annual Market Timing Results (no transaction costs)

Bear Market Accuracy (%)		Bull Market Accuracy (%)					
		50	60	70	80	90	100
50	Mean(%)	-2.87%	-1.67%	-0.26%	0.48%	1.79%	2.86%
	Std Dev (%)	15.31%	14.59%	13.09%	11.86%	9.85%	8.02%
	Win/Loss	0.67	0.78	1.09	1.66	3.06	∞
60	Mean(%)	-2.16%	-1.02%	-0.04%	1.55%	2.54%	3.55%
	Std Dev (%)	16.18%	14.94%	13.51%	12.16%	10.62%	8.51%
	Win/Loss	0.77	1.58	2.69	3.74	4.11	∞
70	Mean(%)	-1.53%	-0.53%	0.84%	1.74%	3.14%	4.02%
	Std Dev (%)	16.05%	15.19%	14.36%	12.79%	11.46%	9.18%
	Win/Loss	0.96	2.12	3.54	4.69	5.10	∞
80	Mean(%)	-0.95%	0.02%	1.07%	2.54%	3.69%	4.75%
	Std Dev (%)	16.86%	15.70%	14.62%	13.07%	11.73%	9.56%
	Win/Loss	1.03	2.63	3.47	0.89	5.21	∞
90	Mean(%)	-0.49%	0.63%	1.93%	2.99%	4.08%	5.29%
	Std Dev (%)	17.15%	15.93%	15.08%	13.58%	12.27%	10.12%
	Win/Loss	1.19	2.87	3.64	4.87	5.67	∞
100	Mean(%)	0.29%	1.22%	2.75%	3.63%	4.73%	5.75%
	Std Dev (%)	17.66%	16.35%	15.44%	13.93%	12.21%	10.45%
	Win/Loss	1.31	1.70	2.17	3.15	6.54	∞

It is important to note that a market timer who possesses a forecasting accuracy of 50 percent has no predictive ability and will make a bad prediction as often as a good prediction. Moreover, Sharpe (1975) stated that a market timer with 50 percent forecasting accuracy will not only make mistakes, but will predict bad periods too often. There are three measures for measuring the performance of a market timer which include the potential gains, standard deviation of the potential gains and the win/loss ratio. The win/loss ratio shows the number of successful switches (resulting in higher returns as compared to that of a buy and hold strategy) to unsuccessful switches (resulting in negative potential gains). In other words, the win/loss ratio indicates the probability a market timing strategy will outperform a buy and hold strategy.

Chua, et al. (1987) and Hsieh (2013a) stated that the ratio produces more useful information than a standard median estimate, as it ignores the numerous situations in which the buy and hold investor and the market timer are holding the ALSI. A win/loss ratio of less than one illustrates that there is less than 50 percent chance that a market timer will outperform a buy and hold strategy. Similarly, a win/loss ratio of greater than one indicates that there is a greater than 50 percent chance that a market timer will outperform a buy and hold strategy.

The first cell in Table 5.4 indicates how much a market timer with no forecasting accuracy in both bull and bear markets (i.e. 50 percent predictive ability in both the ALSI and the STEFI) would gain or lose from following a market timing strategy. The simulated results illustrate that a market timer with no forecasting ability who revised their portfolio annually, ignoring transaction costs, would have decreased their returns by an average of 2.87 percent per annum. Additionally, the win/loss ratio of 0.67 indicates that the probability of a market timer benefitting from market timing activities is approximately 40 percent (0.67/ (1+0.67)). The last cell (i.e. 100 percent predictive ability in both the ALSI and the STEFI) shows the potential gains for a market timer who has perfect forecasting accuracy. Simulation results show that a market timer with perfect forecasting accuracy would have yielded potential gains of 5.75 percent above that of a buy and hold strategy in the ALSI, with a standard deviation of 10.45 percent.

A market timer who revises their portfolio annually requires a joint forecasting accuracy of 70 percent in both the ALSI and the STEFI in order to yield potential gains similar to Sharpe's (1975) study in the U.S. market and Ward's and Terblanche's (2009) study in the South African market. However, Hallerbach (2014) and Dichtl et al. (2016) studies conducted on global markets stated that a market timer requires a joint forecasting accuracy of approximately 60 percent. A market timer who revises their portfolio on an annual basis may also possess the following accuracies in order to yield potential gains; 80 percent bull market accuracy and 50 percent bear market accuracy, 60 percent bull market accuracy and 80 percent bear market accuracy and 50 percent bull market accuracy and 100 percent bear market accuracy.

Assuming a market timer has no bear forecasting accuracy (i.e. 50 percent bear forecasting accuracy), the win/loss ratio rises to more than 1 when the accuracy in forecasting bull markets is greater than or equal to 70 percent. This implies that the market timer who has no bear forecasting accuracy and a bull market forecasting accuracy of greater than or equal to 70 percent, has a 50 percent probability (or more) of outperforming the returns yielded by a buy and hold strategy every time he/she switches (Chua et al., 1987 and Hsieh, 2013a). On the other hand, assuming that a market timer has no bull forecasting accuracy (i.e. 50 percent bull forecasting accuracy), the win/loss ratio is greater than 1 when the accuracy in forecasting bear markets is greater than or equal to 80 percent. This implies that a market timer who possesses a bull market forecasting accuracy of 50 percent and a bear market forecasting accuracy of greater than or equal to 80 percent, has a 50 percent probability (or more) of outperforming a buy and hold strategy.

In order to illustrate the negative impact of transaction costs on potential gains, the potential gains of a market timer who revises their portfolio annually and does not incur transaction costs are compared to the potential gains derived under the maximum assumption of 2 percent transaction costs. The assumptions of 1 percent transaction costs are not included in this chapter; however, they are illustrated in Appendix A. Table 5.5 below illustrates the results for a market timer who revises their portfolio annually and incurs transaction costs of 2 percent.

The yellow highlighted blocks illustrate the potential gains that were available to a market timer when transaction costs are not taken into account as illustrated in Table 5.4. The red blocks indicate the potential gains available to a market timer when 2 percent transaction costs are taken into account. As illustrated in Table 5.5, the forecasting accuracy required to yield potential gains increases roughly by 10 percentage points when moving from 0 percent to 2 percent transaction costs when compared to Table 5.4. Results also reveal that when taking into account transaction costs of 2 percent, the potential gains available to a market timer decreases on average by 1 percentage point.

Table 5.5: Imperfect Annual Market Timing Results (2 percent transaction costs)

Bear Market Accuracy (%)		**Bull Market Accuracy (%)**					
		50	60	70	80	90	100
50	Mean(%)	-3.98%	-2.59%	-1.57%	-0.24%	0.64%	1.95%
	Std Dev (%)	15.21%	14.04%	13.04%	12.11%	10.05%	7.85%
	Win/Loss	0.34	0.38	0.39	0.41	0.47	0.65
60	Mean(%)	-3.22%	-2.03%	-0.71%	0.25%	1.47%	2.58%
	Std Dev (%)	15.54%	14.85%	13.52%	12.36%	10.46%	8.52%
	Win/Loss	0.42	0.46	0.51	0.55	0.59	0.82
70	Mean(%)	-2.54%	-1.22%	-0.30%	0.84%	2.04%	3.21%
	Std Dev (%)	16.21%	15.32%	13.85%	12.62%	10.97%	9.11%
	Win/Loss	0.51	0.57	0.63	0.69	0.71	0.91
80	Mean(%)	-1.99%	-0.92%	0.38%	1.45%	2.55%	3.62%
	Std Dev (%)	16.93%	15.59%	14.65%	13.28%	11.69%	9.69%
	Win/Loss	0.58	0.62	0.67	0.74	0.87	1.03
90	Mean(%)	-1.38%	-0.11%	0.84%	1.94%	3.19%	4.39%
	Std Dev (%)	17.07%	15.99%	15.10%	13.47%	12.17%	10.03%
	Win/Loss	0.72	0.78	0.85	0.99	1.07	1.25
100	Mean(%)	-0.95%	0.48%	1.45%	2.75%	3.91%	4.85%
	Std Dev (%)	17.59%	16.82%	15.17%	14.01%	12.48%	10.19%
	Win/Loss	0.85	0.89	1.01	1.12	1.23	1.43

As illustrated in Table 5.5 above, the joint forecasting accuracy required when switching between the ALSI and the STEFI increases to 80 percent in order to yield positive gains. Additionally, the other forecasting accuracies required to yield potential gains are; 90 percent bull market accuracy and 50 percent bear market accuracy, 80 percent bull market accuracy and 70 percent bear market accuracy and 60 percent bull market accuracy and 100 percent bear market accuracy. It is evident that just by evaluating annual portfolio revisions and taking into account transaction costs of 2 percent, a market timer requires greater forecasting accuracy to yield potential gains.

If a market timer does not possess any bear forecasting ability, it is impossible to raise the win/loss ratio above 1, as the highest attainable win/loss ratio is 0.65 (100 percent bull forecasting accuracy and 50 percent bear forecasting accuracy). Similarly, if a market timer does not possess any bull forecasting ability, the highest attainable win/loss ratio is 0.85. This implies that the probability of yielding potential gains is low when a market timer does not possess any bear forecasting ability and 100 percent bull forecasting accuracy and vice versa. In order to obtain an above average probability of outperforming a buy and hold strategy, a market timer requires an extremely high forecasting accuracy in both bull and bear markets. Results in Table 5.5 reveal that the win/loss ratio is greater than 1 when a market a joint forecasting accuracy of 90 percent in both the ALSI and the STEFI. In addition, the win/loss ratio is also greater than 1 when a market timer has a 100 percent bull forecasting accuracy and 100 percent bear forecasting accuracy; or a 100 percent bear forecasting accuracy and 70 percent bull forecasting accuracy.

The results in Table 5.5 also illustrate that it is more important to forecast bull markets than bear markets. This is indicated by the negative potential gains along the rows in Table 5.5. Assuming no bear forecasting ability, a market timer who possesses 50 percent bull forecasting accuracy underperforms a buy and hold strategy by 3.98 percent and a market timer who possesses 100 percent bull forecasting accuracy yields potential gains of 1.95 percent. Comparatively, assuming no bull forecasting ability, a market timer who possesses 50 percent bear forecasting accuracy underperforms a buy and hold strategy by 3.98 percent and a market timer possesses 100 percent bear forecasting accuracy underperforms a buy and hold strategy by 0.95 percent.

When examining Table 5.4 and Table 5.5, it is evident that transaction costs have a direct relationship with forecasting accuracy. On the other hand, transaction costs have an indirect relationship with potential gains and the probability of outperforming a buy and hold strategy. This implies that, an increase in transaction costs increases the forecasting accuracy required to achieve potential gains. Moreover, an increase in transaction costs reduces potential gains available to a market timer and decreases the probability that a market timer will outperform a buy and hold strategy.

5.3.2 Quarterly Revision Frequency

The results for a market timer who revises their portfolio quarterly and incurs no transaction costs are illustrated in Table 5.6 below. Results indicate that a market timer requires a joint forecasting accuracy of 60 percent in both the ALSI and the STEFI as opposed to 70 percent joint forecasting accuracy required for annual timing to yield potential gains, when transaction costs are not taken into account. The win/loss ratio increases to above 1 when a market timer has a joint forecasting accuracy of 60 percent in both the ALSI and the STEFI. If a market timer does not have any forecasting ability in either the STEFI or the ALSI, the win/loss ratio is greater than 1 when a market timer has a forecasting accuracy of 70 percent in either the ALSI or the STEFI, respectively.

Table 5.6: Imperfect Quarterly Market Timing Results (no transaction costs)

Bear Market Accuracy (%)		Bull Market Accuracy (%)					
		50	60	70	80	90	100
50	Mean(%)	-2.50%	-0.72%	0.84%	2.63%	4.39%	6.26%
	Std Dev (%)	13.16%	12.00%	11.20%	10.38%	9.18%	7.48%
	Win/Loss	0.82	0.96	1.05	1.97	2.06	∞
60	Mean(%)	-1.21%	0.68%	2.10%	3.69%	5.72%	7.69%
	Std Dev (%)	13.64%	12.80%	12.00%	10.74%	9.82%	8.42%
	Win/Loss	0.95	1.56	2.67	3.97	4.88	∞
70	Mean(%)	0.04%	1.17%	3.61%	5.39%	6.68%	8.67%
	Std Dev (%)	14.32%	13.18%	12.48%	11.26%	10.40%	8.84%
	Win/Loss	1.14	2.55	3.89	4.57	5.44	∞
80	Mean(%)	1.25%	3.12%	4.97%	6.64%	8.41%	9.95%
	Std Dev (%)	14.50%	13.84%	12.80%	11.66%	10.60%	9.06%
	Win/Loss	1.28	2.39	4.28	5.37	6.70	∞
90	Mean(%)	2.26%	3.81%	5.97%	7.73%	9.31%	11.29%
	Std Dev (%)	15.04%	14.12%	13.28%	12.20%	10.92%	9.54%
	Win/Loss	1.39	2.88	4.54	5.63	6.90	∞
100	Mean(%)	3.81%	5.59%	7.06%	9.05%	10.86%	13.12%
	Std Dev (%)	15.10%	14.50%	13.32%	12.36%	11.30%	9.72%
	Win/Loss	1.65	1.97	2.71	4.14	7.90	∞

In Appendix A, Table 2 illustrates that when taking into account transaction costs of 1 percent and revises are made to the portfolio on a quarterly basis, the joint forecasting accuracy in both the ALSI and the STEFI increases to 70 percent. It is evident that by increasing the frequency of portfolio revisions from annually to quarterly, the forecasting accuracy required to yield potential gains decreased, however, increasing transaction costs does not only decrease potential gains but also increases the forecasting accuracy required.

Table 5.7 below illustrates the results for a market timer who revises their portfolio on a quarterly basis and incurs 2 percent transaction costs. The results show that a market timer requires a joint forecasting accuracy of 80 percent in both the ALSI and the STEFI to yield potential gains, which is similar to the joint forecasting accuracy required by a market timer who revises his/her portfolio annually with 2 percent transaction costs. The win/loss ratio is greater than 1 when the joint forecasting accuracy is 90 percent in both the ALSI and the STEFI, which is also similar to that of annual market timing with 2 percent transaction costs. The results from Table 5.7 are similar to that of Table 5.5, with the only difference being that a market timer yields greater potential gains if he/she revises his/her portfolio quarterly rather than annually, when taking into account transaction costs of 2 percent.

Table 5.7: Imperfect Quarterly Market Timing Results (2 percent transaction costs)

Bear Market Accuracy (%)		Bull Market Accuracy (%)					
		50	60	70	80	90	100
50	Mean(%)	-6.60%	-4.97%	-3.07%	-1.33%	0.24%	2.22%
	Std Dev (%)	13.38%	12.20%	11.50%	10.14%	9.14%	7.64%
	Win/Loss	0.36	0.38	0.40	0.44	0.47	0.51
60	Mean(%)	-5.09%	-3.48%	-1.57%	0.20%	1.69%	3.24%
	Std Dev (%)	13.38%	13.00%	11.74%	10.78%	9.60%	8.20%
	Win/Loss	0.44	0.46	0.48	0.49	0.51	0.52
70	Mean(%)	-4.23%	-2.02%	-0.72%	0.72%	2.83%	4.68%
	Std Dev (%)	13.96%	13.12%	12.28%	11.20%	10.10%	8.96%
	Win/Loss	0.54	0.58	0.60	0.65	0.69	0.72
80	Mean(%)	-2.99%	-1.29%	0.68%	2.54%	4.23%	6.05%
	Std Dev (%)	14.44%	13.66%	13.02%	11.58%	10.50%	9.12%
	Win/Loss	0.65	0.67	0.69	0.74	0.75	0.78
90	Mean(%)	-1.41%	-0.28%	2.14%	2.99%	5.47%	7.14%
	Std Dev (%)	14.58%	13.94%	12.92%	12.16%	10.70%	9.72%
	Win/Loss	0.77	0.85	0.90	0.93	1.05	1.16
100	Mean(%)	-0.44%	1.49%	3.07%	4.80%	6.64%	8.88%
	Std Dev (%)	15.22%	14.52%	13.42%	12.50%	11.02%	9.54%
	Win/Loss	0.89	0.98	1.06	1.13	1.02	1.39

The results reveal that the potential gains available to a market timer with a joint forecasting accuracy of 80 percent in both the ALSI and the STEFI and who revises their portfolio on an annual basis, incurring 2 percent transaction costs, is on average 1.45 percent per annum. On the contrary, a market timer with 80 percent joint forecasting accuracy in both the ALSI and the STEFI revising their portfolio on a quarterly basis and incurring transaction costs of 2 percent would yield potential gains on average of 2.54 percent per annum. The greater potential gains may be attributed to a market timer revising their portfolio more frequently, allowing them to capture more of the bull markets whilst simultaneously allowing the market timer to avoid the bear markets.

When taking into account transaction costs of 2 percent and quarterly portfolio revisions, the results also reveal that the forecasting accuracy required by a market timer to yield potential gains increases on average by 30 percentage points. On the contrary, increasing transaction costs by 2 percent for an annual market timer would increase the forecasting accuracy by 10 percentage points on average. This implies that with greater revision frequency, transaction costs are incurred on a greater number of transactions, thus reducing the overall portfolio return. Consequently, this causes the required forecasting accuracy to outperform a buy and hold strategy to increase.

5.3.3 Monthly Revision Frequency

Table 5.8 below summarises the simulation results for a market timer who revises their portfolio on a monthly basis, without incurring any transaction costs. A market timer requires a joint forecasting accuracy of 60 percent in both the ALSI and the STEFI to yield potential gains. Additionally, the potential gains available to a market timer with a 60 percent joint forecasting accuracy are 2.06 percent per annum on average.

Results reveal that a market timer may also possess the following bull and bear forecasting accuracies in order to yield potential gains: 70 percent bull accuracy and 50 percent bear accuracy or 50 percent bull accuracy 70 percent bear accuracy. The results also indicate that the win/loss ratio is greater than 1 when a market timer possesses 60 percent bull accuracy and 50 percent bear accuracy or vice versa, even though the results indicate that the market timer yields negative returns. In addition, the win/loss ratio is greater than 1 when a market timer possesses a 60 percent joint forecasting accuracy in both the ALSI and the STEFI. The probability that a market timer will outperform a buy and hold strategy in the ALSI when he/she has a 60 percent joint forecasting accuracy is (2.06/ (1+2.06)) 67.32 percent.

