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Assessing a quantitative approach to tactical asset allocation

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ABSTRACT

The purpose of this paper is to determine whether the adoption of a simple trend-following quantitative method improves the risk-adjusted returns across various asset classes within a South African market setting. A simple moving average timing model is tested since 1925 on the South African equity and bond markets and within a tactical asset allocation framework.

The timing solution when applied to the JSE All Share Index, RSA Government Bond Index and within an equally weighted portfolio improved returns, while reducing risk. Testing the model within sample by decade highlighted periods of inferior return performance providing evidence to support prior research (Faber, 2007) that the timing model acts as a risk reduction technique with limited to no impact on return.

Keywords:

tactical asset allocation, risk-adjusted return, simple moving average, drawdown

DECLARATION

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

Guy Andrew Royston 9 November 2011

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CHAPTER 1: INTRODUCTION

1.1. Investment Performance

Investment is defined by Bruce J. Feibel (2003, p.1) in his book *Investment performance measurement* as "… an initial forfeit of something we value in exchange for the anticipated benefit of getting back more than what we put in. The difference between what we put in and what we get back is the return; we invest in order to yield this return".

Investment performance is the return on an investment portfolio and is one of the primary objectives for any portfolio manager or investor. Performance measures though are not just about rates of return, but also the risks taken in generating those returns. Feibel (2003) goes on to define return as the ratio of capital gains and income to capital invested and risk as the volatility of returns over time.

Capital markets offer incremental returns only when investors assume heightened risk. This risk-return trade-off is a traditional tenet of investment theory – expected returns are positively related to the amount of risk assumed and the higher the degree of return uncertainty, or risk, in a given investment the more return investors' demand. So against any return the risk associated with such return must be weighed.

1.2. Investing in Risky Assets

Global asset classes over the past century have produced spectacular gains in wealth for individuals who bought and held those assets for generation-long holding periods. However, most of the common asset classes have also experienced regular and painful drawdowns (Faber, 2007, p.69). A drawdown is the peak to trough decline an investor would experience in an investment and helps determine an investments financial risk.

The most recent example of a painful drawdown was the global financial crisis in 2008 that followed the sub-prime mortgage crisis originating in the United States. 2008 was a devastating year for buy-and-hold investors, one that saw the S&P 500 Index decline by 36.8% (Faber, 2009) and the JSE All Share Index by 22.5% (Gordon, 2011).

Equities remain the top-performing asset class over all time periods. Bond returns on the other hand have lagged most other asset classes over the majority of time periods (Gordon, 2011). No single asset class continuously outperforms in all economic environments. The medium-term changes in relative performance from the various asset classes highlight the importance of diversification in portfolios. Changing the balance of an investment portfolio can actually improve returns while at the same time reducing volatility.

1.3. The Importance of Asset Allocation in Investment Performance

One of the critical decisions an investor must make is how one should allocate assets among the wide range of possibilities available. According to Bodie, Kane and Marcus (2005) portfolio performance is determined by three main factors: asset allocation, stock selection and the trading activity that follows from the first two factors. The evidence from academic research demonstrates that of these three factors, asset allocation has the greatest influence over the results of portfolio management.

To illustrate the importance of strategic asset allocation as a determinant for investment returns, Brinson, Hood and Beebower (1986) claim that 93.6% of performance variation can be explained by strategic asset allocation decisions. This result implies that strategic asset allocation is far more important than market timing and security selection. In fact, Brinson, Hood and Beebower (1986), Brinson, Singer and Beebower (1991) and Ibbotson and Kaplan (2000) have found that between 80 percent and 94 percent of the variation in quarterly performance of professionally-managed portfolios is explained by the mix of equities, bonds and cash. Brinson, Hood and Beebower (1995) argue that deciding which asset classes to include and which to exclude from a portfolio (investment policy) and deciding on the asset allocation (long-term weights for each of the asset classes selected) are the most significant contributors to investment portfolio performance.

Tactical asset allocation has proven crucial in maximising investor returns in the past. Statistics show if an investor reduced exposure to South African equities when markets became expensive (when the price earnings ratio headed over 16 times), a R1000 investment in 1960 would today be worth nearly R3.5 million. If the investor had simply stayed in equities, the same investment today would be worth around R1.2 million. Had the same investor managed to dodge the seven biggest market collapses over that time, the investment would have soared to R174 million.

1.4. Research Problem and Purpose

1.4.1. Active Managers Ability to Beat the Market

Proponents of efficient markets argue that it is impossible to consistently beat the market. In support of their view, they point to the evidence that active managers as a group do not beat the market (Sharpe, 1991). Their conclusion is that these investment professionals do not have the skills necessary to pick stocks or time the market.

Carhart (1997) demonstrates that persistence in mutual fund performance does not reflect superior stock-picking skill; rather, common factors in stock returns and persistent differences in mutual fund expenses and transaction costs explain almost all the predictability in mutual fund returns. Even those who allow for the possibility that some managers have skill have been hard pressed to find evidence of this skill in the data. Beyond a year, there is little evidence of performance persistence.

In practice, as the evidence above suggests, investment managers get it wrong more than they get it right. There are three broadly accepted explanations for this phenomenon. First, behavioural factors affect decision making – behavioural factors include overconfidence, overreaction, loss aversion, herding, psychological accounting, miscalibration of probabilities, hyperbolic discounting, and regret (Lo, 2004). These psychological biases, that are endemic in human decision-making under uncertainty, lead to irrational and financial ruinous behaviour. Furthermore, these factors lead to inefficiencies such as under- or over-reactions to information, causing market trends and in extreme cases bubbles and crashes. An example of behavioural bias, in this case loss aversion, is the fact that individuals tend to be risk-averse in the face of gains and risk-seeking in the face of losses which can lead to some very poor financial decisions (Kahneman and Tversky, 1979).

Second, questionable forecasting abilities – a popular method used by investors to value firms is based on a multiple of the firm's earnings because many investors believe that earnings are a reasonable measure of a firm's cash flows. A direct measure of an earnings multiple is the firm's price earnings ratio. In the application of the price earnings method, a firm's stock valuation is highly influenced by its level of future earnings. Therefore, investors allocate much time to predicting a firm's future earnings. However, earnings forecasts by professional investment service companies commonly are off by 20% to 40% of the earnings estimate and they are especially subject to error for firms that experience volatile earnings patterns (Gitman and Madura, 2001, p. 553).

Third, unreliable valuation models – the most popular valuation models include the Capital Asset Pricing Model (CAPM) and the Dividend Discount Model (DDM). Both models are however fundamentally flawed. The CAPM is widely used in investment applications, such as asset pricing, risk evaluation and performance assessment of managed portfolios (Hirschey and Nofsinger, 2010, p.128). The attraction of the CAPM is that it offers powerful and intuitively pleasing predictions on how to measure risk and the relation between expected return and risk (Hirschey and Nofsinger, 2010, p.128). Unfortunately, the empirical record of the model is poor (Fama and French, 2004).

The DDM is a stock valuation approach based on expected dividend income and risk considerations (Hirschey and Nofsinger, 2010, p.333). However, it has shortcomings. It is not a good predictor when valuing non-dividend paying or low dividend paying stocks. The model is criticised for being too conservative in estimating value, and the contrarian nature of the model is problematic. In addition it requires many assumptions about company's dividend payments, growth patterns and future rates.