Table 5.8: Imperfect Monthly Market Timing (no transaction costs)

Bear Market Accuracy (%)		Bull Market Accuracy (%)					
		50	60	70	80	90	100
50	Mean(%)	-1.81%	-0.12%	3.17%	6.17%	8.99%	12.68%
	Std Dev (%)	12.92%	12.30%	11.64%	10.57%	9.35%	7.79%
	Win/Loss	0.88	1.11	1.43	2.21	4.2	∞
60	Mean(%)	-0.72%	2.06%	5.16%	8.47%	11.88%	14.57%
	Std Dev (%)	13.75%	12.89%	12.09%	11.19%	10,01%	8.69%
	Win/Loss	1.09	2.06	3.42	4.69	5.28	∞
70	Mean(%)	1.94%	5.66%	8.21%	10.43%	14.03%	17.32%
	Std Dev (%)	14.31%	13.23%	12.37%	11.57%	10.32%	9.04%
	Win/Loss	1.25	2.62	3.87	4.25	5.94	∞
80	Mean(%)	4.66%	7.70%	10.43%	12.95%	16.90%	19.99%
	Std Dev (%)	14.55%	13.79%	12.82%	12.02%	10.95%	9.53%
	Win/Loss	1.43	2.65	4.02	6.34	7.3	∞
90	Mean(%)	6.93%	10.43%	12.42%	16.49%	19.99%	23.29%
	Std Dev (%)	14.86%	14.38%	13.41%	12.40%	11.40%	9.98%
	Win/Loss	1.55	3.45	5.89	7.21	8.51	∞
100	Mean(%)	9.90%	12.28%	15.66%	19.00%	22.28%	24.16%
	Std Dev (%)	15.38%	14.62%	13.72%	12.75%	11.33%	10,01%
	Win/Loss	1.78	2.13	2.28	4.26	8.82	∞

Table 5.9 below takes into account transaction costs of 2 percent every time a market timer switches in and out of the ALSI and the STEFI, with monthly portfolio revisions. Results reveal that a market timer requires a joint forecasting accuracy of 80 percent in both the ALSI and the STEFI to yield potential gains, as opposed to the 60 percent required for monthly portfolio revisions when there are no transaction costs taken into account. A market timer with 80 percent joint forecasting accuracy may yield on average potential gains of 0.60 percent per annum. When taking into account transaction costs of 2 percent, the win loss ratio is greater than 1 when the bull forecasting accuracy is 100 percent and the bear forecasting accuracy is 90 percent. Similarly, the win/loss ratio is greater than 1 when the bear forecasting accuracy is 100 percent and the bull forecasting accuracy is 80 percent.

Table 5.9: Imperfect Monthly Market Timing (2 percent transaction costs)

Bear Market Accuracy (%)		Bull Market Accuracy (%)					
		50	60	70	80	90	100
50	Mean(%)	-16.08%	-13.49%	-9.38%	-6.17%	-3.78%	-0.36%
	Std Dev (%)	13.37%	12.57%	11.74%	10.98%	9.84%	8.63%
	Win/Loss	0.36	0.39	0.4	0.43	0.45	0.5
60	Mean(%)	-13.35%	-9.77%	-6.80%	-3.29%	-0.72%	2.30%
	Std Dev (%)	14.13%	13.20%	12.37%	11.47%	10.32%	9.32%
	Win/Loss	0.45	0.47	0.49	0.53	0.55	0.58
70	Mean(%)	-10.43%	-7.06%	-4.91%	-1.33%	1.45%	4.66%
	Std Dev (%)	14.58%	13.86%	12.85%	11.99%	10.77%	9.66%
	Win/Loss	0.53	0.55	0.58	0.64	0.68	0.72
80	Mean(%)	-8.34%	-5.28%	-1.45%	0.60%	3.66%	6.68%
	Std Dev (%)	14.76%	14.03%	13.51%	12.33%	11.36%	10.25%
	Win/Loss	0.63	0.69	0.75	0.78	0.81	0.88
90	Mean(%)	-5.54%	-1.94%	1.57%	3.04%	5.66%	8.73%
	Std Dev (%)	15.42%	14.48%	13.75%	12.78%	11.81%	10.39%
	Win/Loss	0.71	0.76	0.84	0.89	0.99	1.02
100	Mean(%)	-2.92%	0.12%	1.57%	5.79%	8.47%	10.42%
	Std Dev (%)	15.55%	15.00%	13.86%	13.09%	12.02%	10.88%
	Win/Loss	0.84	0.89	0.97	1	1.13	1.17

Overall the results concur with the findings made by Chua et al. (1987), Shilling (1992), Khokhlov (2016) in developed markets and De Chassart and Firer (2004) in developing markets which state that it is more important to forecast bull markets correctly than bear markets. Additionally, if a market timer can only forecast bull markets accurately 50 percent of the time, then he/she should not participate in market timing (Chua et al., 1987). This is to say, failing to predict bull markets accurately by more than 50 percent, a market timer's mean return will be less than that of a buy and hold strategy even if he/she can forecast bear markets perfectly. This can be seen by the greater negative potential gains in the first columns of Table 5.4, Table 5.5, Table 5.6, Table 5.7, Table 5.9 and Table 2 and Table 4 in Appendix A.

As illustrated in Table 5.9 above, assuming a market timer has no forecasting ability (i.e. 50 percent bull and bear forecasting accuracy); he/she will underperform a buy and hold strategy by 16.08 percent. Moreover, if a market timer does has no bull forecasting and 100 percent bear forecasting accuracy, he/she underperforms a buy and hold strategy by 2.92 percent. On the other hand, assuming a market timer does not possess any bear forecasting accuracy and 100 percent bull forecasting accuracy, he/she underperforms a buy and hold strategy by 0.36 percent. According to Chua et al. (1987) and Hsieh (2013a), it is important to note that the negative average incremental returns from market timing do not imply that every market timer who cannot forecast bull markets will lose from market timing. However, the negative average incremental returns do imply that the probability a market timer will outperform a buy and hold strategy is low.

The results in the tables above illustrate that the standard deviations are large relative to the potential gains. According to Chua et al. (1987), the fact that the volatility of the returns are large when compared to the returns, suggest that investor experience will vary i.e. some will be losers and some will be winners. However, a market timer cannot base his/her market timing strategy on the large standard deviations unless he/she believes that he/she will be consistently luckier than others. The results greatly suggest that market timers with good bull market timing skills will perform better than market timers with good bear market timing skills relative to a buy and hold strategy in the ALSI.

The win/loss ratio is generally greater than 1 even when the market timer has a forecasting accuracy of 80 percent or more in bear markets. This implies that it is likely that a market timer who possesses 50 percent forecasting accuracy in bull markets and 80 percent forecasting accuracy in bear markets will stay in the STEFI too long and miss too many bull markets, which will result in his/her mean return being less than that of a buy and hold strategy. The losses a market timer manages to avoid in bear markets are not enough to cover the large returns he/she misses in bull markets. The significance of not missing bull markets versus avoiding bear markets can be clearly seen by the win/loss ratios in the third column. These figures indicate that if a market timer's bull market forecasting accuracy is greater than or equal to 80 percent, his/her potential gains will most likely be positive even if he/she is unable to forecast bear markets at all (i.e. 50 percent bear forecasting accuracy), (Chua et al., 1987 and De Chassart and Firer, 2004).

5.4 Conclusion

It is evident that under all three portfolio revision periods (annual, quarterly and monthly), a market timer with perfect forecasting accuracy yields a greater return with less variability than that of an investor who buys and holds the ALSI even when taking into account transaction costs of 1 percent and 2 percent respectively. On the contrary, the results from less than perfect timing demonstrate that the benefits of timing the market by switching between bull and bear markets are unattractive. In order to evaluate the potential gains from less than perfect timing, a series of Monte Carlo simulations using various combinations of bull and bear market forecasting accuracies from 50 percent (no forecasting accuracy) to 100 percent (perfect forecasting accuracy). These were used to generate the possible potential gains available to a market timer who switches between the ALSI and the STEFI indices on the JSE.

The benefits of market timing are considerably greater when less restrictive assumptions are made about the frequency of portfolio revisions and level of transaction costs as implemented by Droms (1989), Kester (1990), Hsieh (2013a), Dichtl et al. (2016) and Khokhlov (2016) done in the developed markets and Ward and Terblanche (2009) done in the developing markets. This is clearly demonstrated by the results in this chapter, which demonstrates that better performance is obtained when reviewing the portfolio more frequently and that increasing transaction costs reduces potential gains and increases the forecasting accuracy required by a market timer under all revision periods.

When taking into account the maximum transaction costs of 2 percent, the potential gains available to a market timer drastically decreases across all portfolio revisions. Moreover, when taking into account transaction costs of 2 percent, the required joint forecasting accuracy in both the ALSI and the STEFI is 80 percent across all the portfolio revision periods. The results overall concur with that of Sharpe's (1975) study in the U.S. stock market, Chua et al. (1989) study in the Canadian stock market, Firer, Sandler and Ward (1992) and De Chassart and Firer (2004) whereby both the latter were done on the JSE, which found that potential gains are realised when a market timer has a great degree of predictive accuracy in either of the markets. However, studies done in the U.S. market such as Hallerbach (2014) and Dichtl et al. (2016) state that a market timer requires a moderate level of forecasting accuracy (i.e. 60 percent forecasting accuracy). Furthermore, a market timer with great bull forecasting accuracy will do better on average than those market timers who have greater bear forecasting accuracy.

Overall, the potential gains from market timing between securities and cash on the JSE are likely to be modest at best when compared to that of a buy and hold strategy, as a market timer requires superior forecasting accuracy in order to outperform a buy and hold strategy. Additionally, the forecasting accuracy required to achieve great potential gains and to outperform a buy and hold strategy is unattainable to most market timers. Results also reveal that when 2 percent transaction costs are taken into account, the win/loss is generally greater than 1 when a market timer has a 90 percent joint forecasting accuracy in both the ALSI and the STEFI.

As stated by Sharpe (1975), weak-form market efficiency implies that it is as difficult to predict shifts in the market as it is to identify which securities will do well or poorly. Transaction costs are incurred each time a market timer predicts a shift in the market and switches to another market. These transaction costs are not recoverable and expose a market timer to large losses when errors are made. Empirical studies have argued that potential gains from market timing are too small to justify the costs associated with attempting to take advantage of any inefficiency in the security market.

6

POTENTIAL GAINS FROM SECTOR TIMING ON THE JSE

6.1 Introduction

Hsieh (2013a) provided evidence of market timers who possess significant forecasting ability, and are able to trade at low transaction costs, have greater access to gains from sector timing strategies. Hsieh (2013a) evaluated the potential gains from sector timing when switching between the electronic and financial indices on the Taiwanese Stock Exchange, from 16 December 1999 to 19 December 2012. Results revealed that when transaction costs are taken into account, higher forecasting accuracies are required by market timers when switching between the electronic and financial indices in order to outperform a buy and hold strategy. Moreover, results illustrated that it is more important to forecast financial dominant markets correctly than electronic dominant markets, irrespective of which index is used as the benchmark.

The number of empirical studies conducted on sector timing is limited; particularly in South Africa. Therefore, the results in this chapter expand on earlier studies by examining data over a more recent period; subsequent to the reclassification of the sectors on the JSE. The primary objective of this chapter is to determine whether the market segmentation phenomenon on the JSE provides potential opportunities for profitable sector timing strategies.

This chapter first evaluates the potential gains from perfect sector timing using three simulated sector timing strategies. Additionally, this chapter evaluates the potential gains from less than perfect sector timing, using the three simulated sector timing strategies. The chapter also evaluates the sensitivity of potential gains from sector timing to changes in transaction costs and portfolio revision frequencies. It is important to note that the quarterly and monthly simulated results have been annualised for comparative purposes. In addition, the assumptions of 1 percent transaction costs for all three less than perfect sector timing strategies are excluded in this chapter; however, they are illustrated in the Appendices.

6.2 Potential Gains from Perfect Sector Timing

In order to evaluate the potential gains from perfect sector timing, the study looks at three simulated sector timing strategies as illustrated in Table 6.1 below. The first simulated strategy involves switching between the Financial (FINI) and Industrial (INDI) indices. The second simulated strategy involves switching between Resource (RESI) and INDI and the third simulated strategy involves switching between RESI and FINI.

A hypothetical market timer is assumed to call every market turn with perfect forecasting accuracy. For example, if a market timer is switching between RESI and FINI and foresees a change in the market great enough to cover transaction costs, he/she will move all assets under management (AUM) into RESI in the case of a resource dominant market (RESI outperforms FINI); or switch into FINI in the case of a financial dominant market (FINI outperforms RESI). For each period a perfect market timer is assumed to have the ability to place capital in the sector which yields the greater return for the period.

Table 6.1: Sector Timing Strategies

Sector Timing Strategies	**Index A**	**Index B**
Sector Timing Strategy 1	*FINI*	*INDI*
Sector Timing Strategy 2	*RESI*	*INDI*
Sector Timing Strategy 3	*RESI*	*FINI*

6.2.1 Simulated Buy and Hold Strategies

Table 6.2 below provides the monthly, quarterly and annual historical returns and standard deviations for a buy and hold strategy in the sector indices as well as for the All Share index (ALSI) and the STEFI Call Deposit index (STEFI) over the period from 1 January 2002 to 31 December 2016. As illustrated in Table 6.2 below, out of all the asset classes, INDI yields the greatest annual return over the examination period. The results show that INDI yields an annual return of 21.56 percent with a standard deviation of 19.78 percent. Comparatively, RESI yields an annual return of 15.19 percent with a standard deviation of 27.91 percent. RESI yields the lowest return out of the sector indices and the ALSI, with much greater variability of returns.

Table 6.2: Historical Buy and Hold Performance: RESI, INDI, FINI, Stocks and Cash Equivalents

	Asset Classes				
	RESI	**INDI**	**FINI**	**STEFI**	***FTSE/ALSI Top 40 Stocks***
Monthly					
Mean Returns	0.52%	1.34%	0.90%	0.61%	0.94%
Std. Dev.	7.39%	4.58%	4.99%	0.20%	4.90%
Quarterly					
Mean Returns	3.33%	4.37%	2.70%	2.04%	3.39%
Std. Dev.	13.27%	9.70%	10.38%	0.59%	9.86%
Annual					
Mean returns	15.19%	21.56%	16.16%	8.26%	17.04%
Std. Dev.	27.91%	19.78%	22.29%	2.54%	20.59%

Table 6.3 below provides the simulated buy and hold returns and standard deviations for RESI, INDI, FINI, ALSI and the STEFI; as opposed to Table 6.2 which illustrates the actual returns and standard deviations. As illustrated below, the simulated results of the sector indices, ALSI and STEFI do not differ much from the actual returns and standard deviations in Table 6.2. As mentioned in Section 5.2.1, an investor solely invested in the STEFI yielded the lowest mean return with the lowest variability of return. The strategy solely invested in the ALSI yields a greater return than STEFI, on average, however, with much greater variability when compared to STEFI as indicated by the standard deviations. The results also reveal that a buy and hold strategy solely invested INDI yields the greatest return with the least variability, when compared to RESI, FINI and the ALSI. Moreover, results illustrate that RESI yields the lowest return out of the sector indices, with the greatest variability of returns.

Table 6.3: Overall Simulated Buy and Hold Performance: RESI, INDI, FINI, Stocks and Cash Equivalents

	Asset Classes				
	RESI	**INDI**	**FINI**	**STEFI**	***FTSE/ALSI Top 40 Stocks***
Monthly					
Mean Returns	0.61%	1.46%	0.96%	0.61%	0.99%
Std. Dev.	7.42%	4.56%	4.98%	0.20%	4.87%
Quarterly					
Mean Returns	3.34%	4.44%	2.90%	2.05%	3.43%
Std. Dev.	13.19%	9.58%	10.39%	0.58%	9.95%
Annual					
Mean returns	15.09%	21.69%	16.09%	8.27%	16.93%
Std. Dev.	27.87%	20.15%	22.53%	2.52%	20.80%

6.2.2 Simulated Perfect Sector Timing Strategy

Table 6.4 below summarises the simulated results for a hypothetical market timer, with perfect forecasting accuracy, who revises his/her portfolio on a monthly, quarterly and annual basis assuming various transaction costs incurred (2 percent, 1 percent and 0 percent) respectively. The mean returns and standard deviation of returns from perfect sector timing for the three sector timing strategies, namely: financial and industrial indices (FINI_INDI), resource and industrial indices (RESI_INDI) and resource and financial indices (RESI_FINI) are illustrated in Table 6.4 below. To demonstrate the effect transaction costs have on mean returns and standard deviations, it is assumed transaction costs of 2 percent or 1 percent are incurred, respectively, of the value of AUM every time there is a switch from one index to another. The sector timing strategies assume no withdrawals or additions into the investment.

In addition to the average returns and standard deviations to the perfect sector timing strategies, Table 6.4 below also illustrates the simulated potential gains available to a hypothetical market timer with perfect forecasting accuracy who revises the strategy on a monthly, quarterly and annual basis with different assumptions for the transaction costs incurred (2 percent, 1 percent and 0 percent) respectively. As previously mentioned in Section 4.1, potential gains from sector timing is defined as the incremental returns of a sector timing strategy in excess of a buy and hold strategy in the ALSI.

Table 6.4: Overall Performance: Perfect Sector Timing Strategy

Portfolio revisions	Switching between Asset Classes with various Transaction Costs								
	FINI_INDI			RESI_INDI			RESI_FINI		
	0%	1%	2%	0%	1%	2%	0%	1%	2%
Monthly									
Mean Returns	57.72%	49.02%	40.60%	69.59%	60.10%	51.28%	65.54%	56.27%	47.47%
Std. Dev.	13.82%	13.93%	14.24%	17.25%	17.29%	17.53%	18.05%	18.12%	18.39%
Potential Gains	40.79%	32.09%	23.67%	52.66%	43.17%	34.53%	48.61%	39.34%	30.54%
Quarterly									
Mean Returns	43.19%	40.64%	38.13%	48.34%	45.67%	43.08%	42.40%	39.69%	37.41%
Std. Dev.	16.68%	16.72%	16.82%	19.12%	19.14%	19.18%	25.47%	22.76%	20.48%
Potential Gains	26.26%	23.71%	21.20%	31.41%	28.74%	26.15%	12.30%	9.89%	7.67%
Annually									
Mean Returns	31.09%	30.60%	30.11%	32.20%	31.72%	31.23%	29.62%	29.11%	28.60%
Std. Dev.	17.07%	17.08%	17.11%	19.16%	19.16%	19.18%	20.89%	20.89%	20.91%
Potential Gains	14.16%	13.67%	13.18%	15.27%	14.79%	14.30%	12.69%	12.18%	11.67%

Note: *The quarterly and monthly results in Table 6.4 above have been annualised for comparative purposes*

Results in Table 6.4 above reveal that if a market timer possesses perfect forecasting accuracy when applying any of the three sector timing strategies, he/she would have significantly outperformed a buy and hold strategy in the ALSI, even when taking into account the maximum assumption of 2 percent transaction costs. As illustrated in Table 6.3 above, an investor who applied a buy and hold strategy in the ALSI would have yielded an annual return of only 16.93 percent and a standard deviation of 20.80 percent. Additionally, an investor may also apply a buy and hold strategy in the sector indices. A perfect timing strategy could also be compared to a buy and hold strategy in any of the sector indices. For example, if an investor applied a buy and hold strategy in RESI, INDI or FINI, he/she would have yielded an annual return of 15.09 percent. 21.69 percent or 16.09 percent, as illustrated in Table 6.3.

Results also reveal that for all three perfect sector timing strategies, the more frequently a market timer revises his/her portfolio, the greater the returns. In addition, out of all three perfect sector timing strategies, under all portfolio revisions, a market timer switching between RESI and INDI yields the greatest return with the least variability of returns. Results in Table 6.4 overall reveal that if market timer who possesses perfect forecasting accuracy when switching between the sector indices would have substantially improved upon the returns of a buy and hold strategy in the ALSI, under all portfolio revision frequencies, even when the maximum assumption of 2 percent transaction costs are taken into account. However, if any of the three perfect sector timing strategies are compared to a buy and hold strategy in INDI which yields an annual return of 21.69 percent, the potential gains available to a market timer would have decreased substantially. Section 6.2.2.1 and Section 6.2.2.2 below discuss the sensitivity of potential gains to portfolio frequency revisions and various transaction costs respectively, when compared to a buy and hold strategy in the ALSI, based on the results provided in Table 6.4 above.

Sensitivity Analysis: the effect of portfolio revision frequency

Results in Table 6.4 above reveal the average returns when no transaction costs are taken into account for the perfect sector timing strategies, FINI and INDI, RESI and INDI and RESI and FINI are 31.09 percent, 32.20 percent and 29.62 percent respectively. The standard deviations of returns for the three perfect sector timing strategies are 17.07 percent, 19.16 percent and 20.89 percent respectively. In addition, the potential gains for the three sector timing strategies are 14.16 percent, 15.27 percent and 12.69 percent respectively. The results suggest that when no transaction costs are taken into account and annual portfolio revisions, a market timer would yield the greatest potential gains when switching between RESI and INDI.

Results also indicate that if a market timer had revised his/her portfolio on a monthly basis, ignoring transaction costs when switching between, FINI and INDI, RESI and INDI and RESI and FINI, he/she would yield mean returns of 57.72 percent, 69.59 percent and 65.54 percent respectively. The standard deviations for the three perfect sector timing strategies are 13.82 percent, 17.25 percent and 18.05 percent respectively. Moreover, the potential gains for a hypothetical market timer applying the three strategies are 40.79 percent, 52.66 percent and 48.61 percent respectively.

In summary, across all the sector timing strategies, results reveal that when increasing the frequency of portfolio revisions from annually to monthly, ignoring transaction costs, the mean returns increase and the standard deviations decrease. The results distinctly illustrate that the advantages of perfect sector timing on the JSE are certainly attractive. It is evident that a market timer who possesses perfect forecasting accuracy when switching between the sector indices would have substantially improved upon the returns of a buy and hold strategy in the ALSI, under all portfolio revision frequencies. Similar to the perfect bull and bear market timing results in Chapter 5, Table 6.4 also demonstrates that if a market timer revises his/her portfolio more frequently, ignoring transaction costs, he/she will yield greater potential gains with less variability of returns. The results imply that a perfect sector timing strategy yields vastly greater returns, on average, with less risk compared to that of a buy and hold strategy in the ALSI. However, transaction costs have not been taken into account thus far.

Sensitivity Analysis: the effect of transaction costs

A market timer who perfectly switched annually between FINI and INDI, RESI and INDI and RESI and FINI would have yielded potential gains of 13.67 percent, 14.79 percent and 12.18 percent respectively, when incurring 1 percent transaction costs. Comparatively, the potential gains for the three perfect sector timing strategies when taking into account the maximum assumption of 2 percent transaction costs are 13.18 percent, 14.30 percent and 11.67 percent respectively. Results in Table 6.4 above show that when taking into account transaction costs of 1 percent and 2 percent, both the annual average returns and potential gains decrease. However, when increasing transaction costs, standard deviations of returns increase for all three sector timing strategies.

On the other hand, if a market timer had revised his/her portfolio on a monthly basis when switching between FINI and INDI, RESI and INDI and RESI and FINI with 1 percent transaction costs, he/she would have yielded potential gains of 32.09 percent, 43.17 percent and 39.34 percent respectively. Comparatively, when taking into account a maximum assumption of 2 percent transaction costs and monthly portfolio revisions for the three sector timing strategies, the potential gains decrease to 23.67 percent, 34.53 percent and 30.54 percent respectively. When evaluating all three sector timing strategies, results illustrate that switching between RESI and INDI offers greater opportunities for outperforming a buy and hold strategy in the ALSI.

Similar to results found in Chapter 5, the results suggest that the advantages of timing the market are substantially greater if more realistic assumptions are made about the level of transaction costs and the frequency of portfolio revisions. As illustrated in Table 6.4, increasing transaction costs from 0 percent to 2 percent for annual portfolio revisions whilst switching between RESI and INDI for example, the potential gains from sector timing decreases from 52.66 percent to 34.53 percent. However, when increasing transaction costs from 0 percent to 2 percent for quarterly portfolio revisions, the potential gains decrease from 31.41 percent to 26.15 percent. Moreover, when increasing the transaction costs for an annual market timer from 0 percent to 2 percent, the potential gains decrease from 15.27 percent to 14.30 percent.

Similar to the results found in Chapter 5, the larger decreases in potential gains when increasing portfolio revisions are due to the fact that a market timer incurs more transaction costs as he/she revises their portfolio more often, as illustrated across all three sector timing strategies. The above results concur with that of Hsieh's (2013a) study in the Taiwanese market; a market timer applying a sector timing strategy achieves greater returns with lower switching costs and the more frequently he/she revises their portfolio. It is evident that under all three portfolio revision periods, a perfect market timer with perfect switching between the sector indices yields greater returns with less variability than that of an investor who buys and holds the ALSI, even when taking into account transaction costs of 1 percent and 2 percent respectively. However, the results are based on the unrealistic assumption that a market timer is able to engage in perfect sector timing.

6.3 Potential Gains from Less than Perfect Sector Timing on the JSE

In order to evaluate the potential gains from less than perfect sector timing on the JSE, assumptions are made regarding forecasting accuracies and switching between the sector indices. A hypothetical market timer is assumed to switch between the sector indices depending on his/her prediction for the upcoming period. For example, when evaluating the third sector timing strategy, a hypothetical market timer is assumed to switch between RESI and FINI; dependent on whether a resource dominant market or a financial dominant market is forecasted for the upcoming period. A resource dominant market is defined as the period in which RESI yields greater returns than FINI, and vice-versa for a financial dominant market. Following the assumption originally proposed by Chua et al. (1987), a market timer is assumed to have various forecasting accuracies in different sectors.

Similar to perfect sector timing, potential gains from less than perfect sector timing for a hypothetical market timer is evaluated on a monthly, quarterly and annual basis with different assumptions for the transaction costs incurred (2 percent, 1 percent and 0 percent). Potential gains from the sector timing strategies are defined as the return of the strategy in excess of a buy and hold strategy in the ALSI. The results from this chapter do not include any results obtained from a market timer that possesses less than 50 percent forecasting accuracy; as a market timer that holds predictions less or equal to 50 percent does not possess any forecasting ability. Therefore, similar to Chapter 5, permutations start at 50 percent (i.e. no forecasting accuracy in both sectors), with the level of forecasting accuracies increasing by 10 percent increments to 100 percent (perfect forecasting accuracy).

6.3.1 Annual Revision Frequency

A series of Monte Carlo simulations are implemented using various combinations of FINI and INDI forecasting accuracies in order to evaluate the potential gains from less than perfect sector timing strategies. The simulated potential gains, standard deviations of potential gains and win/loss ratios for each permutation of forecasting accuracies in FINI and INDI sectors are shown in Table 6.5 below.

Each row in Table 6.5 represents the potential gains from sector timing for a market timer with the same accuracy in forecasting the industrial dominant market with differing accuracies in forecasting the financial dominant sector, from 50 percent to 100 percent. Similarly, each column shows the sensitivity of potential gains from sector timing for a market timer with the same accuracy in forecasting the financial dominant sector with differing accuracies in forecasting the industrial dominant sector, from 50 percent to 100 percent. Table 6.5 below illustrates the simulated results for a market timer who revises his/her portfolio on an annual basis when switching between FINI and INDI sectors on the JSE without incurring transaction costs.

Table 6.5: Imperfect Annual Sector Timing Results (no transaction costs)

INDI		FINI					
		50%	60%	70%	80%	90%	100%
50%	Mean(%)	2.21%	2.92%	4.30%	4.87%	6.11%	6.54%
	Std Dev (%)	29.86%	29.36%	28.50%	27.65%	27.55%	27.46%
	Win/Loss	1.11	1.19	1.25	1.32	1.38	1.42
60%	Mean(%)	3.73%	4.62%	4.78%	6.53%	7.10%	8.10%
	Std Dev (%)	29.77%	29.15%	28.32%	27.50%	27.43%	27.30%
	Win/Loss	1.22	1.28	1.34	1.4	1.49	1.56
70%	Mean(%)	5.20%	6.60%	7.01%	7.85%	9.05%	9.45%
	Std Dev (%)	29.70%	28.62%	28.51%	27.45%	27.32%	27.24%
	Win/Loss	1.38	1.42	1.54	1.61	1.67	1.75
80%	Mean(%)	7.01%	8.23%	8.43%	9.31%	10.11%	11.57%
	Std Dev (%)	29.45%	28.32%	28.25%	27.17%	27.11%	27.15%
	Win/Loss	1.48	1.54	1.63	1.75	1.83	1.9
90%	Mean(%)	9.03%	9.41%	9.61%	10.47%	11.87%	13.86%
	Std Dev (%)	29.18%	28.22%	27.70%	27.46%	27.15%	27.10%
	Win/Loss	1.61	1.76	1.82	1.95	2.05	2.14
100%	Mean(%)	9.89%	11.04%	11.75%	12.42%	13.45%	14.16%
	Std Dev (%)	28.89%	28.67%	27.56%	27.38%	27.10%	27.05%
	Win/Loss	1.74	1.79	1.97	1.99	2.24	2.42

The simulated results in Table 6.5 above reveal that if a market timer has no forecasting accuracy in either financial or industrial dominant market (i.e. 50 percent joint forecasting accuracy), ignoring transactions, he/she may yield an average return of 2.21 percent per annum above a buy and hold strategy in ALSI with a standard deviation of potential gains equals to 29.86 percent. The results reveal that even if a market timer does not possess any forecasting accuracy, he/she will yield potential gains. The standard deviation indicates that switching between FINI and INDI is substantially high relative to the potential gains; therefore suggesting that switching between these two sectors is risky. The win/loss ratio is 1.11 when a market timer has a joint forecasting accuracy of 50 percent. The win/loss ratio indicates that the probability of a market timer benefiting from sector timing is approximately (1.11/ (1+1.11)) 52.61 percent.

The simulated results also reveal that a market timer with perfect forecasting accuracy will outperform a buy and hold strategy by 14.16 percent per annum with a standard deviation of potential gains equals to 27.05 percent. The results in Table 6.5 strongly indicate that even if a market timer has no forecasting accuracy when switching between FINI and INDI, he/she could still outperform a buy and hold strategy in the ALSI. This is due to the fact that INDI has a substantially higher return than the ALSI as illustrated in Table 6.3 above. Therefore, results in Table 6.5 show that improvements in the forecasting ability in the industrial dominant market result in potential gains drastically increasing.

Results also reveal that as the market timer's forecasting accuracy increases, so do the potential gains and win/loss ratios. On the contrary, as the forecasting accuracy increases the standard deviation decreases. This indicates that as a market timer's forecasting accuracy increases, the risk associated with the sector timing strategy decreases.

Table 6.6 below illustrates the results for a market timer who switches between FINI and INDI on an annual basis, incurring the maximum assumption of 2 percent transaction costs. Results reveal that even when taking into account transaction costs of 2 percent, a market timer who does not possess any forecasting accuracy (i.e. a joint forecasting accuracy of 50 percent in both FINI and INDI) will yield potential gains of 0.16 percent with a standard deviation of potential gains equals to 30.15 percent.

Moreover, the win/loss ratio is greater than 1 indicating that even if a market timer does not possess forecasting accuracy and assuming maximum transaction costs of 2 percent, he/she has a greater than 50 percent probability of outperforming a buy and hold strategy in the ALSI. The win/loss ratio is 1.06 when a market timer has a joint forecasting accuracy of 50 percent in both FINI and INDI. The win/loss ratio indicates that the probability of a market timer benefiting from sector timing is approximately (1.06/ (1+1.06)) 51.46 percent. However, the probabilities are close to 50 percent, which implies that a market timer has a 50/50 chance of outperforming a buy and hold strategy in the ALSI. Results also reveal that when taking into account transaction costs of 2 percent, the potential gains decrease on average by approximately 1 percent per annum.

Table 6.6: Imperfect Annual Sector Timing Results (2 percent transaction costs)

INDI		**FINI**					
		50%	60%	70%	80%	90%	100%
50%	Mean(%)	0.16%	1.90%	2.79%	4.06%	3.84%	5.72%
	Std Dev (%)	30.15%	30.04%	29.95%	29.86%	29.75%	29.68%
	Win/Loss	1.06	1.12	1.19	1.25	1.3	1.35
60%	Mean(%)	2.14%	3.89%	4.20%	5.31%	6.16%	8.00%
	Std Dev (%)	29.98%	29.90%	29.83%	29.75%	29.66%	29.52%
	Win/Loss	1.16	1.21	1.27	1.35	1.39	1.46
70%	Mean(%)	4.12%	4.95%	6.33%	7.60%	7.60%	8.66%
	Std Dev (%)	29.77%	29.69%	29.64%	29.55%	29.48%	29.38%
	Win/Loss	1.3	1.38	1.45	1.53	1.62	1.67
80%	Mean(%)	6.23%	6.65%	7.32%	8.08%	10.09%	10.44%
	Std Dev (%)	29.57%	29.49%	29.30%	29.18%	29.10%	28.98%
	Win/Loss	1.41	1.46	1.53	1.62	1.69	1.78
90%	Mean(%)	7.44%	7.59%	10.21%	9.46%	11.05%	11.60%
	Std Dev (%)	29.11%	28.98%	28.90%	28.40%	28.28%	28.11%
	Win/Loss	1.53	1.62	1.75	1.86	1.98	2.04
100%	Mean(%)	8.94%	9.76%	10.21%	11.84%	12.62%	13.18%
	Std Dev (%)	29.02%	28.75%	28.28%	28.20%	27.74%	27.65%
	Win/Loss	1.64	1.69	1.81	1.89	2.13	2.25

Table 6.7 below show the results for a market timer who switches between RESI and INDI sectors on an annual basis, without any transaction costs being incurred. Results indicate that a market timer with no forecasting accuracy will yield potential gains of 1.47 percent with a standard deviation of 32.50 percent. When taking into account 0 percent transaction costs, a market timer switching between RESI and INDI with no forecasting accuracy yields approximately 50 percent less potential gains when compared to Table 6.5; whereby a market timer switching between FINI and INDI yields 2.21 percent, as well as incurring greater risk as indicated by the standard deviations. However, when a market timer possesses perfect forecasting accuracy, he/she will yield potential gains of 15.27 percent compared to 14.16 percent in Table 6.5. Moreover, a market timer switching between RESI and INDI starts to yield greater potential gains than a market timer switching between FINI and INDI when he/she possesses a joint forecasting accuracy 70 percent or more.

Table 6.7: Imperfect Annual Sector Timing Results (no transaction costs)

INDI		RESI					
		50%	60%	70%	80%	90%	100%
50%	Mean(%)	1.47%	1.83%	4.01%	4.37%	5.85%	6.43%
	Std Dev (%)	32.50%	32.42%	32.29%	32.21%	32.16%	32.07%
	Win/Loss	1.07	1.15	1.23	1.29	1.36	1.45
60%	Mean(%)	3.19%	4.41%	5.10%	6.47%	7.76%	8.49%
	Std Dev (%)	32.11%	32.04%	31.90%	31.83%	31.69%	31.55%
	Win/Loss	1.19	1.23	1.35	1.48	1.55	1.6
70%	Mean(%)	5.15%	6.52%	7.58%	8.10%	9.35%	10.28%
	Std Dev (%)	31.92%	31.80%	31.70%	31.55%	31.42%	31.26%
	Win/Loss	1.34	1.4	1.53	1.58	1.64	1.77
80%	Mean(%)	6.82%	7.91%	9.03%	9.81%	10.33%	12.42%
	Std Dev (%)	30.96%	30.75%	30.60%	30.47%	30.31%	31.22%
	Win/Loss	1.47	1.57	1.64	1.78	1.86	1.92
90%	Mean(%)	8.71%	9.78%	10.40%	11.44%	13.00%	14.55%
	Std Dev (%)	30.15%	30.05%	29.92%	29.76%	29.55%	29.39%
	Win/Loss	1.62	1.75	1.87	1.92	2.07	2.18
100%	Mean(%)	10.70%	11.73%	12.27%	13.52%	14.57%	15.27%
	Std Dev (%)	29.54%	29.32%	29.18%	29.00%	28.93%	29.83%
	Win/Loss	1.82	1.9	2.04	2.18	2.19	2.34

Table 6.8 below looks at a market timer who switches between RESI and INDI on an annual basis, incurring transaction costs of 2 percent. The potential gains available to a market timer with no forecasting accuracy decreases 1.47 percent as illustrated in Table 6.7 to 0.15 percent with a standard deviation of potential gains equal to 32.51 percent. The win/loss ratio is 1.02 when a market timer has no forecasting accuracy, indicating that a market timer switching between RESI and INDI has a (1/ (1+1.02)) 50.50 percent chance of outperforming a buy and hold strategy compared to (1/ (1+1.07)) 51.69 percent when no transaction costs are incurred. Results reveal that even when taking into account transaction costs of 2 percent, when switching between FINI and INDI or RESI and INDI, a market timer does not require forecasting accuracy in order to yield potential gains. Additionally, the probability of a market timer outperforming a buy and hold strategy is above 50 percent even when transaction costs are 2 percent.

Table 6.8: Imperfect Annual Sector Timing Results (2 percent transaction costs)

INDI		RESI					
		50%	60%	70%	80%	90%	100%
50%	Mean(%)	0.15%	1.69%	2.74%	3.53%	4.55%	5.75%
	Std Dev (%)	32.51%	32.40%	32.32%	32.26%	32.14%	32.06%
	Win/Loss	1.02	1.10	1.18	1.23	1.30	1.39
60%	Mean(%)	2.47%	3.32%	4.20%	4.96%	6.69%	7.17%
	Std Dev (%)	32.43%	32.28%	32.14%	31.96%	31.85%	31.72%
	Win/Loss	1.13	1.22	1.34	1.41	1.48	1.53
70%	Mean(%)	4.45%	5.20%	5.54%	7.16%	8.29%	9.15%
	Std Dev (%)	31.99%	31.89%	31.84%	31.48%	31.24%	31.15%
	Win/Loss	1.38	1.43	1.47	1.52	1.63	1.69
80%	Mean(%)	6.37%	7.21%	7.90%	8.88%	10.23%	11.26%
	Std Dev (%)	31.02%	30.91%	30.77%	30.51%	30.33%	30.04%
	Win/Loss	1.40	1.47	1.56	1.64	1.78	1.82
90%	Mean(%)	7.69%	9.06%	9.89%	10.56%	11.88%	12.20%
	Std Dev (%)	30.17%	30.02%	29.75%	29.64%	29.52%	29.31%
	Win/Loss	1.54	1.63	1.75	1.88	1.97	2.06
100%	Mean(%)	9.64%	10.66%	11.19%	12.47%	13.86%	14.30%
	Std Dev (%)	30.03%	29.74%	29.59%	29.43%	29.13%	28.85%
	Win/Loss	1.72	1.79	1.93	2.05	2.07	2.20

Table 6.9 below shows the results for a market timer who switches between RESI and FINI on an annual basis, and does not incur any transaction costs. A market timer with a 50 percent joint forecasting accuracy in both RESI and FINI would have underperformed a buy and hold strategy by an average of 1.96 percent per annum. On the other hand, a market timer requires a 60 percent joint forecasting accuracy in both RESI and FINI to yield potential gains. A market timer may also possess the following forecasting accuracies: 70 percent accuracy in RESI and 50 percent in FINI or 50 percent accuracy in RESI and 70 percent in FINI. The win/loss ratio is greater than 1 when a market timer possesses a 60 percent forecasting accuracy in RESI and 50 percent in FINI, 50 percent in RESI and 70 percent in FINI or a joint forecasting accuracy of 60 percent in both RESI and FINI. The simulated results also illustrate that a market timer with perfect forecasting accuracy will yield potential gains of 12.69 percent per annum with a standard deviation 29.69 percent.