Quantitative tools are potentially effective in stripping out vulnerabilities such as behavioural issues and can be designed so as not to rely on forecasting and valuation models. In essence the quantitative tools potentially overcome some of the greatest pitfalls that lie in the path of investment decisions. The purpose of the research therefore is to determine whether a quantitative approach to tactical asset allocation, or market timing, can consistently generate superior market returns, on an absolute and risk-adjusted basis.

1.4.2. A Quantitative Approach to Tactical Asset Allocation

Once an investor has determined a policy allocation to stocks, bonds and cash, this allocation can be implemented through a passive indexing strategy or through active management. A passive indexing strategy simply aims to mirror the returns of the stock, bond or cash benchmarks that make up the policy allocation. An actively managed strategy attempts to exceed the return of the policy allocation through security selection and/ or market timing (The Vanguard Group, 2003).

Modern portfolio theory postulates that downside volatility is the trade-off an investor must accept to achieve corresponding levels of return. However, what if a passive investment in an asset class is not the optimal way to gain exposure to that asset class? Can simple asset allocation rules be employed to sell asset classes when they are expensive and buy them when they are cheap? Research done on other markets (Faber, 2007) suggests this can be achieved by mechanical application of a set of straightforward asset allocation rules.

Faber (2007), in a journal paper titled, "A Quantitative Approach to Tactical Asset Allocation", presented a quantitative market-timing model to establish whether an approach to timing the market could generate superior returns over a buy-and-hold strategy. Essentially the system is a model that signals when an investor should be long in a riskier asset class, such as equities, with potential upside, and when to be out and sitting in cash. It is this move to a lower volatility asset class (cash) that drops the overall risk and drawdown of the portfolio.

Faber (2007) tested a simple moving average timing model since 1900 on the United States equity market before testing since 1973 on other diverse and publically traded asset class indices including the Morgan Stanley Capital International EAFE Index (MSCI EAFE), Goldman Sachs Commodity Index (GSCI), National Association of Real Estate Investment Trusts Index (NAREIT), and United States government 10-year Treasury bonds. The result was improved risk-adjusted returns across the various asset classes. The approach was then examined in a tactical asset allocation framework where the empirical results were equity-like returns with bond-like volatility and drawdown.

The intent of Faber's study was to create a simple-to-follow method to managing risk for an asset class, and consequently, a portfolio of assets. When tested on over twenty markets, risk-adjusted returns were almost universally improved. Utilizing a monthly system since 1972, an investor would have been able to increase his risk-adjusted returns by diversifying his assets and employing a market timing solution. In addition, the investor would have been able to side-step many of the protracted bear markets in various asset classes. Avoiding these losses would have resulted in equity-like returns with bond-like volatility and drawdown, and over thirty consecutive years of positive performance.

Faber’s attempt was not to build an optimisation model, but rather to build a simple trading model that works in the vast majority of markets. The results suggest that a market timing solution is a risk-reduction technique that signals when an investor should exit a risky asset class in favour of a risk-free asset (Faber, 2009).

1.4.3. A Compelling Case for South African Markets

There is anecdotal evidence (Faber, 2007) to suggest that the above timing model applied to South African markets produced inferior risk and return characteristics when compared to a simple buy-and-hold approach.

From an academic perspective the substantive theoretical attraction of tactical asset allocation remains in spite of consistent poor performance. Tactical asset allocation potentially offers huge investment returns in South African markets. This is illustrated in the findings of Firer, Sandler and Ward (1992), who point to enhanced returns for timing the market using the JSE All Share Index. However, international literature and the track record of global as well as South African active portfolio managers show they generally lack skill in tactical asset allocation (Saville, 2009).

1.5. Research Motivation

From the above it follows that asset allocation decisions are key to achieving alpha or excess return above the market return, which is the ‘holy grail’ of all investors. Furthermore, there is enough evidence from global markets to suggest further application of a quantitative approach to tactical asset allocation to consistently generate superior returns in the South African market context.

Of concern to investors were the recent drawdowns experienced during the 2008 global financial crises which were not unique to equity markets alone as many non-correlated asset classes experienced large declines simultaneously, thus eradicating the normal benefits of diversification (Faber, 2009). Diversification, as a means to reduce portfolio volatility, on its own may longer be adequate. Risk management technique's, such as the one presented in this research, may be useful to compliment the benefits of diversification within an asset allocation framework.

Thus, formulating a framework of technical tools that provide 'buy' and 'sell' rules with regard to different asset classes, that are conceptually valid, yet ideally computationally simple and function consistently, is of great interest to all investors, including professional investment managers, investment consultants and large institutional investors such as pension funds.

CHAPTER 2: LITERATURE REVIEW

2.1. Portfolio Theory

An investment portfolio is a collection of securities or grouping of financial assets such as stocks, bonds, and cash and equivalents that together provide an investor with an attractive trade-off between risks and return (Hirschey and Nofsinger, 2010, p.109). Knowing how to build an investment portfolio effectively is the most important challenge facing investors. Consequently, investors spend a lot of time developing methods and strategies in attempting to come close to the “perfect investment”, one that leads to high returns coupled with low risk. The most important and influential to date is Modern Portfolio Theory (MPT).

MPT was developed by Harry Markowitz (1952). MPT is a theory on how risk-averse investors can construct portfolios to optimise or maximise expected return based on a given level of market risk, emphasizing that risk is an inherent part of higher reward. According to the theory, it is possible to construct an "efficient frontier" of optimal portfolios offering the maximum possible expected return for a given level of risk. MPT says that it is not enough to look at the expected return and risk (as measured by volatility) of one particular stock. Of most consequence is how the expected return and volatility characteristics of individual securities affect the expected return and volatility of the overall portfolio (Hirschey and Nofsinger, 2010, p.109). By investing in more than one stock, an investor can reap the benefits of diversification, chief among them a reduction in the riskiness of the portfolio.

MPT also known as Portfolio Theory is the simple concept of making security choices based on the expected return and risk of a collection of securities. However this traditional characterisation does not describe how all people actually make investment decisions. For example, some investors will invest in companies who behave in ways that match their own values and beliefs. History

Another deviations from the tenets of MPT is how history illustrates periods in which investors appear to have been smitten with certain types of stocks, biotechnology stocks during the 1980s (Malkiel, 2011, p.72) and internet stocks during the late 1990s (Hirschey and Nofsinger, 2010, p.116) are examples of such popular stocks. As a result, investors sometimes form sub-optimal portfolios.

2.2. Portfolio Management

Portfolio management is the art and science of making decisions about investment mix and policy, matching investments to objectives, asset allocation for individuals and institutions, and balancing risk against performance.

Broadly speaking there are two forms of portfolio management: passive and active. Passive management simply tracks a market index, commonly referred to as indexing or index investing. A truly passive portfolio strategy entails holding the market index portfolio and a money market fund. Active management involves a single manager, co-managers, or a team of managers who attempt to beat the market return by actively managing a fund's portfolio through investment decisions based on research and decisions on individual holdings. Active managers attempt to construct a risky portfolio that maximises the reward-to-variability (Sharpe) ratio (Bodie, Kane & Marcus, 1999). The choice between active and passive management is an important one, but often made on a foundation of false assumptions and flawed logic (Arnott and Darnell, 2003).