Table 6.9: Imperfect Annual Sector Timing Results (no transaction costs)

FINI		RESI 50%	60%	70%	80%	90%	100%
50%	Mean(%)	-1.96%	-0.69%	0.02%	1.93%	3.28%	5.10%
	Std Dev (%)	33.44%	33.32%	33.16%	33.01%	32.82%	32.68%
	Win/Loss	0.98	1.02	1.11	1.19	1.29	1.33
60%	Mean(%)	-0.35%	1.02%	2.46%	3.64%	5.34%	6.59%
	Std Dev (%)	32.70%	32.59%	32.38%	32.29%	32.13%	32.01%
	Win/Loss	1.03	1.12	1.23	1.35	1.46	1.51
70%	Mean(%)	0.96%	2.66%	4.23%	5.76%	6.60%	7.54%
	Std Dev (%)	32.13%	32.01%	31.92%	31.78%	31.64%	31.45%
	Win/Loss	1.21	1.29	1.34	1.41	1.52	1.58
80%	Mean(%)	2.65%	4.01%	6.08%	6.76%	7.92%	9.94%
	Std Dev (%)	31.78%	31.47%	31.78%	31.55%	31.15%	31.03%
	Win/Loss	1.30	1.39	1.45	1.56	1.66	1.74
90%	Mean(%)	4.80%	5.81%	6.22%	8.55%	9.60%	11.12%
	Std Dev (%)	31.38%	31.15%	31.06%	30.87%	30.64%	30.54%
	Win/Loss	1.40	1.51	1.64	1.78	1.85	1.98
100%	Mean(%)	5.38%	7.56%	8.45%	10.17%	11.26%	12.69%
	Std Dev (%)	30.89%	30.56%	30.42%	30.36%	29.80%	29.69%
	Win/Loss	1.53	1.63	1.8	1.87	1.94	2.19

Table 6.10 below illustrates the results for a market timer who revises his/her portfolio annually when switching between RESI and FINI, incurring 2 percent transaction costs. The green highlighted blocks illustrate the potential gains that were available to a market timer when transaction costs are not taken into account as previously illustrated in Table 6.9 above. The red blocks indicate the potential gains available to a market timer when the maximum assumption of 2 percent transaction costs is taken into account. Similar to Table 6.9, a market timer requires a joint forecasting accuracy of 60 percent in both RESI and FINI to outperform a buy and hold strategy. However, even though the joint forecasting accuracy required is the same when taking into account transaction costs of 2 percent, the potential gains available to a market timer decreases by approximately 1 percent per annum with a market timer exposed to greater risk as illustrated by the standard deviation of potential gains.

Table 6.10: Imperfect Annual Sector Timing Results (2 percent transaction costs)

FINI		RESI 50%	60%	70%	80%	90%	100%
50%	Mean(%)	-2.77%	-0.89%	-0.18%	1.79%	3.33%	4.17%
	Std Dev (%)	33.86%	33.56%	33.38%	32.98%	33.92%	33.82%
	Win/Loss	0.93	0.99	1.03	1.09	1.18	1.24
60%	Mean(%)	-1.04%	0.05%	1.84%	2.89%	4.37%	5.99%
	Std Dev (%)	32.95%	32.62%	32.52%	32.56%	33.53%	32.98%
	Win/Loss	0.98	1.10	1.20	1.29	1.37	1.44
70%	Mean(%)	0.44%	1.96%	3.56%	3.95%	6.14%	7.81%
	Std Dev (%)	32.53%	32.50%	32.47%	32.17%	32.16%	32.30%
	Win/Loss	1.12	1.21	1.32	1.39	1.46	1.5
80%	Mean(%)	1.88%	3.91%	4.26%	5.91%	7.76%	9.20%
	Std Dev (%)	32.09%	31.88%	31.72%	31.68%	31.382%	31.02%
	Win/Loss	1.19	1.34	1.42	1.51	1.59	1.66
90%	Mean(%)	3.70%	5.06%	5.96%	6.94%	8.73%	10.70%
	Std Dev (%)	31.45%	31.31%	31.19%	30.93%	30.84%	30.64%
	Win/Loss	1.29	1.42	1.55	1.63	1.78	1.86
100%	Mean(%)	5.08%	6.59%	7.88%	9.54%	10.79%	11.67%
	Std Dev (%)	30.97%	30.76%	30.76%	30.42%	29.93%	29.70%
	Win/Loss	1.38	1.54	1.7	1.77	1.85	2.08

A market timer may also possess forecasting accuracies of 80 percent in RESI and 50 percent in FINI or 50 percent in RESI and 70 percent in FINI to yield potential gains. The win loss ratio is greater than 1 when a market timer possesses forecasting accuracies of 70 percent in RESI and 50 percent in FINI, 50 percent in RESI and 70 percent in FINI or a joint forecasting accuracy of 60 percent in both RESI and FINI. Similar to the results of Chapter 5, transaction costs have a direct relationship with forecasting accuracy. This implies that an increase in transaction costs increases the forecasting accuracy required to achieve potential gains. On the other hand, transaction costs have an indirect relationship with potential gains and the win/loss ratio.

Results overall reveal that by evaluating annual portfolio revisions, even when taking into account the maximum assumption of 2 percent transaction costs, a market timer switching between FINI and INDI, and RESI and INDI does not require any forecasting accuracy to benefit from potential gains. However, as illustrated in Table 6.9, Table 6.10 and Table 6 in Appendix B, when switching between RESI and FINI, a market timer requires some degree of forecasting accuracy (i.e. 60 percent joint forecasting accuracy in both RESI and FINI) even when transaction costs are not taken into account. Additionally, the results illustrate that across all sector timing strategies; an increase in transaction costs reduces potential gains available to a market timer and decreases the probability that a market timer will outperform a buy and hold strategy in ALSI.

Results from annual portfolio revisions also reveal that the win/loss ratio is greater than 1 for a market timer switching between RESI and INDI, and FINI and INDI when there is a 50 percent joint forecasting in the sectors, even when the maximum transaction costs of 2 percent are taken into account. However, a market timer who switches between RESI and FINI, the win/loss ratio is greater than 1 when the forecasting accuracy in the sectors is equal to 70 percent in either of the sectors. In other words, assuming that market timer switches between RESI and FINI on an annual basis and does not have any RESI forecasting ability, the win/loss ratio is greater than 1 when the accuracy in forecasting FINI is greater than or equal to 70 percent. Similarly, assuming that a market timer does not possess any FINI forecasting ability when switching between RESI and FINI, the win/loss ratio is greater than 1 when the accuracy in forecasting RESI is greater than or equal to 70 percent. Results overall illustrate that a market timer revising his/her portfolio annually when switching between RESI and INDI will yield the greatest potential gains out of all sector timing strategies when a market timer possesses a 70 percent joint forecasting accuracy or more.

6.3.2 Quarterly Revision Frequency

Table 6.11 below shows the simulated results for a market timer who revises his/her portfolio on a quarterly basis switching between FINI and INDI, and does not incur any transaction costs. Results reveal that a market timer requires 50 percent joint forecasting accuracy in both FINI and INDI in order to benefit from potential gains. The potential gains available to a market timer are on average 2.46 percent annually compared to 2.21 percent as illustrated in Table 6.5. Results also reveal the probability of outperforming a buy and hold strategy is (1.03/ (1 + 1.03)) 50.74 percent compared to 52.61 percent as shown in Table 6.5. Even though the win/loss ratios are similar, by revising a portfolio quarterly as opposed to annually, the probability of outperforming a buy and hold strategy in ALSI slightly decreases. However, potential gains increase as we increase the portfolio revision from annually to quarterly, when no transaction costs are incurred.

Table 6.11: Imperfect Quarterly Sector Timing Results (no transaction costs)

INDI		FINI					
		50%	60%	70%	80%	90%	100%
50%	Mean(%)	2.46%	3.81%	5.30%	7.27%	9.87%	11.59%
	Std Dev (%)	26.28%	26.16%	26.01%	25.88%	25.70%	25.51%
	Win/Loss	1.03	1.14	1.17	1.3	1.34	1.44
60%	Mean(%)	4.35%	6.51%	8.33%	9.78%	12.20%	14.53%
	Std Dev (%)	26.02%	25.86%	25.67%	25.52%	25.36%	25.20%
	Win/Loss	1.16	1.24	1.35	1.42	1.48	1.53
70%	Mean(%)	7.27 %	9.35%	11.25%	12.73%	15.69%	17.53%
	Std Dev (%)	25.80%	26.12%	26.4 %	25.56%	25.58 %	25.02 %
	Win/Loss	1.19	1.25	1.36	1.48	1.54	1.62
80%	Mean(%)	8.97%	11.07%	13.82 %	15.82%	17.80%	18.48%
	Std Dev (%)	25.63%	25.46%	25.32%	25.25%	25.16%	25.06%
	Win/Loss	1.30	1.44	1.52	1.63	1.76	1.84
90%	Mean(%)	10.81%	14.75%	16.36%	18.07%	20.54%	24.64%
	Std Dev (%)	25.50%	25.40%	25.34%	25.16%	24.98%	24.50%
	Win/Loss	1.47	1.52	1.63	1.78	1.85	1.97
100%	Mean(%)	15.64%	16.49%	19.57%	21.41%	23.65%	26.26%
	Std Dev (%)	25.44%	25.26%	25.05%	24.72%	24.30%	24.12%
	Win/Loss	1.60	1.73	1.82	1.89	2.09	2.12

Table 6.12 below illustrates the results for a market timer who revises his/her portfolio on a quarterly basis, incurring transaction costs of 2 percent. Results reveal that a market timer requires a 60 percent joint forecasting accuracy in both FINI and INDI to yield potential gains, compared to 50 percent joint forecasting accuracy in Table 6.11. The results also reveal that a market timer with a 60 percent joint forecasting accuracy in both FINI and INDI yields potential gains of 2.42 percent per annum as opposed to 6.51 percent per annum when no transaction costs are taken into account.

A market timer may also possess forecasting accuracies of 70 percent in FINI and 50 percent in INDI or 50 percent in FINI and 60 percent in INDI. The win/loss ratio is greater than 1 when a market timer has a 60 percent joint forecasting accuracy in both FINI and INDI, 50 percent in FINI and 60 percent in INDI or 70 percent in FINI and 50 percent in INDI. When taking into account 2 percent transaction costs and quarterly portfolio revisions, the potential gains decrease substantially due to a market timer switching more often between the indices and thus incurring more transaction costs.

Table 6.12: Imperfect Quarterly Sector Timing Results (2 percent transaction costs)

INDI		FINI					
		50%	60%	70%	80%	90%	100%
50%	Mean(%)	-2.06%	-0.60%	1.25%	4.47%	5.09%	7.61%
	Std Dev (%)	26.76%	26.60%	26.52%	26.28%	26.20%	26.12%
	Win/Loss	0.92	1.02	1.03	1.15	1.19	1.24
60%	Mean(%)	0.96%	2.42%	3.44%	6.64%	8.84%	10.30%
	Std Dev (%)	26.58%	26.32%	26.20%	26.10%	26.08%	25.92%
	Win/Loss	1.03	1.10	1.15	1.21	1.26	1.36
70%	Mean(%)	2.83%	5.39%	6.05%	8.37%	10.60%	12.81%
	Std Dev (%)	26.40%	26.12%	26.02%	25.90%	25.74%	25.28%
	Win/Loss	1.06	1.17	1.25	1.31	1.38	1.43
80%	Mean(%)	5.09%	8.20%	10.08%	12.29%	13.56%	15.87%
	Std Dev (%)	26.30%	26.34%	26.14%	26.00%	25.42%	25.22%
	Win/Loss	1.16	1.24	1.35	1.48	1.55	1.61
90%	Mean(%)	8.24%	9.65%	12.16%	14.09%	17.26%	17.89%
	Std Dev (%)	25.96%	25.76%	25.58%	25.52%	24.94%	24.82%
	Win/Loss	1.30	1.47	1.56	1.66	1.72	1.74
100%	Mean(%)	10.94%	13.25%	15.42%	16.54%	18.57%	21.20%
	Std Dev (%)	25.88%	25.38%	25.10%	24.99%	24.72%	24.42%
	Win/Loss	1.42	1.55	1.60	1.64	1.81	1.86

The results for a market timer who switches between RESI and INDI and revises his/her portfolio quarterly and incurs no transaction costs are shown in Table 6.13 below. Results indicate that a market timer requires a 50 percent joint forecasting accuracy in both RESI and FINI in order to benefit from potential gains. Results also reveal that a market timer with 50 percent joint forecasting accuracy in RESI and INDI will outperform a buy and hold strategy in the ALSI on average by 2.10 percent per annum.

The win/loss ratio of 1.05 indicates that a market timer has a probability of (1.05/ (1.05 + 1)*100) 51.22 percent of outperforming a buy and hold strategy in the ALSI. Results also reveal that a market timer, who possesses perfect forecasting accuracy when switching between RESI and INDI, will yield on average potential gains of 31.41 percent with a standard deviation of potential gains equal to 25.80 percent. Similar to annual sector timing, a market timer switching between RESI and INDI starts to yield greater potential gains than a market timer switching between FINI and INDI when they possess 70 percent joint forecasting accuracy or more.

Table 6.13: Imperfect Quarterly Sector Timing Results (no transaction costs)

INDI		RESI					
		50%	60%	70%	80%	90%	100%
50%	Mean(%)	2.10%	2.95%	6.60%	7.31%	10.64%	13.96%
	Std Dev (%)	28.66%	28.47%	28.33%	28.28%	28.18%	28.09%
	Win/Loss	1.05	1.13	1.19	1.32	1.41	1.43
60%	Mean(%)	4.80%	6.22%	9.48 %	11.25 %	14.04 %	17.12 %
	Std Dev (%)	28.56%	28.38%	28.24%	28.09%	27.93%	27.76%
	Win/Loss	1.16	1.23	1.37	1.49	1.52	1.56
70%	Mean(%)	7.78%	9.35%	11.46%	14.04%	18.39%	19.02%
	Std Dev (%)	28.26%	28.00%	27.85%	27.70%	27.51%	27.38%
	Win/Loss	1.27	1.35	1.47	1.59	1.68	1.72
80%	Mean(%)	10.94%	12.77%	16.00%	17.26%	21.41%	22.34%
	Std Dev (%)	27.94%	27.64%	27.36%	27.22%	27.07%	27.90%
	Win/Loss	1.39	1.44	1.58	1.62	1.76	1.88
90%	Mean(%)	14.44%	14.84%	16.49%	20.44%	24.64%	25.63%
	Std Dev (%)	27.26%	27.08%	26.78%	26.52%	26.40%	26.30%
	Win/Loss	1.47	1.62	1.75	1.89	1.97	2.09
100%	Mean(%)	17.39%	20.17%	21.88%	25.11%	25.77%	31.41%
	Std Dev (%)	26.98%	26.32%	26.26%	26.10%	25.97%	25.80%
	Win/Loss	1.64	1.74	1.78	1.95	2.10	2.39

Table 6.14 below illustrates the results for a market timer who revises his/her portfolio on a quarterly basis when switching between RESI and INDI and incurs 2 percent transaction costs. When taking into account transaction costs of 2 percent, the joint forecasting accuracy required increases from 50 percent as illustrated in Table 6.13, to 60 percent. Additionally, the other forecasting accuracies required by a market timer to yield potential gains are 70 percent in RESI and 50 percent in INDI or 50 percent in RESI and 60 percent in INDI. Assuming either no RESI or INDI forecasting ability, the win/loss ratio is greater than 1 when a market timer has 60 percent forecasting accuracy in either RESI or INDI respectively. Results also reveal that when taking into account the maximum assumption of 2 percent transaction costs, the potential gains available to a market timer decreases on average by approximately 4 percent per annum, in comparison to Table 6.13. Moreover, the standard deviation overall increases, when 2 percent transaction costs are incurred.

Table 6.14: Imperfect Quarterly Sector Timing Results (2 percent transaction costs)

INDI		RESI					
		50%	60%	70%	80%	90%	100%
50%	Mean(%)	-2.02%	-0.64%	1.97%	4.18%	7.19%	9.39%
	Std Dev (%)	28.84%	28.76%	28.66%	28.56%	28.48%	28.38%
	Win/Loss	0.92	1.01	1.07	1.17	1.26	1.29
60%	Mean(%)	0.56%	2.22%	6.30%	7.61%	10.55%	12.07%
	Std Dev (%)	28.70%	28.62%	28.56%	28.46%	28.36%	28.30%
	Win/Loss	1.03	1.12	1.19	1.25	1.32	1.38
70%	Mean(%)	3.36%	6.01%	8.41%	9.82%	12.46%	15.06%
	Std Dev (%)	28.52%	28.40%	28.24%	28.16%	28.02%	27.90%
	Win/Loss	1.15	1.23	1.36	1.47	1.51	1.54
80%	Mean(%)	6.47%	8.24%	10.99%	13.60%	16.45%	18.52%
	Std Dev (%)	27.74%	27.70%	27.58%	27.44%	27.30%	27.18%
	Win/Loss	1.23	1.32	1.45	1.51	1.62	1.66
90%	Mean(%)	9.01%	12.03%	13.87%	15.55%	19.66%	21.88%
	Std Dev (%)	27.46%	27.30%	26.90%	26.78%	26.64%	26.58%
	Win/Loss	1.30	1.43	1.58	1.65	1.77	1.86
100%	Mean(%)	11.68%	14.62%	16.54%	18.93%	22.95%	26.15%
	Std Dev (%)	26.14%	26.02%	25.88%	25.74%	25.62%	25.42%
	Win/Loss	1.46	1.53	1.56	1.73	1.85	2.08

Table 6.15 below shows the results for a market timer switching between RESI and FINI on a quarterly basis, without taking transaction costs into account. Results reveal that a market timer requires a joint forecasting accuracy of 60 percent in both RESI and FINI in order to yield potential gains. Additionally, the other forecasting accuracies required by a market timer to yield potential gains are 60 percent FINI and 50 percent RESI or 50 percent FINI and 60 percent RESI. The win/loss ratio is greater than 1 when a market timer has 60 percent joint forecasting accuracy in both FINI and RESI. Moreover, when a market timer has a joint forecasting accuracy of 60 percent, the win/loss ratio is 1.11, indicating that they have a probability of (1.11/ (1 + 1.11)*100) 52.61 percent of outperforming a buy and hold strategy. Results also reveal that a market timer with perfect forecasting accuracy may yield potential gains of 29.42 percent per annum on average, when transaction costs are not taken into account.

Table 6.15: Imperfect Quarterly Sector Timing Results (no transaction costs)

FINI		RESI					
		50%	60%	70%	80%	90%	100%
50%	Mean(%)	-2.47%	2.18%	3.73%	6.65%	10.02%	11.78%
	Std Dev (%)	31.14%	31.02%	30.87%	30.75%	30.62%	30.53%
	Win/Loss	0.96	1.03	1.13	1.19	1.30	1.41
60%	Mean(%)	0.61%	3.51%	6.64%	10.60%	12.06%	16.96%
	Std Dev (%)	30.93%	30.71%	30.54%	30.33%	30.22%	30.15%
	Win/Loss	1.01	1.11	1.21	1.28	1.41	1.51
70%	Mean(%)	3.15%	6.56%	10.15%	12.28%	16.27%	18.73%
	Std Dev (%)	30.75%	30.67%	30.44%	30.31%	30.15%	30.09%
	Win/Loss	1.09	1.18	1.30	1.42	1.49	1.62
80%	Mean(%)	6.66%	9.22%	12.31%	14.56%	19.48%	22.39%
	Std Dev (%)	30.47%	30.39%	30.29%	30.18%	30.10%	29.98%
	Win/Loss	1.21	1.31	1.38	1.53	1.61	1.73
90%	Mean(%)	7.59%	12.69%	15.86%	17.41%	22.32%	24.88%
	Std Dev (%)	29.91%	29.89%	29.78%	29.65%	29.55%	29.46%
	Win/Loss	1.26	1.39	1.47	1.64	1.75	1.84
100%	Mean(%)	11.91%	15.28%	18.39%	21.57%	24.54%	25.47%
	Std Dev (%)	29.49%	29.38%	29.29%	29.19%	29.08%	28.90%
	Win/Loss	1.38	1.51	1.65	1.78	1.91	2.02

Table 6.16 below illustrates the results for a market timer who switches between RESI and FINI on a quarterly basis, incurring 2 percent transaction costs. Similar to that of Table 6.13, a market timer requires a joint forecasting accuracy of 60 percent in both RESI and FINI. However, when taking into account transaction costs of 2 percent and quarterly portfolio revisions, the potential gains available to a market timer are on average 0.24 percent annually compared to 3.51 percent as illustrated in Table 6.15. Similarly to Table 6.15, the win/loss ratio is greater than 1 when a market timer has a joint forecasting of 60 percent in both RESI and FINI. Results reveal that when a market timer has a joint forecasting accuracy of 60 percent, the win/loss ratio is 1.01, indicating that they have a probability of (1.01/ (1 + 1.01)*100) 50.25 percent of outperforming a buy and hold strategy. Comparatively, a market timer who revises his/her portfolio quarterly and does not incur transaction costs, has a 52.61 percent probability of outperforming a buy and hold strategy.

Table 6.16: Imperfect Quarterly Sector Timing Results (2 percent transaction costs)

FINI		RESI					
		50%	60%	70%	80%	90%	100%
50%	Mean(%)	-6.02%	-2.05%	0.47%	3.09%	5.37%	8.17%
	Std Dev (%)	31.39%	31.21%	31.10%	30.99%	30.90%	30.82%
	Win/Loss	0.86	0.92	1.02	1.08	1.18	1.28
60%	Mean(%)	-2.88%	0.24%	2.94%	4.88%	9.99%	13.55%
	Std Dev (%)	31.24%	31.09%	30.97%	30.85%	30.72%	30.60%
	Win/Loss	0.91	1.01	1.09	1.14	1.26	1.36
70%	Mean(%)	-0.13%	1.92%	5.01%	8.48%	11.13%	13.58%
	Std Dev (%)	31.03%	30.93%	30.80%	30.74%	30.61%	30.55%
	Win/Loss	0.99	1.07	1.17	1.22	1.29	1.45
80%	Mean(%)	0.47%	4.70%	8.27%	11.61%	13.27%	17.17%
	Std Dev (%)	30.90%	30.77%	30.68%	30.57%	30.48%	30.37%
	Win/Loss	1.09	1.15	1.23	1.30	1.38	1.47
90%	Mean(%)	5.39%	8.96%	10.92%	13.97%	16.57%	18.56%
	Std Dev (%)	30.78%	30.67%	30.54%	30.40%	30.26%	30.11%
	Win/Loss	1.13	1.2	1.27	1.36	1.45	1.57
100%	Mean(%)	6.73%	11.02%	12.92%	16.51%	18.01%	20.48%
	Std Dev (%)	30.30%	30.17%	30.02%	29.94%	29.79%	29.63%
	Win/Loss	1.23	1.26	1.31	1.39	1.49	1.60

6.3.3 Monthly Revision Frequency

Table 6.17 below summarises the results for a market timer who revises his/her portfolio monthly with no transaction costs being incurred, when switching between FINI and INDI. Simulated results reveal that a market timer requires a joint forecasting accuracy of 60 percent to yield potential gains as opposed to 50 percent joint forecasting accuracy required for annual and quarterly portfolio revisions, when no transaction costs are incurred. Additionally, the potential gains available to a market timer with a 60 percent joint forecasting accuracy is on average 6.93 percent per annum. Results also reveal that even though a market timer's returns are below that of a buy and hold strategy when a market timer has a joint forecasting accuracy of 50 percent in both FINI and INDI, the win/loss ratio is still greater than 1. A market timer who possesses perfect forecasting accuracy when switching between FINI and INDI may yield on average potential gains of 40.79 percent per annum.

Table 6.17: Imperfect Monthly Sector Timing Results (no transaction costs)

INDI		FINI					
		50%	60%	70%	80%	90%	100%
50%	Mean(%)	-0.48%	3.41%	8.60%	12.55%	16.77%	17.60%
	Std Dev (%)	25.53%	25.36%	25.25%	25.15%	25.11%	25.01%
	Win/Loss	1.07	1.11	1.19	1.23	1.35	1.45
60%	Mean(%)	4.66%	6.93%	12.68%	15.39%	20.27%	21.56%
	Std Dev (%)	25.22%	25.05%	24.94%	24.84%	24.73%	24.60%
	Win/Loss	1.12	1.21	1.23	1.34	1.41	1.51
70%	Mean(%)	10.69%	12.95%	15.80%	20.13%	24.46%	28.02%
	Std Dev (%)	25.05%	24.91%	24.80%	24.66%	24.56%	24.42%
	Win/Loss	1.24	1.25	1.32	1.43	1.51	1.61
80%	Mean(%)	14.44%	17.88%	21.27%	24.02%	29.84%	33.86%
	Std Dev (%)	24.91%	24.80%	24.73%	24.60%	24.49%	24.42%
	Win/Loss	1.28	1.32	1.45	1.53	1.59	1.69
90%	Mean(%)	19.56%	24.16%	24.75%	29.99%	32.61%	37.03%
	Std Dev (%)	24.80%	24.66%	24.56%	24.42%	24.32%	24.18%
	Win/Loss	1.31	1.42	1.55	1.69	1.85	1.91
100%	Mean(%)	23.29%	26.08%	27.87%	32.46%	37.35%	40.79%
	Std Dev (%)	24.39%	24.18%	24.04%	23.87%	23.73%	23.56%
	Win/Loss	1.48	1.55	1.63	1.78	1.89	2.00

Table 6.18 below illustrates a market timer who switches between FINI and INDI on a monthly basis, incurring 2 percent transaction costs. The simulated results reveal that a market timer requires a joint forecasting accuracy of 70 percent in both FINI and INDI as opposed to 60 percent joint forecasting accuracy illustrated in Table 6.17, when no transaction costs are taken into account. Additionally, a market timer may also require the following forecasting accuracies: 90 percent in FINI and 50 percent in INDI, 80 percent in FINI and 60 percent in INDI, 60 percent in FINI and 70 percent in INDI or 50 percent in FINI and 80 percent in INDI. The win/loss ratio is greater than 1 when a market timer has a 70 percent joint forecasting accuracy in both FINI and INDI. Results reveal that a market timer with no forecasting accuracy and incurs 2 percent transaction costs underperforms a buy and hold strategy by 9.77 percent per annum as opposed to underperforming a buy and hold strategy by 0.48 when no transaction costs are incurred.

Table 6.18: Imperfect Monthly Sector Timing Results (2 percent transaction costs)

INDI		FINI 50%	60%	70%	80%	90%	100%
50%	Mean(%)	-9.77%	-7.06%	-3.54%	-1.69%	2.43%	5.41%
	Std Dev (%)	25.88%	25.70%	25.60%	25.46%	25.36%	25.25%
	Win/Loss	0.84	0.87	0.97	0.99	1.07	1.18
60%	Mean(%)	-5.03%	-3.91%	-1.69%	4.16%	5.91%	9.25%
	Std Dev (%)	25.60%	25.46%	25.36%	25.25%	25.11%	24.94%
	Win/Loss	0.91	0.96	0.99	1.08	1.13	1.18
70%	Mean(%)	-3.41%	0.36%	3.29%	7.31%	12.28%	14.57%
	Std Dev (%)	25.60%	25.25%	25.08%	24.87%	24.77%	24.60%
	Win/Loss	0.98	1.02	1.04	1.15	1.2	1.29
80%	Mean(%)	0.84%	4.16%	7.44%	9.77%	14.03%	16.08%
	Std Dev (%)	25.43%	25.18%	24.94%	24.80%	24.66%	24.56%
	Win/Loss	1.02	1.1	1.19	1.22	1.3	1.34
90%	Mean(%)	6.82%	8.73%	11.75%	16.49%	20.98%	22.87%
	Std Dev (%)	25.11%	24.94%	24.77%	24.60%	24.32%	24.18%
	Win/Loss	1.07	1.15	1.26	1.35	1.46	1.51
100%	Mean(%)	7.70%	12.55%	15.53%	18.30%	21.85%	23.67%
	Std Dev (%)	7.28%	7.18%	7.09%	7.04%	6.97%	6.84%
	Win/Loss	1.18	1.23	1.31	1.38	1.47	1.55

Table 6.19 below shows the simulated results for a market timer who switches between RESI and INDI on a monthly basis, without incurring transaction costs. Results reveal that a market timer with a 50 percent joint forecasting accuracy in both RESI and INDI outperforms a buy and hold strategy by 1.21 percent per annum with a standard deviation of 28.61 percent. Moreover, the win/loss ratio indicates that a market timer with no forecasting accuracy has a (1.01/ (1 + 1.01)) 50.25 percent probability of outperforming a buy and hold strategy. Results also reveal that a market timer with perfect forecasting accuracy will yield potential gains of 52.66 percent per annum on average with a standard deviation of potential gains equal to 24.74 percent.

Table 6.19: Imperfect Monthly Sector Timing Results (no transaction costs)

INDI		RESI					
		50%	60%	70%	80%	90%	100%
50%	Mean(%)	1.21%	3.54%	9.51%	14.03%	17.46%	23.00%
	Std Dev (%)	28.61 %	28.47%	28.38%	28.16%	28.03%	27.91%
	Win/Loss	1.01	1.06	1.99	1.28	1.33	1.5
60%	Mean(%)	6.04%	11.75%	12.28%	17.46%	22.85%	27.57%
	Std Dev (%)	27.89%	27.41%	28.41%	28.51 %	28.68 %	28.79 %
	Win/Loss	1.1	1.16	1.25	1.36	1.43	1.56
70%	Mean(%)	12.55%	13.49%	21.27%	23.58%	28.32%	33.55%
	Std Dev (%)	27.47%	27.34%	27.16%	27.06%	26.88%	26.62%
	Win/Loss	1.19	1.28	1.34	1.44	1.57	1.69
80%	Mean(%)	18.02%	19.00%	25.78%	29.69%	37.19%	41.42%
	Std Dev (%)	27.29%	27.03%	26.87%	26.64%	26.36%	26.19%
	Win/Loss	1.27	1.32	1.46	1.55	1.63	1.78
90%	Mean(%)	21.41%	27.42%	29.99%	36.55%	40.92%	45.93%
	Std Dev (%)	26.50%	26.36 %	26.09%	25.87%	25.70%	26.54%
	Win/Loss	1.4	1.51	1.63	1.78	1.85	1.98
100%	Mean(%)	26.68%	33.70%	35.75%	42.74%	48.84%	52.66%
	Std Dev (%)	25.91%	25.68%	25.40%	25.22%	25.06%	24.74%
	Win/Loss	1.5	1.62	1.78	1.84	1.99	2.17

Table 6.20 below illustrates the simulated results for a market timer who revises his/her portfolio on a monthly basis when switching between RESI and INDI, taking into account the maximum assumption of 2 percent transaction costs. Results reveal that when taking into account the maximum assumption of 2 percent transaction costs, the joint forecasting accuracy required yielding potential gains increases to 70 percent from 50 percent when no transaction costs incurred as illustrated in Table 6.19. Additionally, the other forecasting accuracies required for a market timer is 80 percent in RESI and 50 percent in INDI, 70 percent in RESI and 60 percent in INDI, 60 percent RESI and 70 percent in INDI and 50 percent in RESI and 80 percent in INDI. The win/loss ratio is greater than 1 when a market timer has a 70 percent joint forecasting accuracy in both RESI and INDI. Results overall reveal that 2 percent transaction costs increases the required forecasting accuracy by approximately 20 percentage points and drastically decreases potential gains.

Table 6.20: Imperfect Monthly Sector Timing Results (2 percent transaction costs)

INDI		RESI 50%	60%	70%	80%	90%	100%
50%	Mean(%)	-10.30%	-8.34%	-2.67%	1.94%	4.78%	10.30%
	Std Dev (%)	28.54%	28.41%	28.30%	28.16%	27.99%	27.89%
	Win/Loss	0.84	0.88	0.99	1.05	1.11	1.21
60%	Mean(%)	-6.29%	-0.72%	3.41%	6.04%	8.08%	13.76%
	Std Dev (%)	28.23%	28.09%	27.96%	27.78%	27.61%	27.50%
	Win/Loss	0.90	0.94	1.04	1.11	1.2	1.28
70%	Mean(%)	-2.30%	3.66%	5.28%	10.16%	14.30%	19.14%
	Std Dev (%)	27.61%	27.50%	27.33%	27.16%	27.02%	26.81%
	Win/Loss	0.97	1.06	1.13	1.24	1.32	1.36
80%	Mean(%)	2.80%	5.54%	12.28%	15.15%	20.13%	26.08%
	Std Dev (%)	27.16%	26.99%	26.85%	26.67%	26.47%	26.26%
	Win/Loss	1.04	1.17	1.22	1.29	1.37	1.43
90%	Mean(%)	8.99%	12.42%	15.66%	19.56%	23.14%	29.99%
	Std Dev (%)	26.92%	26.74%	26.57%	26.36%	26.19%	25.98%
	Win/Loss	1.12	1.23	1.34	1.45	1.53	1.59
100%	Mean(%)	13.89%	19.00%	20.13%	27.57%	29.69%	34.53%
	Std Dev (%)	26.19%	25.95%	25.81%	25.63%	25.50%	25.29%
	Win/Loss	1.22	1.36	1.41	1.57	1.65	1.71

The results in Table 6.7, Table 6.8, Table 6.13, Table 6.14, 6.19 and Table 6.20 overall reveal that the potential gains available to a market timer are more sensitive to an increase in forecasting accuracy in an industrial dominant market as indicated by all portfolio revisions. This is evident in that the potential gains increase more along the columns than across the rows. As illustrated in Table 6.20 above, assuming that a market timer has no forecasting ability (i.e. 50 percent forecasting accuracy in both RESI and INDI, he/she underperforms a buy and hold strategy by 10.30 percent. However, assuming that a market timer has no forecasting ability in the INDI market and 100 percent forecasting accuracy in the RESI market, he/she yields potential gains of 10.30 percent per annum. On the other hand, assuming that a market timer has no forecasting ability in the RESI market and 100 percent forecasting accuracy in the INDI market, he/she yields potential gains of 13.89 percent per annum. This result is expected due to the fact that the industrial index is a better performing index than the resource index. Therefore, improving the forecasting accuracy for the industrial dominant market is a more effective way of improving the performance of the sector timing strategy.

Table 6.21 below shows the simulated results for a market timer switching between RESI and FINI on a monthly basis, without any transaction costs incurred. Results illustrate that a market timer requires a 60 percent joint forecasting accuracy in both RESI and FINI in order to outperform a buy and hold strategy. A market timer with a 60 percent joint forecasting accuracy in both RESI and FINI yields potential gains of 6.04 percent per annum on average. Results also reveal that a market timer with 60 percent joint forecasting accuracy has a (1.12/ (1+1.12)) 52.83 percent probability of outperforming a buy and hold strategy. Similar to results in Table 6.17 (FINI_INDI), a market timer who revises his/her portfolio monthly and does not incur transaction costs requires 60 percent joint forecasting accuracy. However, a market timer with a 60 percent joint forecasting accuracy in both FINI and INDI yields potential gains of 6.93 percent as opposed 6.04 percent potential gains yielded by a market timer switching between RESI and FINI.

Table 6.21: Imperfect Monthly Sector Timing Results (no transaction costs)

FINI		RESI					
		50%	60%	70%	80%	90%	100%
50%	Mean(%)	-3.54%	-0.36%	6.93%	9.77%	13.35%	19.28%
	Std Dev (%)	28.41%	28.29%	28.03%	27.91%	27.77%	7.55%
	Win/Loss	0.98	1.02	1.12	1.21	1.30	1.39
60%	Mean(%)	0.96%	6.04%	10.56%	14.71%	20.70%	24.90%
	Std Dev (%)	28.02%	27.84%	28.64%	28.54%	28.31%	29.13%
	Win/Loss	1.05	1.12	1.23	1.30	1.40	1.48
70%	Mean(%)	7.19%	10.30%	14.71%	21.99%	26.38%	30.30%
	Std Dev (%)	27.68%	27.43%	27.22%	27.06%	26.86%	26.66%
	Win/Loss	1.15	1.21	1.30	1.36	1.43	1.5
80%	Mean(%)	10.69%	16.90%	19.99%	26.23%	30.30%	34.96%
	Std Dev (%)	27.23%	27.06%	26.82%	26.54%	26.31%	26.12%
	Win/Loss	1.26	1.28	1.37	1.45	1.52	1.59
90%	Mean(%)	17.18%	21.13%	25.34%	29.84%	34.49%	44.41%
	Std Dev (%)	26.92%	26.75%	26.56%	26.31%	26.19%	26.02%
	Win/Loss	1.33	1.39	1.44	1.54	1.6	1.68
100%	Mean(%)	20.70%	27.27%	33.23%	38.32%	42.58%	48.61%
	Std Dev (%)	26.26%	26.08%	25.95%	25.80%	25.66%	25.51%
	Win/Loss	1.45	1.52	1.59	1.63	1.70	1.77

Table 6.22 shows the simulated results for a market timer who switches between RESI and FINI on a monthly basis, incurring 2 percent transaction costs. Results reveal that a market timer with no forecasting accuracy underperforms a buy and hold strategy by 14.84 percent per annum. Results also illustrate that a market timer requires a joint forecasting accuracy of 70 percent in both RESI and FINI to outperform a buy and hold strategy. Additionally, the other forecasting accuracies required are: 90 percent in RESI and 50 percent in FINI, 80 percent in RESI and 60 percent in FINI, 60 percent in RESI and 80 percent in FINI, 50 percent in RESI and 80 percent in FINI. The win/loss ratio is greater than 1 when a market timer has a 70 percent joint forecasting accuracy in both RESI and FINI. On average, when taking into account monthly portfolio revisions and the maximum assumption of 2 percent transaction costs, the forecasting accuracy required by a market timer when switching between RESI and FINI increases on average by 20 percentage points.