According to Sharpe (1991), properly measured, the average actively managed dollar must underperform the average passively managed dollar, net of costs. Empirical analyses that appear to refute this principle are guilty of improper measurement.

It is however possible for some active managers to beat their passive brethren, even after costs. The following three considerations should frame the discussion, first, are there inefficiencies in the market, second, can managers who have persistent skill be identified, and third, will the benefits derived overcome the costs (Stein, 2003). According to Stein, if the answer is yes to each of the questions then the choice of active should be made.

2.3. Active Management

Active management refers to a portfolio management strategy where the manager actively manages a fund's portfolio, making specific investments based on perceptions of mispricing, with the goal of outperforming an investment benchmark index. The objective with active management is to produce better returns than those of passively managed index funds. To achieve this active managers rely on analytical research, forecasts, and their own judgment and experience in making investment decisions on what securities to buy, hold and sell.

Investors who believe in active management do not follow the efficient market hypothesis (EMH) and believe it is possible to profit from the stock market through any number of strategies that aim to identify mispriced securities. EMH states that markets are efficient. An efficient market is defined as a market where there are large numbers of rational, profit-maximisers actively competing, with each trying to predict future market values of individual securities, and where important current information is almost freely available to all participants. In an efficient market, competition among the many intelligent participants leads to a situation where, at any one point, actual prices of individual securities already reflect the effects of information based both on events that have already occurred and on events which, as of now, the market expects to take place in the future. In other words, in an efficient market at any point in time the actual price of a security will be a good estimate of its intrinsic value (Fama, 1965).

According to EMH it is impossible for investors to "beat the market" through expert stock selection or market timing.

Although EMH is a cornerstone of modern financial theory, it is highly controversial and often disputed. Believers argue it is pointless to search for undervalued stocks or to try to predict trends in the market through either fundamental or technical analysis. In other words, that active management is largely wasted effort and unlikely to justify the expenses incurred. Believers therefore advocate a passive investment strategy that makes no attempt to outsmart the market, but at establishing a well diversified portfolio of securities without attempting to find under- or overvalued stocks (Bodie, et al, 1999, p337). Meanwhile, opponents will point to successful investors, such as Warren Buffett, who have consistently beaten the market over long periods of time, and to market bubbles and subsequent crashes as evidence that stock prices can seriously deviate from their fair values.

One of the most common rhetorical bulwarks in the defence of buy-and-hold investing is to demonstrate the effects of missing the best ten days in the market and how that would affect the compound return to investors. Faber (2011) in an article titled, "Where the black swans hide & the 10 best days myth", examines market outliers in financial markets, specifically how much effect these outliers have on long term performance. Faber finds that these rare outliers or "black swans" have a massive impact on returns. Examining the S&P 500 from 1928 to 2010, if an investor missed the best one percent of all days, return drops significantly from an annualised rate of 4.86% to -7.08%. Conversely, if an investor was able to miss the worst one percent of all days, returns explode to 19.09%. If an investor missed both the best and worst one percent of days return is higher than buy-and-hold at 5.548%. Buy-and-hold supporters proclaim that a passive investment approach is the only way to ensure being in the market for these best days and that there is infinitesimally small chance of predicting when they will occur and therefore the effort is useless.

According to Faber (2011) the vast majority of outliers (60%-80%), of the best and worst days, occur after the market has already started declining. The reason is that markets are more volatile when they are declining, and when the really volatile events and days occur they tend to cluster together. Faber's central argument is that returns improve and volatility is reduced when an investor is invested in up trending markets thus avoiding the volatility and clustering of best and worst days inherent in declining markets. Again, examining the S&P 500 from 1928 to 2010, the annualised volatility is 18.34%, but increases to 24.03% in declining markets (<200 day SMA) and reduces to 14.32% in advancing markets (>200 day SMA).

In support of Faber's finding in the US markets Estrada (2007) examined the evidence from 15 international markets and finds that "on average across all 15 markets, missing the ten best days resulted in a portfolio 50.8% less valuable than a passive investment; and avoiding the ten worst days resulted in a portfolio 150.4% more valuable than a passive investment." Estrada (2007) goes on to conclude that, "given that ten days represent less than 0.1% of the days considered in the average market, the odds against successful market timing are staggering."

The above makes a compelling case for investors to attempt to avoid these highly volatile periods in markets. A quantitative approach to tactical asset allocation is one possible way to achieve this goal.

2.3.1. Technical and Fundamental Analysis

The attempt to predict accurately the future course of stock prices and thus the appropriate time to buy and sell a stock must rank as one of investors' most persistent endeavours. Two common approaches to active management are technical analysis and fundamental analysis.

Technical analysis is the method of predicting the appropriate time to buy or sell a stock used by those believing the castle-in-the-air view of stock pricing. Investors believing in the castle-in-the-air view ignore intrinsic value estimates choosing to focus rather on how crowds of investors are likely to behave in the future and buying or selling before the crowd (Malkiel, 2011, p.33).

Fundamental analysis is the technique of applying the tenets of the firm-foundation theory to the selection of individual stocks. Investors believing in the firm-foundation theory argue that each investment instrument has a firm anchor of intrinsic value, which can be determined by careful analysis of present conditions and future prospects. If market prices fall below the intrinsic value, a buy opportunity arises, if market prices rise above the intrinsic value, a sell opportunity arises, because these fluctuations will eventually be corrected (Malkiel, 2011, p.31).

2.3.1.1. Technical Analysis

Technical analysis is the search for recurrent and predictable patterns in stock prices (Bodie, et al., 1999). According to Malkiel (2011) technical analysis is essentially the making and interpreting of stock charts. Technical analysts study the past – both the movements of common stock prices and the volume of trading – for a clue to the direction of future change. Many technical analysts believe that the market is only 10% logical and 90% psychological. Therefore, technical analysts do not attempt to measure a security's intrinsic value but instead use charts and other tools to identify patterns that can suggest future activity in the belief that historical performance of stocks and markets are indications of future performance.

The first principle of technical analysis is that all information about earnings, dividends and the future performance of the company is automatically reflected in the company’s past market prices. This is consistent with EMH theory. A chart showing these prices and the volume of trading already comprises all the fundamental information, good or bad, which the security analyst can hope to know. The second principle is that prices tend to move in trends: a stock that is rising tends to keep rising, whereas a stock at rest tends to remain at rest (Malkiel, 2011).

Malkiel (2011) suggests technical analysis should work due to the crowd instinct of mass psychology making trends perpetuate themselves; unequal access to fundamental information about a company which results in a gradual increase (decrease) in the price of a stock when the news is good (bad); and investors often under-react initially to new information, thus the stock market adjusts to earnings information only gradually, resulting in a sustained period of price momentum. The latter point is supported by Bodie, et al. (1999, p. 331) who suggest that the key to successful technical analysis is a sluggish response of stock prices to fundamental supply and demand factors. Malkiel (2011) then lists reasons why technical analysis should fail. Technical analysts buy only after price trends have been established and sell only after they have been broken and because sharp reversals in the market may occur suddenly, they often miss the boat. Also such techniques must ultimately be self-defeating as more and more people use it the value of any technique depreciates. No buy or sell signal can be worthwhile if everyone tries to act on it simultaneously.