Table 6.22: Imperfect Monthly Sector Timing Results (2 percent transaction costs)

FINI		RESI					
		50%	60%	70%	80%	90%	100%
50%	Mean(%)	-14.84%	-11.25%	-6.97%	-2.61%	0.36%	5.41%
	Std Dev (%)	26.68%	28.51%	28.34%	28.20%	27.99%	27.82%
	Win/Loss	0.85	0.91	0.96	1.00	1.13	1.15
60%	Mean(%)	-9.85%	-5.50%	-1.19%	2.43%	6.55%	10.03%
	Std Dev (%)	28.41%	28.27%	28.06%	27.89%	27.64%	27.50%
	Win/Loss	0.91	0.95	0.99	1.09	1.16	1.20
70%	Mean(%)	-4.93%	-1.90%	2.18%	6.42%	9.90%	13.89%
	Std Dev (%)	28.16%	28.02%	27.89%	27.71%	27.50%	27.37%
	Win/Loss	0.94	0.99	1.11	1.21	1.29	1.28
80%	Mean(%)	0.42%	1.94%	7.31%	12.01%	15.12%	21.27%
	Std Dev (%)	27.82%	27.75%	27.64%	27.50%	27.30%	27.09%
	Win/Loss	1.03	1.10	1.24	1.28	1.32	1.39
90%	Mean(%)	3.66%	7.44%	13.35%	18.30%	21.84%	28.02%
	Std Dev (%)	27.57%	27.37%	27.02%	26.85%	26.67%	26.57%
	Win/Loss	1.12	1.22	1.27	1.32	1.378	1.44
100%	Mean(%)	8.86%	11.88%	16.08%	21.43%	26.08%	30.54%
	Std Dev (%)	26.60%	26.33%	26.15%	25.98%	25.88%	25.70%
	Win/Loss	1.20	1.24	1.34	1.43	1.54	1.68

As illustrated by Table 6.9, Table 6.10, Table 6.21, Table 6.22, Table 6 in Appendix C and Table 13 in Appendix D, when switching between RESI and FINI, the potential gains are more sensitive to increases in the forecasting accuracy in the financial dominant market as opposed to the resource dominant market. This is indicated by potential gains increasing more along the columns than across the rows. As illustrated in Table 6.22 above, assuming that a market timer does not possess any RESI and FINI forecasting ability, he /she underperforms a buy and hold strategy by 14.84 percent. However, assuming that a market timer has no forecasting ability in the FINI market and 100 percent forecasting accuracy in the RESI market, he/she yields potential gains of 5.41 percent per annum. On the other hand, assuming that a market timer has no forecasting ability in the RESI market and 100 percent forecasting accuracy in the FINI market, he/she yields potential gains of 8.86 percent per annum. This result is expected due to the fact that the financial index is a better performing index than the resource index. Therefore, improving the forecasting accuracy for the financial dominant market is a more effective way of improving the performance of the sector timing strategy.

6.4 Conclusion

It is evident that under all three portfolio revision periods for all sector timing strategies, a market timer with perfect forecasting accuracy yields much greater returns with less variability than that of an investor who buys and holds the ALSI, even when taking into account transaction costs of 1 percent and 2 percent respectively. Moreover, results overall reveal that a market timer possessing perfect forecasting accuracy when switching between RESI and INDI yields the greatest return out of the three sector timing strategies, under all three portfolio revisions. A market timer switching between FINI and INDI yields the second greatest return and a sector timing strategy when switching between RESI and FINI yields the lowest return with the greatest variability.

The results from less-than perfect timing overall demonstrate, for both annual and quarterly portfolio revisions and assuming transaction costs of 2 percent, that a market timer who switches between the indices requires a moderate level of accuracy (i.e. 60 percent joint forecasting accuracy) in order to outperform a buy and hold strategy in the ALSI. Additionally, results reveal that a market timer with a moderate level of forecasting accuracy has a greater than 50 percent probability of outperforming a buy and hold strategy. However, when taking into account transaction costs and monthly portfolio revisions, a market timer requires significant forecasting accuracy (i.e. 70 percent joint forecasting accuracy) in order to outperform a buy and hold strategy in ALSI for all sector timing strategies. This may be due to the fact that a market timer is required to switch more often between sector indices, thus, incurring more transaction costs.

Based on the market segmentation phenomenon by Van Rensburg and Slaney (1997) and Van Rensburg (2002), results reveal that even when transaction costs are taken into account, there are potential gains available to a market timer who has significant forecasting accuracy when switching between RESI and INDI. Moreover, results illustrate that it is more important to improve on the forecasting accuracy in the industrial dominant market than it is to forecast the resource dominant market. This is illustrated by the negative potential gains across the rows, which indicates that it is more important to forecast INDI than it is to forecast RESI. Additionally, results indicate that if a market timer can only forecast a resource dominant market accurately 50 percent of the time, then he/she should not participate in sector timing. Therefore, the easiest way to outperform a buy and hold strategy is improving the market timing ability in the industrial dominant market. Overall, the potential gains from sector timing on the JSE are likely to be modest at best, and a market timer requires superior forecasting accuracy in order to outperform a buy and hold strategy in ALSI.

7

CONCLUSION

Traditional finance theories such as the Efficient Market Hypothesis (EMH) assume that investors are rational and that the market is efficient; whereby all relevant information is reflected in asset prices (Fama, 1965, 1970 and 1991). An efficient market is defined as a market with a large number of rational investors who actively compete but fail to outperform their rivals by consistently generating risk adjusted returns (Fama, 1965). Additionally, Von Neumann and Morgenstern (1944) are of the belief that investors tend to be risk averse and rational in their decision making.

The EMH divides an efficient market into three forms; each form has a unique characteristic that rules out the possibility that an investor is able to consistently outperform the market. The first is the weak-form EMH which states that an investor cannot use historical prices and volume data to determine future probable prices of assets. The weak-form EMH concurs with the random walk hypothesis, which states that a series of price changes have no memory, therefore, past prices cannot be used to predict future prices, as they are already incorporated in the current asset prices**.** Secondly, semi-strong form EMH is where an investor cannot use publicly available information to outperform the market in a consistent manner. Lastly, strong-form EMH is where an investor cannot use private information to outperform the market in a consistent manner. Private information is information that is not publically available, and if used it would be illegal and known as insider trading.

Contrary to traditional finance theories, behavioural finance assumes that investors are irrational and make investment decisions based on their emotions and are subject to behavioural biases. Kahneman and Tversky's (1979) prospect theory's outcomes are considered to have contributed to the major developments in behavioural finance, and the behavioural biases are considered as outcomes of the prospect theory. The cognitive biases outlined by prospect theory include: loss aversion, the disposition effect, the certainty effect, the reflection effect, mental accounting and heuristic simplification. These biases lead investors to violate the assumptions of traditional finance theories; thus causing a drift in their decisions from rationality towards irrationality.

The presence of market segmentation between the resource sector and the financial sector as well as the industrial sector on the JSE, as motivated by Van Rensburg and Slaney (1997) and Van Rensburg (2002), prompts this research to examine the potential gains from sector timing on the JSE. The primary objective of this study is to determine whether the market segmentation phenomenon on the JSE provides opportunities for profitable sector timing strategies. Defining potential gains as the incremental returns from a market timing strategy in excess of that of a buy and hold strategy in the ALSI, this study evaluates the potential gains available to a hypothetical market timer applying pre-specified sector timing strategies on the JSE over the period from 1 January 2002 to 31 December 2016, taking into account different portfolio revision frequencies and transaction costs.

7.1 Summary of Results

The first test in the study evaluated the potential gains available to a hypothetical market timer who switches between the ALSI and the STEFI in bull and bear markets respectively, on the JSE. The simulated buy and hold results revealed that an investor who applied a buy and hold strategy in the STEFI yields an annual average return of 8.21 percent with a standard deviation of returns of 2.52 percent. On the contrary, an investor holding the ALSI yields an annual average return of 16.93 percent with a standard deviation of returns of 20.80 percent. The simulated buy and hold results revealed that the returns of an investor solely invested in the ALSI yields more than twice the return generated by an investor solely invested in the STEFI, however with much greater variability of returns as illustrated by the standard deviations.

The simulated results from perfect timing overall illustrate that under all three portfolio revision periods, a market timer with perfect forecasting accuracy yields a greater return with less variability than that of a buy and hold strategy in the ALSI even when taking into account the maximum assumption of 2 percent transaction costs. These results concur with that of Shape (1975), Chua, Woodward and To (1987) and Hsieh (2013a) studies conducted in the U.S. market, Canada and Taiwan respectively. This result is expected as the timing strategy assumes perfect foresight from the market timer hypothetically.

Results from less than perfect timing reveal that when taking into account 2 percent transaction costs, the general required joint forecasting accuracy in both the ALSI and the STEFI is 80 percent to yield potential gains, across all the portfolio revision periods. The results concur with that of Sharpe's (1975) study in the U.S. stock market, Chua et al. (1987) study in the Canadian stock market, Firer, Sandler and Ward (1992), De Chassart and Firer (2004) and Ward and Terblanche's (2009). The latter three were conducted on the JSE, which found that potential gains are realised when a market timer has a great degree of predictive accuracy that is almost unattainable to most investors. In addition, the win/loss ratio is generally greater than 1 when a market timer possesses 90 percent joint forecasting or more, in both the ALSI and the STEFI. This implies that a market timer is required to have a 90 percent joint forecasting accuracy or more, in both the ALSI and the STEFI to achieve a greater probability to outperform a buy and hold strategy in the ALSI.

The results obtained in this research also concur with the findings made by Chua et al. (1987), Shilling (1992), Khokhlov (2016) in developed markets and De Chassart and Firer (2004) in developing markets in that it is more important to forecast bull markets correctly than bear markets. If a market timer possesses no ability to predict an upcoming bull market (i.e. bull market forecasting accuracy of 50 percent), a market timer's mean return will be less than that of a buy and hold strategy in the ALSI even if he/she can forecast bear markets perfectly (i.e. 100 percent bear forecasting accuracy). On the other hand, if a market timer's bull market forecasting accuracy is greater than or equal to 80 percent, his/her potential gains will most likely be positive even if he/she is unable to predict the upcoming bear market at all (i.e. 50 percent bear forecasting accuracy).

Overall, the results from the first test reveal that the potential gains from market timing between bull and bear markets on the JSE are likely to be modest at best, as a market timer requires superior forecasting accuracy (i.e. 80 percent joint forecasting accuracy or more) in order to outperform a buy and hold strategy in the ALSI. In addition, the forecasting accuracy required to outperform a buy and hold strategy in the ALSI is unattainable to most market timers.

The second test evaluated the potential gains available to a hypothetical market timer switching between the sector indices on the JSE. The simulated buy and hold strategy results for an investor solely invested in INDI yields the greatest return with the least variability of returns compared to the other sector indices and the ALSI. An investor applying a buy and hold strategy in INDI yields an annual return of 21.69 percent with a standard deviation of returns of 20.15 percent. Comparatively, an investor applying a buy and hold strategy in RESI generates the lowest returns with the greatest variability of returns out of all the sector indices and the ALSI. An investor applying a buy and hold strategy in RESI yields an annual return of 16.09 percent with a standard deviation of returns of 27.87 percent.

The simulated results from the sector timing simulations revealed that under all three portfolio revision periods, a market timer with perfect forecasting accuracy when switching between the sector indices, yields greater returns with less variability than that of an investor who buys and holds the ALSI, even when taking into account 2 percent transaction costs.

These results from perfect sector timing concur with that of Hsieh's (2013a) sector timing study in the Taiwanese market. In addition, when evaluating all three perfect sector timing strategies, results illustrate that switching between RESI and INDI offers the greatest opportunities for outperforming a buy and hold strategy in the ALSI.

Based on the market segmentation phenomenon observed by Van Rensburg and Slaney (1997) and Van Rensburg (2002), the results from less than perfect sector timing simulations revealed that when transaction costs are not taken into account, a market timer switching between the RESI and INDI and FINI and INDI generally do not require any forecasting accuracy to outperform a buy and hold strategy in the ALSI. This could be attributed to the time-diversification benefit derived from the sector timing strategies. However, when transaction costs are not taken into account, a market timer switching between RESI and FINI generally requires moderate forecasting accuracy (i.e. 60 percent joint forecasting accuracy) to outperform a buy and hold strategy in the ALSI.

For both annual and quarterly portfolio revisions with an assumption of 2 percent transaction costs, a market timer switching between the sector indices generally requires a moderate level of accuracy in order to outperform a buy and hold strategy in the ALSI. However, when taking into account 2 percent transaction costs and monthly portfolio revisions, results illustrate that a market timer requires 70 percent joint forecasting accuracy across all sector timing strategies.

The greater forecasting accuracy required by a market when increasing to monthly portfolio revisions are due to the fact that a market timer incurs more transaction costs as he/she revises their portfolio more often, as illustrated across all three sector timing strategies. In addition, results reveal that as portfolio revision frequencies increase; the joint forecasting accuracy and reducing transaction costs are crucial for improvements in the win/loss ratios. Thus, according to the win/loss ratio results, when taking into account 2 percent transaction costs and the more a market timer revises his/her portfolio, the likelihood of benefitting from sector timing requires significant forecasting accuracy (i.e. 70 percent joint forecasting accuracy or more).

The results from less than perfect sector timing also illustrate that a market timer switching between RESI and INDI will generally yield the greatest potential gains out of all sector timing strategies when a market timer possesses a 70 percent joint forecasting accuracy or more in both RESI and INDI. Moreover, results illustrate that it is more important to improve on the forecasting accuracy in the industrial dominant market than it is to forecast the resource dominant market. Additionally, the results indicate that if a market timer can only forecast a resource dominant market accurately 50 percent of the time, then he/she should not participate in sector timing. Therefore, the most effective way to outperform a buy and hold strategy is by improving the market timing ability in forecasting the industrial dominant market. This result is expected due to the fact that the industrial index is the best performing index out of the three sector indices.

In conclusion, the results overall indicate that the benefits of market timing on the JSE are considerably greater when less restrictive assumptions are made about the frequency of portfolio revisions and the level of transaction costs. Similar results were obtained by Droms (1989), Kester (1990), Hsieh (2013a), Dichtl, Drobertz and Kryzanowski (2016) and Khokhlov (2016) in the developed markets and Ward and Terblanche (2009) in the developing markets. Therefore, an effective market timing strategy is characterised by high forecasting accuracies, frequent portfolio revisions and low transaction costs.

7.2 Recommendations

The first recommendation is that the research can be extended to examine returns over different business cycles of the South African economy, as this study did not explicitly discuss. In particular the potential gains of sector timing on the JSE should be specifically studied during the downward phase of the South African business cycle from December 2007 to August 2009. This will assist in identifying how the sectors on the JSE performed during the market downturn, caused by global financial crisis. Furthermore, the potential gains should be compared to that achieved by investors in the subsequent recovery of the South African economy from September 2009. The other area that demands further attention to aid in the development of potential gains available to market timers, is the use of sector indices as benchmarks (RESI, INDI, FINI) to ascertain whether returns achieved by investors are outperforming or underperforming a specific benchmark. In addition, while the transaction costs and portfolio revisions are incorporated in the analysis of the potential gains of sector timing, the study did not take into account 0.25 percent and 0.50 percent transaction costs. By taking into account 0.25 percent and 0.50 percent, we get a more accurate representation of transaction costs incurred today. Lastly, by extending the research period, the time specific bias will be removed and the results will be more relevant to investors practicing market timing today.

BIBLIOGRAPHY

Bailey, J.J., and Kinerson, C. (2005). “Regret Avoidance Risk Tolerance”. *Journal of Financial Counseling Planning*, 16(1), pp. 23–28.

Banz, R. (1981). “The Relationship between Return Market Value of Common Stocks”. *Journal of Financial Economics*, 9(1), pp. 3-18.

Baquero, G., Ter Horst, J., & Verbeek, M. (2005). “Survival, look-ahead bias, and persistence in hedge fund performance”. *Journal of Financial and Quantitative analysis*, *40*(3), pp. 493-517.

Barberis, N.. and Shleifer, A. (2003). “Style Investing”. *Journal of Financial Economics*, 68(2), pp. 161-199.

Barret, A.L., and Brodeski, B.R. (2006). “Survivorship Bias Improper Measurement: How the Mutual Fund Industry Inflates Actively Managed Fund Performance”. *Savant Capital Research Paper*, pp. 3-28.

Basu, S. (1977). “Investment Performance of Common Stocks in Relation to Their Price – Earnings Ratios: A Test of the Efficient Market Hypothesis”. *Journal of Finance*, 32(3), pp. 663 - 682.

Basu, S. (1983). “The Relationship between Earnings’ Yield, Market Value Return for NYSE Common Stocks: Further Evidence”. *Journal of Financial Economics*, 12(1), pp. 129 – 156.

Berent, P., Clarke, R.G., Fitzgerald, M.T., and Statman, M. (1989). “Market Timing with Imperfect Information”. *Financial Analysts Journal*, 45(6), pp. 27-36.

Bikhchani, S., and Sharma, S. (2001). "Herd Behavior in Financial Markets". *IMF Staff Papers,* 47(3), pp. 279- 310.

Bodie, Z., Kane, A., and Marcus, A. (2010). "Essentials of Investments". *Chicago: McGraw-Hill/Irwin.*

Brock, W., Lakonishok, L., and LeBaron, B. (1992). "Simple Technical Trading Rules the Stochastic Properties of Stock Returns". *Journal of Finance*, 47(5), pp. 1731-1764.

Carhart, M. (1997). "On Persistence in Mutual Fund Performance". *The Journal of Finance*, 52(1), pp. 57-82.

Carosso, V.P. (1970). "Investment Banking in America: A History". *Cambridge: Harvard University Press.*

Christopherson, J.A., and Williams, C.N. (1997). "Equity Style: What it is and Why it Matters". *The Handbook of Equity Style Management*, pp. 1-19.

Chua, J.H., To, E.C., and Woodward, R.S. (1987). "Potential Gains from Stock Market Timing in Canada". *Financial Analysis Journal*, 43(5), pp. 50-56.

Clarke, R.G., Fitzgerald M.T., Berent P., and Statman, M. (1989). "Market Timing with Imperfect Information". *Financial Analysts Journal*, 45(6), pp. 27-36.

DE Bondt, W.F.M., and Thaler, R.H. (1987). "Further Evidence on Investor Overreaction Stock Market Seasonality". *The Journal of Finance*, 42(3), pp. 557-581.