2.3.1.2. Fundamental Analysis

Whereas the technician is interested only in the record of the stock's price, the fundamentalist's primary concern is what the stock is really worth. The fundamentalist strives to be relatively immune to the optimism and pessimism of the crowd and makes a sharp distinction between a stock's current price and its true value (Malkiel, 2011).

Fundamental analysis or the intrinsic value method assumes that at any one point in time an individual security has an intrinsic value which depends on the earnings potential of the security. The earnings potential of the security depends in turn on such fundamental factors as quality of management, industry outlook and the economy (Fama, 1965). Fundamental analysts attempt to study everything that can affect a security's value, including macroeconomic factors such as future interest rates and company-specific factors such as quality of management, industry positioning, risks and future prospects (Bodie, et al. 1999, p. 336). The end goal of performing fundamental analysis is to produce a value that an investor can compare with the security's current price, with the aim of figuring out what position to take with that security – if underpriced buy, if overpriced sell.

According to Malkiel (2011) a fundamentalist uses four basic determinants to help estimate the proper value for any stock: the expected growth rate, the expected dividend payout, the degree of risk and the level of market interest rates. A security's firm foundation value (and its price earnings multiple) will be higher the larger the company's growth rate and the longer its duration; the larger the dividend payout for the company; the less risky the company's stock; and the lower the general level of interest rates.

Malkiel (2011) suggests that despite the plausibility of this type of analysis there are three potential flaws. First, the information and analysis may be incorrect. Second, the security analyst's estimate of value may be faulty. Third, the market may not correct its mistake and the stock price may not converge to its value estimate.

The mathematical precision of fundamental-value formulas is based on treacherous ground that is forecasting the future. The major fundamentals for these calculations are never known with certainty. They are only relatively crude estimates about what might happen in the future and predicting the future is a most hazardous occupation.

2.4. Passive Management

Passive management is the opposite of active management in which a fund's manager attempts to beat the market with various investing strategies and buying or selling decisions of a portfolio's securities. Passive management is usually characterised by a buy-and-hold strategy. Because EMH indicates that stock prices are at fair levels, given all available information, it makes no sense to buy and sell securities frequently, which generates large brokerage fees without increasing expected performance (Bodie, et al., 1999).

A passive portfolio purchases the same fraction of each and every company's outstanding shares and is managed so as to achieve the capitalisation-weighted average return of all securities in the market. The index includes all securities. An implementation of a passive or indexed portfolio can never be perfect, but aims at a closely tracking approximation to its targeted goal at low cost (Stein, 2003).

Followers of passive management believe in the efficient market hypothesis. It states that at all times markets incorporate and reflect all information, rendering individual stock picking futile. As a result, the best investing strategy is to invest in index funds, which, historically, have outperformed the majority of actively managed funds.

2.5. Asset Allocation

Asset allocation is a process of diversifying an investment portfolio across various asset categories, such as stocks, bonds and cash. Because investment risk is inescapable, investors are best served by time-tested strategies for risk management – even a modest amount of diversification can sharply curtail portfolio risk (Hirschey & Nofsinger, 2010, p.487). The investment strategy aims to balance risk and reward by apportioning a portfolio's assets according to an individual's goals, risk tolerance, investment horizon and financial circumstances. It should be noted that in addition to the three main asset classes some investment professionals would add real estate and commodities, and possibly other types of investments, to the asset class mix.

Each asset class will reflect different risk and return investment characteristics and will perform differently in any given market environment.

There is no simple formula that can find the right asset allocation for every individual. However, the consensus among most financial professionals is that asset allocation is one of the most important decisions that investors make. In other words, the selection of individual securities is secondary to decisions regarding the investment allocation in stocks, bonds and money market instruments. Investment allocation decisions are the principal determinants of investment results.

Successful portfolio management begins with appropriate asset allocation. In the case of actively-managed portfolios, which are designed to outperform a passive benchmark, there are two elements of successful strategies, namely Strategic Asset Allocation and Tactical Asset Allocation. The choice is long-term or short-term, respectively, as well as across asset classes.

2.5.1. Strategic Asset Allocation

Strategic Asset Allocation (SAA) provides an investor's long-term target allocation among the major asset classes. SAA, also known as policy asset allocation or investment policy, is the establishment of a long-term target allocation in the major asset classes such as stocks, bonds and cash, based on portfolio objective, risk tolerance and time horizon (Stockton and Shtekhman, 2010). SAA over time is the most important determinant of the total return and risk of a broadly diversified portfolio. Studies empirically support the dominance of SAA in determining total return and return variability (Brinson, Hood & Beebower, 1995).

Furthermore, asset allocation explains a large part of the volatility in investment returns. As noted by Anson (2004) asset allocation is the predominant contributor to the variation in a portfolio's returns. Asset allocation is therefore an important determinant in the creation or destruction of wealth within a portfolio, as well as a key determinant of other measures of performance, such as risk-adjusted returns.

2.5.2. Tactical Asset Allocation

Tactical asset allocation (TAA) is a dynamic investment strategy that actively adjusts an investment portfolio's strategic asset allocation based on short-term market forecasts. Its objective is to systematically exploit, through the use of quantitative investment models, inefficiencies or temporary imbalances in equilibrium values among different asset or sub-asset classes to generate excess return (Stockton and Shtekhman, 2010). These models often are based on known financial market anomalies (inefficiencies) that are supported by academic and practitioner research.

TAA is an important part of an investors attempt to earn higher alpha's, defined as above market returns that cannot be explained by greater risk-taking behaviour. To earn above market returns, investors must engage in superior asset allocation among asset categories (display superior tactical skill) or in superior asset allocation within asset categories (display superior analytical skill) (Hirschey & Nofsinger, 2010, p.148). TAA is known as a moderately active strategy since managers return to the portfolio's original strategic asset mix when desired short-term profits are achieved. TAA attempts to produce excess returns by overweighting those asset classes that are expected to outperform and underweighting those expected to underperform in the near term on a relative basis. In a TAA model, financial and economic variables ("signals") are used to predict performance and assign relative short-term asset class weightings (Tokat, Wicas and Stockton, 2007). Two primary benefits of using TAA strategies versus other traditional active strategies, such as security-selection, are lower transaction costs and more independence as asset classes are less correlated than individual securities.

In practice, few portfolio managers display the superior tactical and analytical skill necessary to outperform the market (earn positive alpha's) on a long term basis (Hirschey & Nofsinger, 2010, p.148). Tokat et al. (2007) determined that whilst strategic asset allocation is critical, a well designed tactical asset allocation strategy can add value at the margin. However, successful tactical asset allocation requires rigorous methodology. Understanding the tactical asset allocation process, using quantitative performance evaluation metrics to distinguish skill from luck, and minimising costs are essential to the success of tactical asset allocation strategies.