DE Bondt, W.F.M., and Thaler, R.H. (1985). "Does the Stock Market Overreact"'. *The Journal of Finance*, 40(3), pp. 793-805.

De Chassart, M.D., Firer, C., Grantham, W., Hill, S., Pryce, M., and Rudden, I. (2000). "Market Timing using Derivatives on the Johannesburg Stock Exchange during Bear Periods". *South African Journal Business Management*, 31(4), pp. 149-155.

De Chassart, M.D., and Firer, C. (2001). "The Effects of Bull and Bear Periods on Market Timing Strategies". *South African Journal Business Management*, 32(30), pp. 1-9.

De Chassart, M.D., and Firer, C. (2001). "Market Timing under Different Market Conditions". *Investment Analysis Journal*, 54(1), pp. 19-31.

De Chassart, M.D., and Firer, C. (2004). "Risk Associated with Market Timing under Different Market Conditions". *The International Journal of Management Science*, 32(1), pp. 201-211.

DeFusco, R. A., McLeavey, D. W., Pinto, J. E., and Runkle, D. E. (2004). "Quantitative Methods for Investment Management". *CFA Institute, Charlottesville, VA*.

Dichtl, H., Drobetz, W., Kryzanowski, L. (2016). "Timing the stock market: Does it really make no sense?". *Journal of Behavioral Experimental Finance*, *10*, 88-104

Droms W.G. (1989). "Market Timing as an Investment Policy". *Financial Analysts Journal,* 45(1), pp. 73-77.

Falkena, H. B., Fourie, L. J., & Kok, W. J. (1986). "*The Mechanics of the South African Financial System: Financial Institutions, Instruments, and Markets"*. MacMillan South Africa.

Fama, E.F. (1965). “Rom Walks in Stock-Market Prices”. *Financial Analysts Journal,* 51(1), pp. 75-80.

Fama, E.F. (1970). “Efficient Capital Markets: A Review of Theory Empirical Work”. *The Journal of Finance*, 25(2), pp. 383-417.

Fama, E.F. (1991). “Efficient Capital Markets: II”. *The Journal of Finance*, 46(5), pp. 1575-1617.

Fama, E., and French, K. (1992) “The Cross-Section of Expected Stock Returns”. *The Journal of Finance,* 47(2), pp. 427-465.

Fama, E., and French, K. (1993). “Common Risk Factors in the Returns on Stocks Bonds”. *Journal of Financial Economics*, (33) 1, pp. 3-56.

Fama, E., and French, K. (1996). “Multifactor Explanations of Asset Pricing Anomalies”. *The Journal of Finance*, 51(1), pp. 55-84.

Fama, E., and French, K. (1998). “Value versus Growth: The International Evidence”. *The Journal of Finance*, 53(6), pp. 1975-1999.

Firer, C., Ward, M., and Teeuwisse, F. (1987). “Market Timing the JSE”. *The Investment Analysts Journal*, 30(1), pp.19-31.

Firer. C., Sler, M., and Ward, M. (1992). “Market Timing Revisited”. *Investment Analysts Journal*, 35(1), pp.7-13.

Forner, C., and Marhuenda, J. (2003). “Contrarian Momentum Strategies in the Spanish Stock Market”. *European Financial Management*, 9(1), pp. 67-88.

Galbraith, J.K. (1954). “The Great Crash 1929”. *Boston: Houghton Mifflin Company*.

Garber, P.M. (1990). "Famous First Bubbles". *The Journal of Economic Perspectives*, 4(2), pp. 35-54.

Geier, B. (2015). "What Did We Learn From the Dotcom Stock Bubble of 2000?". available: http://time.com/3741681/2000-dotcom-stock-bust/.

Gilbert, E., and Strugnell, D. (2010). "Does Survivorship Dias Really Matter? An Empirical Investigation into its Effects on the Mean Reversion of Share Returns on the JSE (1984–2007)". *Investment Analysts Journal*, 39(72), pp. 31-42.

Gondo, J. (2009). "Financial Development Economic Growth: Evidence from South Africa: 1970-1999". *Annual Western Cape Economics Postgraduate Student Conference. Stellenbosch*.

Grinold, R. C. (1989). "The Fundamental Law of Active Management". *The Journal of Portfolio Management*, *15*(3), pp. 30-37.

Grind, K. (2013). "The Seven Deadly Sins of Investing", available: http://www.wsj.com/articles/SB10001424127887324906304579037163080446646.

Hamada, K. (2003). "The Heisei recession: an overview". In *The ESRI International Forum, The Social and Economic Research Institute, Cabinet Office of Japan*, pp. 1-38.

Haugen, R., and Baker N. (1996). "Commonality in the Determinants of Expected Stock Returns". *Journal of Financial Economics*, 41(3), pp. 401-439.

Hallerbach, W. G. (2014). "On the expected performance of market timing strategies". *The Journal of Portfolio Management*, *40*(4), pp. 42-51.

Hirshleifer, D. (2001). “Investor Psychology Asset Pricing”. *The Journal of Finance*, 56(4), pp. 1533-1598.

Hodnett, K. (2012). “Explaining Stock Market Returns: A Review of Empirical Tests of Asset Pricing Anomalies”. *African Journal of Business Management*, 6(17), pp. 5684-5691.

Holt, J. (2009). ”A Summary of the Primary Causes of the Housing Bubble the Resulting Credit Crisis: A Non-Technical Paper”. *The Journal of Business Inquiry*, 8(1), pp.120-129.

Hsieh, H.H., and Hodnett, K.E. (2011). “Tests of the Overreaction Hypothesis the Timing of Mean Reversals on the JSE Securities Exchange (JSE): the Case of South Africa”. *Journal of Applied Finance & Banking*, 1(1), pp. 107-130.

Hsieh, H.H., Hodnett, K.E., and Van Rensburg, P. (2012). “Resilient Market Timing Strategies”. *Journal of Applied Business Research*, 28(5), pp. 803-814.

Hsieh, H.H. (2013a). “Potential Gains from Predicting the Timing of Stock Market Persistence Mean Reversion”. *Investment Management Financial Innovations*, 10(3), pp. 55-67.

Hsieh, H.H. (2013b). “Potential Gain from Sector Timing in Taiwan”. *Journal of Economic Behavioral Studies*, 5(10), pp. 2-11.

Jeffrey, R. (1984). “The Folly of Stock Market Timing”. *Harvard Business Review*, 62(2), pp. 689-706.

Jegadeesh, N., and Titman, S. (1993). “*Returns to Buying Winners Selling Losers: Implications for Stock Market Efficiency”*. *The Journal of Finance*, 48(1), pp. 65.

Jiménez, Á.J. (2011). "Understanding Economic Bubbles". *Programa Universitat-Empresa*, available: www.eco.uab.es/ue/trabajos%20premi/tfc%2061%20Jim%C3%A9nez%201.pdf.

Kahneman, D., and Tversky, A. (1979). "Prospect Theory: An Analysis of Decision under Risk". *Econometrica*, 47(2), pp. 263-291.

Kahneman, D., and Tversky, A. (1982). "Variants of uncertainty". *Cognition*, 11(2), pp. 143-157.

Kearney, L. (2012). "Mining and Minerals in South Africa", available: https://www.brandsouthafrica.com/investments-immigration/business/economy/mining-and-minerals-in-south-africa.

Kendall, M.G., and Hill, B. (1953). "The Analysis of Economic Time-Series-Part 1: Prices". *Journal of Royal Statistical Society. Series A (General)*, 116(1), pp. 11-34.

Kester, G.W. (1990) "Market Timing with Small versus Large-Firm Stocks: Potential Gains Required Predictive Ability". *Financial Analysts Journal*, 46(5), pp. 63-69.

Khokhlov, V. (2016). "Perold-Sharpe Rebalancing Strategies in Practice". *Baltic Journal of Economic Studies*, *2*(3), 127-133.

"Lakonishok, J. (1988). "Are Seasonal Anomalies Real? A Ninety-Year Perspective'. *Review of Financial Studies*, 1(4), pp. 403-425.

Lakonishok, J., Shleifer, A.., and Vishny, R. (1994). "Contrarian Investment, Extrapolation, Risk". *The Journal of Finance*, 49(5), pp.1541-1578.

Lintner, J. (1965). "The Valuation of Risky Assets the Selection of Risky Investments in Stock Portfolios Capital Budgets". *Review of Economic Statistics*, 47(1), pp. 13-37.

Malkiel, B.G. (1973). “A Random Walk Down Wall Street”. *W.W. Norton & Company.*

Malkiel, B.G. (2003). “The Efficient Market Hypothesis and its Critics”. *Journal of Economic Perspectives*, 17(1), pp. 1-47.

Markowitz, H. (1952). “Portfolio Selection”. *The Journal of Finance*, 7(1), pp. 77-91.

Markowitz, H.M. (1990). “Foundations of Portfolio Theory”. *Brauch College, The City University of New York*, pp. 280-287.

Muller, C. (1999). “Investor Over-reaction on the JSE”. *Investment Analysts Journal*, 28(49), pp. 5-17.

Mutooni, R., and Muller, C. (2007). “Equity Style Timing”. *Investment Analysts Journal*, 36(65), pp. 15-24

Olsen, R.A. (1998). ‘Behavioural Finance and its Implications for Stock-Price Volatility’. *Financial Analyst Journal*, 54(2), pp. 10-18.

Oosthuyse, D. (2016). “Gross Domestic Product”. *Stats South Africa*, available:http://www.statssa.gov.za/publications/P0441/P04411stQuarter2017.pdf.

Page, M.J., and Way, C.V. (1992). “Stock Market Over-reaction: The South African Evidence”. *Investment Analysts Journal*, 21(36), pp. 35 – 50.

Peach, N.W. (1941). “The Security Affiliates of National Banks”. *Baltimore: Johns Hopkins Press*.

Peerbhai, F. (2011). “The International Capital Asset Pricing Model: Empirical Evidence for South Africa”. Doctoral dissertation, University of KwaZulu-Natal, Pietermaritzburg.

Peters, D. (2015). “JSE Surges on Financial and Industrial Stocks”. *Fin 24*, available: http://www.fin24.com/Markets/Equities/JSE-surges-on-financial-and-industrial-stocks-20150306

Phung, A. (2014). “Behavioural Finance: Key Concepts- Mental Accounting”. *Investopedia.com*, available at: www.investopedia.com/university/behavioral_finance/behavioral5.asp.

Pierce, P. (1986). “The Dow Jones Averages, 1885-1985”. *Homewood: Dow Jones-Irwin*.

Quiggin, J. (1982). “A Theory of Anticipated Utility”. *Journal of Economic Behavior & Organization*, *3*(4), pp. 323-343.

Rabin, M. (2000). “Risk Aversion and Expected-Utility Theory: A Calibration Theorem”. *Econometrica,* 68(5), pp. 1281-1292.

Raychaudhuri, S. (2008). “Introduction to Monte Carlo Simulation”. *Winter Simulation Conference*, pp. 91-100.

Ritter, J.R. (2003). “Behavioral Finance”. *Pacific-Basin Finance Journal*, 11(4), pp. 429-437.

Rubenstein, M. (2002). “Markowitz ‘Portfolio Selection’: A Fifty Year Retrospective”. *The Journal of Finance*, 57(3), pp. 1041-1045.

Roll, R. (1981). “A Possible Explanation of the Small Firm Effect”. *The Journal of Finance*, 36(4), pp. 879-888.

Samuelson, P.A. (1965). “Proof that Properly Anticipated Prices Fluctuate Randomly”. *Industrial Management Review*, 6(2), pp. 41–49.

Schiereck, D., De Bondt, W., and Weber, M. (1999). “Contrarian Momentum Strategies in Germany”. *Financial Analysts Journal*, 55(6), pp. 104-116.

Sewell, M. (2010). “Behavioral Finance”. *University of Cambridge*, available at: http://www.behaviouralfinance.net/behavioural-finance.pdf.

Sharpe, W.F. (1964). “Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk”. *The Journal of Finance*, 19(3), pp. 425-442.

Sharpe, W.F. (1975). “Likely Gains from Market Timing”. *Financial Analysts Journal*, 31(2), pp. 60-69.

Shefrin, H., and Statman, M. (1985). “The Disposition to Sell Winners too Early Ride Losers too Long: Theory evidence”. *The Journal of Finance*, 40(3), pp. 777-790.

Shilling, A.G. (1992). “Market Timing: Better than a Buy-hold Strategy”. *Financial Analysts Journal*, 48(2), pp. 46–50.

Shiratsuka, S. (2003). “Inflation Measures for Monetary Policy: Measuring Underlying Inflation Trend and its Implication for Monetary Policy Implementation”. *Institute for Monetary and Economic Studies*, 15(2), pp. 1-26.

National Treasury (2015). “Economic Overview”. available: http://www.treasury.gov.za/documents/national%20budget/2017/review/Chapter%202.pdf

Temin, P., and Voth, H. J. (2004). “Riding the South Sea Bubble”. *The American Economic Review*, *94*(5), 1654-1668.

Thaler, R. (1985). “Mental Accounting and Consumer Choice”. *Marketing Science*, *4*(3), pp. 199-214.

Tversky, A., and Kahneman, D. (1974). "Judgment Under Uncertainty: Heuristics Biases". *Science*, 185(4157), pp.1124-1131.

Van Rensburg, P. (2002). "Market Segmentation on the Johannesburg Stock Exchange II". *Studies in Economics and Econometrics*, 26(1), pp. 1-19.

Van Rensburg, P., and Slaney, K. (1997). "Market Segmentation on the Johannesburg Stock Exchange". *Studies in Economics and Econometrics*, 28(1), pp. 69-72.

Von Neumann, J., and Morgenstern, O. (1944). "Theory of Games and Economic Behaviour". *Princeton University Press*.

Ward, M Terblanche, RC, 2009, 'Market Timing on the JSE using exchange rate fluctuations', Investment Analysts Journal, No.70, pp. 1-10.

Waksman, G., Sandler, M., Ward, M., and Firer, C. (1997). "Market timing on the Johannesburg Stock Exchange using derivative instruments". *Omega*, 25(1), pp. 81-91.

Weale P.R., and Amin, H. (2003). "Bursting the Dot.com 'Bubble': a Case Study in Investor Behavior". Technology Analysis and Strategic Management, 15(1), pp.117–136.

White, E.N. (1990). "The Stock Market Boom and Crash of 1929 Revisited". The Journal of Economic Perspectives, 4(2), pp. 67-83.

Young, J. (2013). "Overview of the Financial Services Sector in South Africa". *Matchdeck*, available: https://www.matchdeck.com/article/2347-overview-of-the-financial-services-sector-in-south-africa#/index

APPENDIX A

The tables in Appendix A illustrate the potential gains available to a market timer switching between bull and bear markets on the JSE. Table A-1 below illustrates the potential gains available to a market timer switching between the ALSI and the STEFI on a monthly basis, incurring 1 percent transaction costs. Table A-2 below illustrates the potential gains available to a market timer switching between the ALSI and the STEFI on a quarterly basis, incurring 1 percent transaction costs. Table A-3 below illustrates the potential gains available to a market timer switching between the ALSI and the STEFI on an annual basis, incurring 1 percent transaction costs.

Appendix A-1: Imperfect Monthly Market Timing Results (1 percent transaction costs)

Bear Market Accuracy (%)		**Bull Market Accuracy (%)**					
		50	60	70	80	90	100
50	Mean(%)	-8.64%	-6.18%	-3.19%	0.36%	2.43%	5.91%
	Std Dev (%)	13.16%	12.44%	11.60%	10.67%	9.46%	8.14%
	Win/Loss	0.41	0.44	0.45	0.49	0.52	0.56
60	Mean(%)	-6.18%	-2.84%	-1.43%	2.18%	5.54%	8.08%
	Std Dev (%)	13.41%	12.99%	12.33%	11.19%	10.29%	8.63%
	Win/Loss	0.51	0.53	0.59	0.62	0.66	0.67
70	Mean(%)	-3.77%	-1.31%	1.69%	4.53%	7.70%	11.22%
	Std Dev (%)	14.06%	13.51%	12.89%	11.43%	10.57%	9.25%
	Win/Loss	0.61	0.68	0.7	0.74	0.76	0.86
80	Mean(%)	-1.67%	0.72%	3.66%	6.93%	10.03%	13.76%
	Std Dev (%)	14.48%	13.93%	12.89%	12.30%	11.05%	9.60%
	Win/Loss	0.73	0.78	0.89	0.95	1	1.06
90	Mean(%)	1.33%	3.91%	6.29%	9.38%	12.28%	16.08%
	Std Dev (%)	15.10%	14.34%	13.51%	12.57%	11.47%	10.01%
	Win/Loss	0.83	0.87	0.94	0.98	1.15	1.25
100	Mean(%)	2.18%	6.42%	8.08%	11.48%	15.66%	17.60%
	Std Dev (%)	15.28%	14.79%	13.65%	12.89%	11.64%	10.39%
	Win/Loss	0.97	1.04	1.19	1.24	1.38	1.46

Appendix A-2: Imperfect Quarterly Market Timing Results (1 percent transaction costs)

Bear Market Accuracy (%)		Bull Market Accuracy (%)					
		50	60	70	80	90	100
50	Mean(%)	-4.25%	-2.69%	-1.08%	0.60%	2.34%	4.02%
	Std Dev (%)	12.90%	12.04%	11.42%	10.26%	8.88%	7.68%
	Win/Loss	0.39	0.41	0.44	0.48	0.51	0.55
60	Mean(%)	-2.89%	-1.91%	0.12%	1.73%	3.44%	5.30%
	Std Dev (%)	13.58%	12.70%	11.94%	10.96%	9.66%	8.20%
	Win/Loss	0.47	0.51	0.55	0.57	0.65	0.68
70	Mean(%)	-2.46%	-0.24%	1.61%	3.20%	5.26%	6.60%
	Std Dev (%)	13.76%	13.26%	12.46%	11.32%	10.18%	8.58%
	Win/Loss	0.60	0.65	0.69	0.71	0.76	0.79
80	Mean(%)	-1.35%	1.53%	3.12%	4.06%	6.35%	8.07%
	Std Dev (%)	14.24%	13.76%	12.60%	11.72%	10.42%	9.04%
	Win/Loss	0.72	0.75	0.77	0.79	0.81	0.83
90	Mean(%)	-0.04%	2.38%	4.02%	5.59%	6.93%	8.88%
	Std Dev (%)	14.80%	14.12%	13.08%	12.10%	10.84%	9.36%
	Win/Loss	0.85	0.87	0.95	0.98	1.19	1.32
100	Mean(%)	1.49%	3.16%	5.30%	6.85%	8.92%	10.68%
	Std Dev (%)	15.14%	14.28%	13.44%	12.12%	11.12%	9.98%
	Win/Loss	1.00	1.09	1.18	1.23	1.25	1.59

Appendix A-3: Imperfect Annual Market Timing Results (1 percent transaction costs)

Bear Market Accuracy (%)		Bull Market Accuracy (%)					
		50	60	70	80	90	100
50	Mean(%)	-3.21%	-2.28%	-0.91%	0.39%	1.39%	2.34%
	Std Dev (%)	15.08%	14.18%	13.08%	12.28%	10.14%	7.84%
	Win/Loss	0.36	0.39	0.40	0.45	0.49	0.68
60	Mean(%)	-2.81%	-1.48%	-0.23%	0.94%	1.84%	3.06%
	Std Dev (%)	15.81%	14.74%	13.52%	12.17%	10.62%	8.50%
	Win/Loss	0.44	0.47	0.52	0.58	0.60	0.86
70	Mean(%)	-2.06%	-1.07%	0.26%	1.47%	2.69%	3.63%
	Std Dev (%)	16.24%	15.41%	14.28%	13.04%	11.20%	9.21%
	Win/Loss	0.53	0.58	0.62	0.67	0.76	0.89
80	Mean(%)	-1.26%	-0.52%	0.73%	1.96%	2.83%	4.25%
	Std Dev (%)	16.64%	15.53%	14.37%	13.27%	11.72%	9.47%
	Win/Loss	0.66	0.75	0.79	0.86	0.92	1.07
90	Mean(%)	-0.67%	0.15%	1.54%	2.44%	3.65%	4.96%
	Std Dev (%)	16.86%	16.04%	15.12%	13.66%	11.90%	9.83%
	Win/Loss	0.75	0.84	0.95	1.02	1.12	1.33
100	Mean(%)	-0.30%	0.56%	1.74%	3.03%	4.30%	5.46%
	Std Dev (%)	17.56%	16.83%	15.55%	13.94%	12.40%	10.35%
	Win/Loss	0.89	0.97	1.07	1.18	1.34	1.54

APPENDIX B

Appendix B illustrates the potential gains available to a market timer who revises his/her portfolio on an annual basis, for all three sector timing strategies. Table B-1 below illustrates the potential gains available to a market timer switching between the FINI and the INDI on an annual basis, incurring 1 percent transaction costs. Table B-2 below illustrates the potential gains available to a market timer switching between the RESI and the INDI on an annual basis, incurring 1 percent transaction costs. Table B-3 below illustrates the potential gains available to a market timer switching between the RESI and the FINI on an annual basis, incurring 1 percent transaction costs.