2.5.2.1. Commonly Used Tactical Asset Allocation Signals

There are several commonly used TAA signals. The "Fed" model which involves comparing earnings yields (the inverse of the price earnings ratio) to nominal bond yields to determine the relative attractiveness of equities over bonds. Business-cycle or macroeconomic signals which attempt to find alpha by timing the business-cycle-related variation in market risk premiums and firms earning. Fundamental-valuation signals which use fundamental firm-valuation metrics, such as dividend yield, book-to-market ratio or price earnings ratio, to determine relative valuation. Momentum signals which try to find alpha by following short-term momentum in markets and sentiment signals which attempt to find alpha through a contrarian strategy modelled around investor behaviour (Stockton and Shtekhman, 2010).

There have been many attempts to describe the success of trend following and momentum trading systems. They work, presumably, because the market exhibits momentum (positive serial correlation) due to under reaction and overreaction in different timescales. Kahneman and Tversky (1979) provided a behavioural theory, entitled prospect theory, which describes how humans have an irrational tendency to be less willing to gamble with profits than with losses. In short, investors tend to sell their winners too early and hold on to losers too long.

This research paper will focus on momentum signals which attempt to add value by following the short-term momentum in the market. Typical momentum signals include technical indicators, company earnings growth and changes in trading volume. Specifically, in terms of technical indicators, moving average based trading systems are the simplest and most popular trend following systems, according to Allen and Taylor (1992) and Lui and Mole (1998). The most often cited long-term measure of trend in the technical analysis community is the 200-day simple moving average (Faber, 2007).

2.6. Momentum Investing

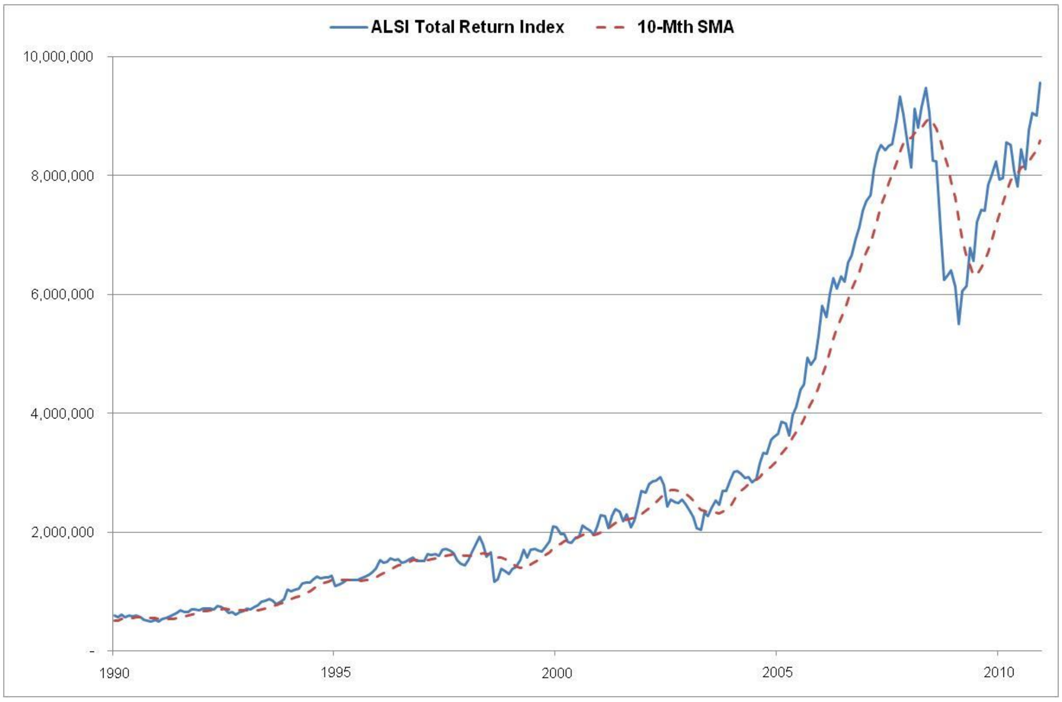
Momentum investing is an investment strategy that aims to capitalise on the continuance of existing trends in the market. It is a belief investors hold that stocks with high prior returns will continue to achieve high returns in the future and stocks with low prior returns are believed to continue earning low returns (Hirschey & Nofsinger, 2010, p.143). To participate in momentum investing a trader will take a long position in an asset, which has shown an upward trending price, or short sell a security that has been in a downtrend. The basic idea is that once a trend is established, it is more likely to continue in that direction than to move against it.

Traditional approaches to asset pricing, such as CAPM and more recently APT are not able to adequately describe the relationship between the expected rate of return on a portfolio and risk. This has led to other behavioural influences now being considered and finance scholars are studying the potential importance of behavioural risk factors such as the reluctance to realise losses, overconfidence, crowd psychology and momentum (Hirschey & Nofsinger, 2010, p.143).

A frequently used indicator to measure momentum and define areas of possible support and resistance is a moving average. A moving average shows the average value of a security's price over a set period. Moving averages are used to emphasize the direction of a trend and to smooth out price and volume fluctuations, or "noise", that can confuse interpretation. Typically, upward momentum is confirmed when a short-term average (15-day) crosses above a longer-term average (50-day). Downward momentum is confirmed when a short-term average crosses below a long-term average.

A simple, or arithmetic, moving average (SMA) is calculated by adding the closing price of the security for a number of time periods and then dividing this total by the number of time periods. Short-term averages respond quickly to changes in the price of the underlying security, while long-term averages are slower to react. In other words, this is the average stock price over a certain period of time. Keep in mind that equal weighting is given to each daily price. Many traders watch for short-term averages to cross above longer-term averages to signal the beginning of an uptrend. Using total return time series data obtained from I-Net Bridge, Figure 1 below shows the ALSI and its 10-month simple moving average since 1990.

Figure 1: ALSI total return versus 10 month simple moving average, since 1990



2.7. Asset Pricing

2.7.1. Traditional Theory

A traditional tenet of investment theory is that expected returns are positively related to the amount of risk assumed. Investors who want a higher than risk-free rate of return must be willing to take on some investment risk. Formal asset pricing models reflect the attempt to determine the exact equation or set of equations that can be used to tell investors about the exact form of the relation between the expected rate of return and risk. Asset pricing models can be used to predict the return that various investments should earn. If the anticipated amount of investment risk can be accurately measured, then traditional asset pricing models can be used to determine the predicted return. In fulfilling this function, asset pricing models become very useful and important to professional and individual investors alike.

2.7.2. A New Perspective – Behavioural Finance

Efficient market theory, modern portfolio theory and various asset-pricing relationships between risk and return are all built on the premise that stock market investors are rational. As a whole, they make reasonable estimates of the present value of stocks and their buying and selling ensures that the prices of stocks fairly represent their future prospects (Malkiel, 2011, p.235).

The design of asset pricing models began using theories of rational investor behaviour. Rational investors are generally thought to be risk averse, can fully exploit all available information and do not suffer from psychological biases. Traditional asset pricing models have demonstrated only limited ability to predict future returns. As the empirical performance and usefulness of traditional asset pricing models still leave a lot to be desired, there is ongoing effort by finance scholars to broaden the awareness of investment behaviour in asset pricing (Hirschey & Nofsinger, 2010, p.127).

Behaviourists believe that investors are not as rational as economic models assume and that market prices are highly imprecise (Malkiel, 2011, p.236). They argue that people deviate in systematic ways from rationality, and the irrational trades of investors tend to be correlated. Behavioural finance also suggests that it is possible to quantify or classify such irrational behaviour. This is important as it adds credence to trend-following models.

Basu, Raj and Tchalian (2008) present compelling empirical evidence supporting the belief that irrational investment decision making is a widespread phenomena. They also question the value and utility of using normative models, such as MPT, that assume investor rationality.

Burton Malkiel's, *A random walk down Wall Street* (1973), popularised the notion of irrational markets. Malkiel argues in the book that economists' portrait of people making rational financial decisions based on sufficient market information is simply a nonexistent idea. Malkiel offers as historical evidence such events as the Dutch Tulip craze of the 17th century; the Great Depression of 1929; and, in the 2011 update, the Japanese property and stock market bubble of the 1990s; the internet bubble and ridiculous valuations of the early 2000s; and the U.S. property bubble and subsequent global financial crisis, to suggest that when it comes to investing, people generally act on emotion not reason. Malkiel (2011) goes on to suggest that there are four factors that create irrational market behaviour: over-confidence, biased judgements, herd mentality and loss aversion.

This line of argument has been gaining credibility over the last decade or so, not only among behavioural finance experts but also economists themselves, as well as stock market pundits and the population at large. There is a strong sense among all these groups that greed, exuberance, fear and herding behaviour affect markets as much or more than calculations of price earnings ratios, profit projections or market benchmarks.

Basu, et al. (2008) analysis shows that investors actually behave differently than either MPT or EMH would predict. Investors harbour a host of biases, fears and psychological pitfalls that lead them to make investment decisions irrationally. According to Basu, et al. (2008), as an example of loss aversion, investors evaluate and react to risk very differently when the market is up than when it is down. These findings are supported by Odean's research (2001) that strongly suggests investors are generally averse to loss and not to risk, as MPT would suggest. Kahneman and Tversky established their Prospect Theory (1979), based on the understanding that investors are averse to loss and not to risk.

Behavioural biases play a major role in investors' behaviour and decision making process. A well documented pattern suggests that many investors attribute good outcomes (gains) to skill while attributing bad outcomes (losses) to bad luck. Thus, they are often overconfident, overestimating their chances of correctly predicting the direction of price changes. This is supported by a study by Lichenstein and Fischoff (1977) that found that 65% of interviewees expected their predictions regarding stock prices to be accurate, while only 47% of them where actually so. Likewise, investors over estimate their powers of discerning winning stocks from losing stocks. Evidence is provided by Odean (1998) who showed that investors rapidly sell and buy back stocks in order to capture expected gains, where had these investors held onto these stocks instead of replacing them with stocks they thought would perform better, the resulting portfolio would have outperformed their active portfolio by an average of 3.5% a year over the span of the entire year.

Other behavioural biases include cognitive dissonance and confirmation bias. The former suggests that investors experience an internal conflict when a belief or assumption of theirs is proven wrong. The latter suggests that they then seek out information that will help confirm their existing views. Investors are also influenced by what is known as "anchoring" and "representative heuristic". Anchoring is a phenomenon whereby people stay within range of what they already know in making guesses or estimates about what they do not know. Representative heuristic is defined as an overreliance on familiar clues, such as past performance. For instance, most investors assume that the stock of a company with strong earnings will perform well and that a stock of a company with weak earnings will perform poorly. Mean reversion shows, however, that the exact opposite is true. Finally, most investors exhibit what Kahneman and Tversky (1979, March) call “availability bias”, or a strong tendency toward investing in what they know, such as companies based in their home country.

Basu, et al. (2008), conclude that investors hardly ever behave the way that models of rational behaviour would suggest. In fact, their behaviour is often counterintuitive and therefore, more often than not, also counterproductive. They appear to be influenced by fads and are susceptible to market bubbles. Investors also exhibit herding and gambling behaviour, both often related to overconfidence. Most of all they are never immune to the irrational fears associated with loss aversion.

2.8. Summary of Literature Review

The two basic theories used to trade in the market are fundament analysis and technical analysis. Fundamental analysis involves monitoring the fundamentals for a particular market to predict a change in market direction before that change has been reflected in the price of the market with the believe that money can be made with that knowledge. Technical analysis operates in stark contrast to fundamental analysis. This approach is based on the belief that at any given point in time market prices reflect all known factors affecting the supply and demand for that particular market. Instead of evaluating fundamental factors technical analysts look at the market prices themselves.

There are two common approaches to technical analysis: a predictive view and trend following. A predictive view uses past prices to predict future performance. Trend following tries to neither predict nor forecast. Instead of trying to predict a market direction, a trend follower's strategy is to react to the markets movements whenever they occur, it is a reactive approach. This enables them to focus on the market's actual movements and not get emotionally involved with trying to predict direction or duration (Covel, 2011, p.10).

A mechanical approach to trend following is founded on the bases that an investment strategy can only be as successful as the discipline of the manager to adhere to the requirements, avoiding behavioural biases, in the face of market adversity.

CHAPTER 3: RESEARCH PROPOSITION

Given the above literature review a case for quantitative tactical asset allocation using a ten month simple moving average to generate excess returns over a buy-and-hold of listed South African equities and traded South African government bonds is to be investigated. Research done on other markets suggests this can be achieved. However, anecdotal evidence suggests that when applied to South African markets, since 1972, this strategy produced inferior risk and return characteristics when compared to a simple buy-and-hold approach (Faber, 2007).

The research proposition that will be investigated is stated below:

South African markets are inefficient making it possible to capture alpha through a quantitative approach to tactical asset allocation.

CHAPTER 4: RESEARCH METHODOLOGY

4.1. Methodology

The study aims to replicate Faber’s (2007) quantitative market timing approach to tactical asset allocation, testing the model within the South African asset environment. Moving-average based trading systems are the simplest and most popular trend following systems, according to Taylor and Allen (1992) and Lui and Mole (1998). The most often cited long-term measure of trend in the technical analysis community is the 200-day simple moving average (SMA). For the purposes of this research the monthly equivalent of Siegel’s 200-day simple moving average, the ten month SMA, has been adopted.

The effectiveness of the model will be measured in terms of its ability to improve returns while reducing risk, in other words, to achieve alpha. This is in line with the current literature (Faber, 2007). Alpha is defined as a measure of performance on a risk-adjusted basis. Alpha takes the volatility (price risk) of a fund and compares its risk-adjusted performance to a benchmark index. The excess return of the fund relative to the return of the benchmark index is a fund's alpha. Alpha is measurement intended to help investors determine the risk-reward profile of a fund and is considered in practice to represent the value that a portfolio manager adds to or subtracts from a fund's return.

A quantitative study is best suited for this type of investigation. A causal study will be conducted since the objective is to understand if simple, tactical price-based decisions can improve performance over a buy-and-hold strategy (Blumberg, Cooper, & Schindler, 2008, p. 197). The concern in casual analysis is with how one variable, or set of variables, is responsible for changes in another (Blumberg et al., 2008, p. 197). Because the objective of the research is to improve upon the performance of an investment portfolio using a quantitative tactical asset allocation approach, the research will be experimental by design.