Appendix B-1: Imperfect Annual Market Timing Results (1percent transaction costs)

INDI		**FINI**					
		50%	60%	70%	80%	90%	100%
50%	Mean(%)	1.27%	2.45%	3.15%	4.59%	4.67%	5.79%
	Std Dev (%)	30.30%	30.62%	30.06%	30.37%	29.92%	29.67%
	Win/Loss	1.09	1.12	1.21	1.28	1.32	1.38
60%	Mean(%)	3.57%	4.10%	5.41%	6.39%	6.81%	8.05%
	Std Dev (%)	30.30%	29.94%	29.77%	29.90%	30.03%	29.89%
	Win/Loss	1.19	1.24	1.35	1.4	1.48	1.51
70%	Mean(%)	5.09%	5.09%	6.49%	7.54%	8.96%	9.03%
	Std Dev (%)	29.62%	30.14%	29.65%	29.49%	29.47%	29.28%
	Win/Loss	1.34	1.38	1.43	1.56	1.64	1.71
80%	Mean(%)	6.93%	7.49%	8.30%	8.88%	9.87%	10.57%
	Std Dev (%)	29.60%	29.41%	29.43%	29.71%	28.95%	28.37%
	Win/Loss	1.44	1.52	1.64	1.7	1.78	1.84
90%	Mean(%)	7.62%	8.58%	9.36%	10.65%	11.45%	12.55%
	Std Dev (%)	29.47%	29.47%	28.99%	29.05%	28.51%	27.98%
	Win/Loss	1.57	1.64	1.75	1.89	1.97	2.1
100%	Mean(%)	9.89%	10.90%	11.73%	13.03%	13.53%	14.21%
	Std Dev (%)	29.01%	28.86%	28.48%	28.18%	28.01%	27.20%
	Win/Loss	1.69	1.74	1.84	1.94	2.19	2.33

Appendix B-2: Imperfect Annual Market Timing Results (1 percent transaction costs)

INDI		RESI					
		50%	60%	70%	80%	90%	100%
50%	Mean(%)	0.79%	2.15%	2.65%	3.53%	5.06%	6.26%
	Std Dev (%)	32.80%	32.74%	33.13%	33.00%	33.39%	33.83%
	Win/Loss	1.05	1.13	1.21	1.26	1.33	1.31
60%	Mean(%)	2.62%	4.28%	4.46%	5.31%	7.30%	7.69%
	Std Dev (%)	32.34%	32.37%	32.83%	32.74%	32.92%	32.25%
	Win/Loss	1.16	1.24	1.29	1.35	1.47	1.56
70%	Mean(%)	4.66%	5.36%	6.70%	8.10%	8.83%	9.88%
	Std Dev (%)	31.99%	32.45%	31.95%	31.55%	32.21%	31.84%
	Win/Loss	1.31	1.42	1.54	1.59	1.65	1.73
80%	Mean(%)	7.09%	7.35%	8.96%	9.21%	10.35%	11.44%
	Std Dev (%)	31.44%	31.29%	30.59%	31.37%	31.00%	30.51%
	Win/Loss	1.43	1.52	1.64	1.71	1.78	1.86
90%	Mean(%)	7.90%	9.10%	10.15%	11.08%	12.36%	13.39%
	Std Dev (%)	30.14%	30.43%	30.27%	30.75%	30.18%	29.86%
	Win/Loss	1.57	1.65	1.72	1.89	1.99	2.12
100%	Mean(%)	10.26%	11.10%	12.26%	13.02%	14.38%	15.48%
	Std Dev (%)	29.81%	29.43%	29.11%	29.13%	29.08%	28.60%
	Win/Loss	1.77	1.84	1.99	2.12	2.13	2.28

Appendix B-3: Imperfect Annual Market Timing Results (1 percent transaction costs)

FINI		RESI					
		50%	60%	70%	80%	90%	100%
50%	Mean(%)	-1.66%	-0.25%	0.81%	2.23%	3.73%	4.92%
	Std Dev (%)	32.94%	33.06%	33.30%	33.23%	32.92%	33.02%
	Win/Loss	0.92	0.97	1.03	1.10	1.22	1.27
60%	Mean(%)	-0.35%	1.36%	2.37%	3.64%	5.32%	6.05%
	Std Dev (%)	32.46%	32.91%	32.69%	32.70%	33.14%	32.75%
	Win/Loss	0.94	1.01	1.14	1.28	1.32	1.38
70%	Mean(%)	1.14%	2.81%	3.30%	4.94%	6.56%	8.53%
	Std Dev (%)	32.10%	32.20%	32.45%	32.14%	32.13%	32.10%
	Win/Loss	1.04	1.14	1.25	1.31	1.37	1.48
80%	Mean(%)	2.63%	3.94%	6.04%	6.71%	8.28%	10.11%
	Std Dev (%)	31.92%	32.06%	31.94%	31.66%	31.63%	31.13%
	Win/Loss	1.15	1.21	1.32	1.44	1.52	1.62
90%	Mean(%)	4.18%	5.38%	7.09%	7.71%	9.78%	11.20%
	Std Dev (%)	31.50%	31.09%	31.09%	31.20%	30.68%	30.50%
	Win/Loss	1.19	1.26	1.37	1.49	1.69	1.77
100%	Mean(%)	5.71%	6.72%	8.26%	9.86%	10.93%	12.05%
	Std Dev (%)	31.25%	30.75%	30.54%	30.02%	29.78%	29.71%
	Win/Loss	1.30	1.41	1.48	1.61	1.77	1.89

APPENDIX C

Appendix B illustrates the potential gains available to a market timer who revises his/her portfolio on an annual basis, for all three sector timing strategies. Table C-1 below illustrates the potential gains available to a market timer switching between the FINI and the INDI on a quarterly basis, incurring 1 percent transaction costs. Table C-2 below illustrates the potential gains available to a market timer switching between the RESI and the INDI on a quarterly basis, incurring 1 percent transaction costs. Table C-3 below illustrates the potential gains available to a market timer switching between the RESI and the FINI on a quarterly basis, incurring 1 percent transaction costs.

Appendix C-1: Imperfect Quarterly Market Timing Results (1 percent transaction costs)

INDI		FINI					
		50%	60%	70%	80%	90%	100%
50%	Mean(%)	-0.56%	2.30%	4.10%	5.72%	7.90%	9.22%
	Std Dev (%)	26.36%	26.50%	26.16%	26.50%	26.24%	25.74%
	Win/Loss	0.97	1.08	1.1	1.23	1.27	1.36
60%	Mean(%)	2.63%	4.47%	6.77%	8.16%	10.42%	11.77%
	Std Dev (%)	26.62%	26.64%	26.34%	26.10%	25.86%	26.28%
	Win/Loss	1.09	1.17	1.25	1.31	1.39	1.44
70%	Mean(%)	4.14%	7.14%	9.44%	10.86%	12.86%	14.89%
	Std Dev (%)	26.22%	26.34%	26.02%	25.92%	26.04%	25.32%
	Win/Loss	1.12	1.24	1.37	1.44	1.49	1.51
80%	Mean(%)	7.95%	10.25%	11.55%	13.60%	15.82%	17.71%
	Std Dev (%)	26.36%	25.92%	25.60%	25.68%	25.86%	25.16%
	Win/Loss	1.23	1.34	1.47	1.54	1.68	1.73
90%	Mean(%)	11.03%	13.03%	14.58%	16.13%	18.07%	21.27%
	Std Dev (%)	26.18%	26.26%	26.04%	25.30%	24.88%	24.74%
	Win/Loss	1.38	1.42	1.57	1.66	1.78	1.86
100%	Mean(%)	13.56%	14.31%	17.80%	19.30%	21.60%	23.60%
	Std Dev (%)	25.62%	25.34%	25.30%	24.96%	24.36%	24.54%
	Win/Loss	1.51	1.64	1.70	1.76	1.95	1.99

Appendix C-2: Imperfect Quarterly Market Timing Results (1 percent transaction costs)

INDI		RESI					
		50%	60%	70%	80%	90%	100%
50%	Mean(%)	-0.20%	2.02%	4.47%	5.47%	9.65%	10.81%
	Std Dev (%)	28.88%	28.84%	29.20%	29.08%	29.24%	29.10%
	Win/Loss	1	1.07	1.13	1.25	1.33	1.37
60%	Mean(%)	1.37%	5.30%	7.57%	9.61%	11.29%	13.96%
	Std Dev (%)	28.24%	28.60%	28.70%	28.88%	28.86%	28.82%
	Win/Loss	1.10	1.19	1.26	1.31	1.39	1.47
70%	Mean(%)	4.31%	6.98%	10.21%	12.38%	15.46%	16.13%
	Std Dev (%)	28.08%	28.18%	28.22%	28.22%	28.38%	28.32%
	Win/Loss	1.21	1.34	1.41	1.54	1.58	1.62
80%	Mean(%)	8.37%	10.64%	12.81%	17.35%	17.98%	19.34%
	Std Dev (%)	27.62%	28.04%	28.08%	27.74%	27.40%	27.62%
	Win/Loss	1.31	1.40	1.49	1.56	1.67	1.76
90%	Mean(%)	10.90%	13.69%	16.22%	18.84%	21.88%	23.74%
	Std Dev (%)	27.36%	27.08%	27.20%	26.68%	26.88%	26.76%
	Win/Loss	1.38	1.45	1.57	1.69	1.82	1.96
100%	Mean(%)	15.95%	16.85%	19.85%	23.84%	24.21%	27.59%
	Std Dev (%)	26.54%	26.18%	26.52%	26.82%	26.00%	25.80%
	Win/Loss	1.55	1.64	1.67	1.84	1.98	2.24

Appendix C-3: Imperfect Quarterly Market Timing Results (1 percent transaction costs)

FINI		RESI					
		50%	60%	70%	80%	90%	100%
50%	Mean(%)	-3.12%	-0.48%	2.06%	4.23%	6.51%	8.97%
	Std Dev (%)	29.00%	29.18%	29.14%	29.24%	29.38%	29.28%
	Win/Loss	0.9	0.94	1.08	1.16	1.21	1.31
60%	Mean(%)	-3.51%	-0.24%	2.30%	3.12%	7.14%	9.48%
	Std Dev (%)	28.72%	29.22%	29.04%	29.18%	29.56%	29.32%
	Win/Loss	0.94	0.96	1.07	1.15	1.23	1.27
70%	Mean(%)	-8.10%	1.00%	2.87%	4.31%	6.39%	9.35%
	Std Dev (%)	28.68%	29.44%	29.66%	28.70%	29.50%	29.50%
	Win/Loss	0.88	0.94	1.07	1.18	1.29	1.38
80%	Mean(%)	-3.71%	1.37%	1.89%	4.51%	6.43%	9.48%
	Std Dev (%)	29.12%	29.26%	28.74%	29.66%	29.40%	29.24%
	Win/Loss	0.94	1.02	1.13	1.17	1.26	1.32
90%	Mean(%)	-3.28%	0.84%	1.08%	4.14%	6.26%	9.14%
	Std Dev (%)	28.60%	28.98%	29.68%	29.54%	29.26%	29.46%
	Win/Loss	0.90	1.05	1.16	1.24	1.28	1.30
100%	Mean(%)	-2.81%	1.29%	1.97%	3.81%	5.51%	9.99%
	Std Dev (%)	29.14%	29.24%	29.04%	29.36%	29.30%	29.16%
	Win/Loss	0.91	1.09	1.15	1.16	1.24	1.35

APPENDIX D

Appendix D illustrates the potential gains available to a market timer who revises his/her portfolio on an annual basis, for all three sector timing strategies. Table D-1 below illustrates the potential gains available to a market timer switching between the FINI and the INDI on a monthly basis, incurring 1 percent transaction costs. Table D-2 below illustrates the potential gains available to a market timer switching between the RESI and the INDI on a monthly basis, incurring 1 percent transaction costs. Table D-3 below illustrates the potential gains available to a market timer switching between the RESI and the FINI on a monthly basis, incurring 1 percent transaction costs.

Appendix D-1: Imperfect Monthly Market Timing Results (1 percent transaction costs)

INDI		FINI					
		50%	60%	70%	80%	90%	100%
50%	Mean(%)	-3.89%	-1.07%	3.04%	4.66%	8.73%	11.22%
	Std Dev (%)	25.67%	25.39%	25.84%	25.60%	25.74%	25.29%
	Win/Loss	1.74	0.99	1.05	1.11	1.2	1.31
60%	Mean(%)	-0.96%	2.30%	5.91%	9.90%	13.22%	16.08%
	Std Dev (%)	25.63%	25.53%	25.63%	25.46%	25.29%	24.98%
	Win/Loss	1.01	1.08	1.11	1.19	1.26	1.33
70%	Mean(%)	2.06%	7.44%	10.69%	14.44%	17.04%	19.70%
	Std Dev (%)	25.67%	25.32%	25.46%	25.05%	24.87%	25.05%
	Win/Loss	1.11	1.12	1.17	1.28	1.31	1.45
80%	Mean(%)	6.80%	10.95%	14.57%	17.46%	19.99%	25.05%
	Std Dev (%)	25.32%	25.29%	25.11%	25.11%	24.49%	24.49%
	Win/Loss	1.14	1.2	1.26	1.34	1.42	1.5
90%	Mean(%)	10.30%	14.98%	19.42%	23.00%	25.93%	30.15%
	Std Dev (%)	25.22%	24.84%	24.53%	24.49%	24.28%	23.56%
	Win/Loss	1.18	1.29	1.36	1.48	1.61	1.7
100%	Mean(%)	16.08%	19.00%	22.85%	24.90%	30.76%	34.96%
	Std Dev (%)	24.98%	24.42%	24.32%	24.18%	24.04%	23.56%
	Win/Loss	1.33	1.42	1.51	1.58	1.65	1.76

Appendix D-2: Imperfect Monthly Market Timing Results (1 percent transaction costs)

INDI		RESI					
		50%	60%	70%	80%	90%	100%
50%	Mean(%)	-2.26%	-0.96%	1.33%	7.70%	12.01%	15.80%
	Std Dev (%)	28.27%	29.13%	29.24%	29.48%	29.41%	29.38%
	Win/Loss	0.92	0.97	1.08	1.16	1.21	1.37
60%	Mean(%)	1.57%	3.66%	7.70%	13.08%	18.58%	19.99%
	Std Dev (%)	28.16%	28.37%	28.44%	28.82%	28.58%	28.86%
	Win/Loss	1.00	1.05	1.17	1.25	1.36	1.41
70%	Mean(%)	4.66%	8.73%	12.28%	16.35%	22.71%	26.08%
	Std Dev (%)	27.37%	27.99%	27.75%	28.09%	28.06%	27.92%
	Win/Loss	1.08	1.14	1.22	1.31	1.38	1.42
80%	Mean(%)	9.12%	12.95%	17.60%	22.13%	29.23%	32.15%
	Std Dev (%)	27.30%	27.30%	27.05%	27.54%	27.12%	27.71%
	Win/Loss	1.24	1.29	1.34	1.38	1.46	1.59
90%	Mean(%)	14.16%	18.86%	22.42%	29.99%	33.39%	38.96%
	Std Dev (%)	26.29%	26.71%	26.67%	26.81%	26.88%	26.78%
	Win/Loss	1.26	1.34	1.45	1.52	1.67	1.77
100%	Mean(%)	19.99%	25.05%	28.93%	33.70%	38.96%	44.92%
	Std Dev (%)	25.74%	25.74%	25.77%	25.63%	25.67%	25.43%
	Win/Loss	1.36	1.45	1.52	1.68	1.8	1.94

Appendix D-3: Imperfect Monthly Market Timing Results (1 percent transaction costs)

FINI		RESI					
		50%	60%	70%	80%	90%	100%
50%	Mean(%)	-8.53%	-3.77%	-0.72%	4.91%	6.55%	11.62%
	Std Dev (%)	28.61%	28.51%	28.27%	27.54%	27.30%	26.22%
	Win/Loss	1.02	1.03	1.18	1.4	1.56	1.89
60%	Mean(%)	-5.15%	-2.14%	3.78%	7.83%	10.56%	18.44%
	Std Dev (%)	28.72%	28.58%	28.72%	27.89%	27.26%	26.08%
	Win/Loss	0.87	0.89	0.92	0.95	0.99	1.02
70%	Mean(%)	0.72%	5.54%	8.60%	13.22%	15.53%	24.31%
	Std Dev (%)	28.96%	28.89%	28.47%	27.71%	27.16%	25.81%
	Win/Loss	0.87	0.89	1.94	1.97	1.09	1.16
80%	Mean(%)	5.16%	8.60%	12.95%	18.72%	24.46%	28.63%
	Std Dev (%)	28.79%	28.72%	28.61%	27.85%	26.99%	26.22%
	Win/Loss	0.89	0.88	1.02	1.35	0.92	0.89
90%	Mean(%)	8.99%	14.98%	18.30%	25.93%	25.93%	33.70%
	Std Dev (%)	28.89%	28.61%	28.68%	28.37%	26.78%	25.98%
	Win/Loss	0.85	0.92	1.12	1.25	1.43	1.59
100%	Mean(%)	14.30%	19.42%	24.60%	28.78%	34.17%	37.51%
	Std Dev (%)	28.65%	28.54%	28.58%	28.09%	27.40%	26.02%
	Win/Loss	0.88	1.06	1.19	1.59	1.67	1.89