The research proposition will be backward tested against historical stock and other asset class market data. Market data is available from selected financial databases and sources more fully described in the population and sampling section of the report.

A longitudinal study will be used for two reasons. First, longitudinal studies are used in order to track changes over time (Blumberg et al., 2008, p. 199). One of the objectives of the study is to track portfolio returns since 1925. Second, longitudinal studies are better suited for causal studies since each event occurs over a period of time or investment horizon (Blumberg et al., 2008, p. 199).

4.2. Population and Sampling

The target population of this study was monthly index closing price data. Price data were retrieved from the indices of three primary asset classes, namely equities, bonds, and cash and equivalents, during the period 1925 to 2010. Total return indices measuring the total return on the underlying constituents, combining both capital performance and reinvested income were used. The research was subject to the availability of accurate total return index data and thus restricted to the period from 1925 to 2010. Having identified equities, bonds, and cash and equivalents as the relevant asset classes to be tested, proxies for these asset classes were identified as the FTSE/JSE Africa All Share Index (ALSI), RSA Government Bond Index (GOVI) and the Alexander Forbes Short-Term Fixed Interest Index (STeFI), respectively.

The ALSI is a weighted average of the market prices of the top 99% of eligible listed companies on the Johannesburg Stock Exchange when ranked by full market capitalisation. The index gives the best indication of general market direction because it includes shares from all sectors of the stock market.

The GOVI is a non-investable total return index that measures the performance of bonds issued by the South African government. It contains those RSA bonds of the All Bond Index in which primary dealers are obliged to make a market. The local bond market is still dominated by securities issued by the South African government, with local government, public enterprises and major corporations accounting for the rest of the debt issuers active in the market. This makes the GOVI a good proxy for the local fixed-interest market.

The STeFI is a proprietary index that measures the performance of short term fixed interest or money market investment instruments in South Africa. It is a benchmark index constructed by Alexander Forbes, calculated and published daily by the South African Futures Exchange, and has become the industry benchmark for cash equivalent investments (that is up to maturities of 12 months).

Sampling methods will not be employed. This is due to the fact that the data collected and tested will consist of the entire population of listed stocks, bonds and cash equivalents.

4.3. Unit of Analysis

The unit of analysis is the time series monthly index closing prices of each of the proxies listed above.

4.4. Data Collection

Historical asset class indices data was obtained from the I-Net Bridge database. Total return index data prior to the introduction of total return time series indices dating back to 1925 was provided by Brian Rudd (a colleague of Professor Adrian Saville who supervised this study). The data is Cannon Asset Managers (Pty) Ltd in-house long term data.

Consistent with Faber’s (2007) methodology all entry and exit prices are on the day of the signal at the close, being the first day of the month; all data series are total return series, updated monthly; and taxes, commissions, slippage and general transaction costs are excluded.

4.5. Data Analysis

In deciding on what logic to base this system there are a few criteria that are necessary to produce a simple model that investors can follow yet is mechanical enough to remove emotion and subjective decision making. They are:

1. Simple, purely mechanical logic;
2. The same model and parameters for every asset class; and
3. Price based only.

Faber's (2007) market timing system works as follows:

Buy Rule:
Buy the index when the monthly index price > ten month SMA and be fully invested in the index.

Sell Rule:
Sell the index and move to cash when monthly index price < ten month SMA and be fully invested in cash.

To determine the relative performance of the defined market timing policy the distinction is made between a passive fund mirroring the market index and hence earning the market return and the return that reflects the funds execution of active strategy or market timing. The required variables for analysis include return, risk-adjusted return and volatility, with a focus on downside volatility. Return is measured on an absolute and risk-adjusted basis. The proxy for absolute return is the compound annual growth rate (CAGR), while risk-adjusted return is measured by the Sharpe ratio. The proxy for volatility is standard deviation and downside volatility is measured by drawdown and worst year. These variables will be calculated per asset class for both a buy-and-hold strategy and a market timing strategy and compared to which method achieves superior performance.

Consistent with Faber's approach the study will also look at how returns would look in the context of an investor's portfolio. The returns for a buy-and-hold allocation are equally weighted across the two asset classes. The timing model treats each asset class independently, it is either long the asset class or in cash with its 50% allocation of the funds.

The table summarises the variables calculated and used to determine the truth of the research proposition:

Table 1: Summary of return and risk variables for analysis

Variable	**Measurement**
1. Return	1.1. Compound annual growth rate (CAGR)
	1.2. Best year
2. Risk-adjusted return	2.1. Alpha (Jensen's measure)
	2.2. Sharpe ratio
	2.3. Sortino ratio
3. Volatility	3.1. Standard deviation
	3.2. Maximum drawdown
	3.3. Worst year

4.6. Research Limitations

The following limitations were relevant to this study:

Assets perform differently over varying time periods and these differences are magnified the shorter the period over which they are measured. This renders very short-term comparisons almost meaningless but, equally, very long-term comparisons suffer deficiencies as well, given the extensive changes that can occur in economic, monetary and other background fundamentals over the long-term. In South Africa, for example, the structural decline in inflation which began in 1993 resulted in the subsequent prolonged outperformance of bonds relative to equities until 2004.

Historical performance should clearly not be used slavishly as a guide to the future. It is nevertheless a vital factor and investors need to assess, against the empirical evidence of the past, what factors could cause a change in the historical experience.

Additional practical considerations an investor must analyze before implementing these models for real-world applicability are management fees, taxes, commissions and slippage.

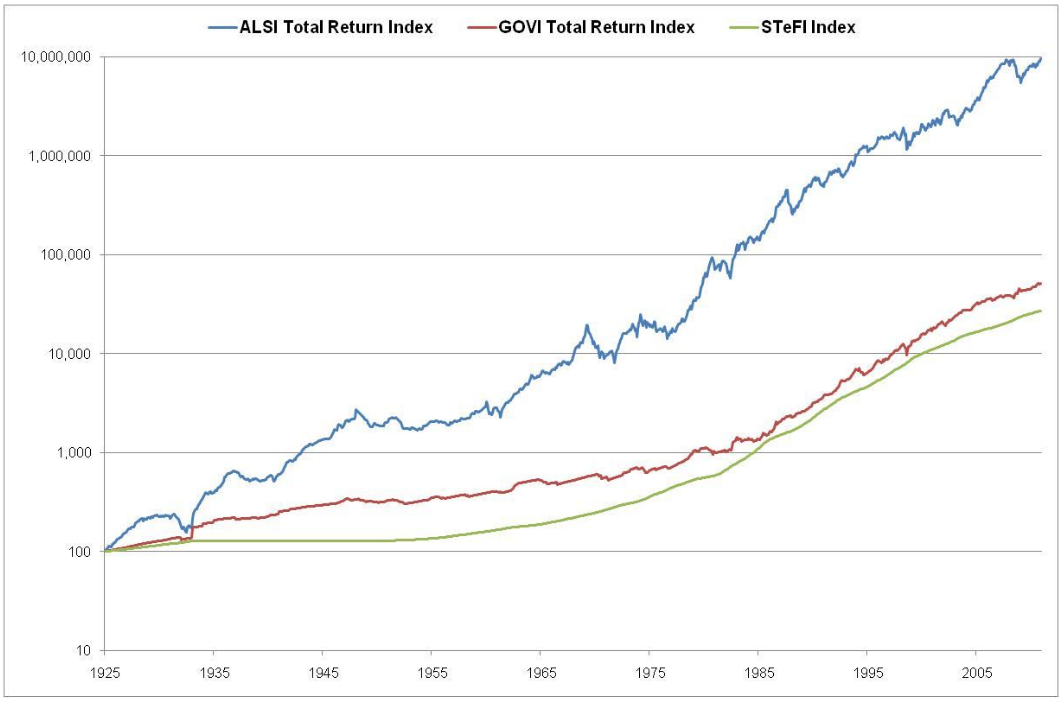
CHAPTER 5: RESULTS

5.1. Data Description

The data population comprised of 1020 monthly index closing prices across each of the three proxy asset classes, ALSI (equities), GOVI (bonds) and STeFI (cash) over the period under review (January 1925 to December 2010).

Figure 2 (a logarithmic scale) below illustrates the performance of the ALSI and GOVI indices, measured against cash returns since 1925. As expected, the ALSI significantly outperformed the GOVI over the period. The GOVI outperformed cash, making cash the worst performing asset class over the period under review.

Figure 2: Asset class total returns, 1925 to 2010

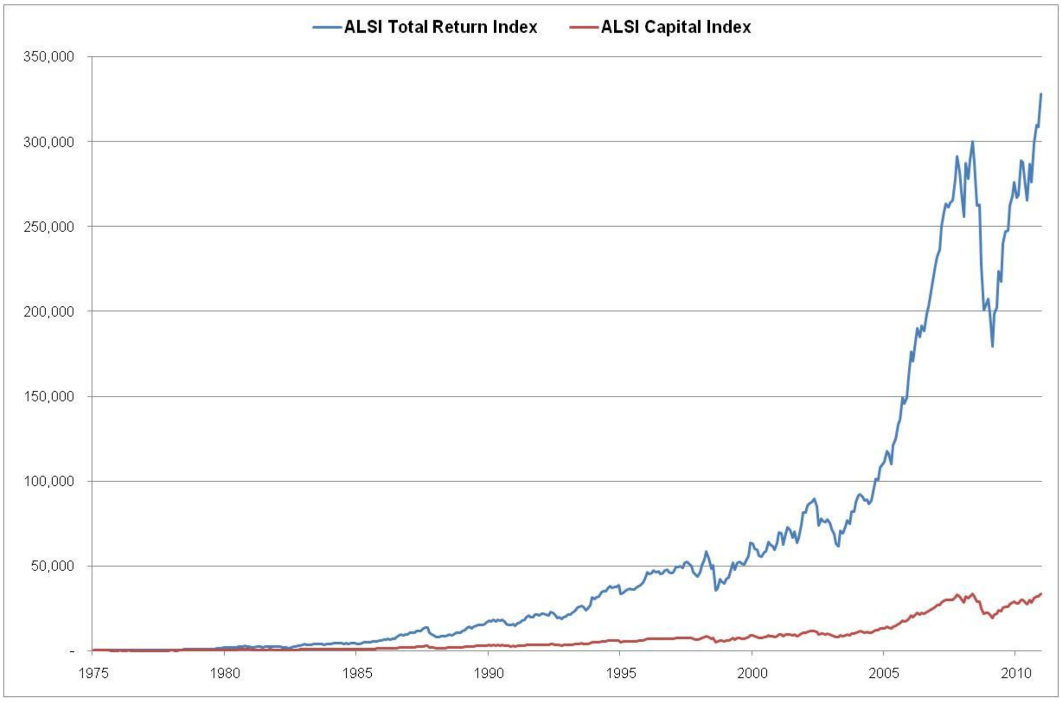


5.2. Total Returns

Compounding is the ability of an asset to generate earnings, which are then reinvested in order to generate their own earnings. Simply by reinvesting earnings one is able to capture the future returns on the reinvested earnings as well as on the original investments. Albert Einstein is believed to have referred to compounding as "the greatest mathematical discovery of all time". It is generally accepted that the most important thing an investor needs to know about building wealth is the power of making regular periodic investments and reinvesting rather than spending the profits.

Figure 3 below illustrates the benefits of compounding by comparing the ALSI capital index against the ALSI total return index since 1960. Investing R1 in the capital index thereby excluding the reinvestment of dividends in 1960 would be worth R338 at the end of 2010. However, if dividends were reinvested, R1 would be worth R3281, 9.71 times more.

<u>Figure 3: ALSI total return index and ALSI capital index, 1975 to 2010</u>



5.3. Volatility Return Trade-Off

Table 2 below compares the returns and volatility of two asset classes, equities and RSA Government bonds, since 1925. The ALSI returned 14.10% versus the GOVI returning 7.53%, on average 657 basis points per annum, or 87.25%, more than the GOVI. However, the higher return comes at 2.28 times the volatility – standard deviations of 0.23 and 0.10 for the ALSI and GOVI, respectively.

The risk-adjusted returns, measured by the Sharpe ratio, for the ALSI are significantly improved. The ALSI and GOVI returned Sharpe ratios of 0.44 and 0.19, respectively. The higher volatility of the ALSI is further evidenced when comparing the best and worst years of the two asset classes. The ALSI returned a best year of 76.38% (1979) versus a best year of 40.58% (1982) for the GOVI, but returned a worst year of -24.70% (2008) versus a worst year of -9.06% (1980) for the GOVI. To achieve higher returns investors must accept higher volatility.

Table 2: Asset class total returns, 1925 to 2010

Measurement	**Asset Class**	
	Equities (ALSI)	**Bonds (GOVI)**
Compound Annual Growth Rate	14.10%	7.53%
Standard Deviation	0.2313	0.1015
Sharpe Ratio	0.4428	0.1938
Maximum Drawdown	-50.97%	-23.83%
Best Year	76.38%	40.58%
Worst Year	-24.70%	-9.06%

5.4. ALSI and Timing from 1925 to 2010

To demonstrate the logic and characteristics of the timing model, the ALSI was tested back to 1925. Table 3 presents the yearly returns for the ALSI and the timing method for past 85 years. A cursory glance at the results reveals that the timing solution improved returns. The CAGR increased from 14.10% for the ALSI to 14.91% for timing. Furthermore, timing reduced risk. The standard deviation, drawdown, downside deviation and worst year all showed improvements. These results were achieved all while being invested in the market 73.33% of the time and making less than one round trip trade per year (0.61).

Table 3: ALSI total returns versus timing total returns, 1925 to 2010

Measurement	**Equities**	
	ALSI	**Timing**
Compound Annual Growth Rate	14.10%	14.91%
Standard Deviation	0.2310	0.2058
Sharpe Ratio	0.4428	0.5020
Maximum Drawdown	-50.97%	-29.71%
Downside Deviation	0.0936	0.0713
Sortino Ratio	1.0767	1.4489
% time in market	100.00%	73.33%
Roundtrip Trades per Year	-	0.61
Best Year	76.38%	76.38%
Worst Year	-24.70%	-24.54%

The timing system under-performs the ALSI in 36 out of 85 years since 1925. Furthermore, timing fails to improve returns in 57 out of 85 years. The timing system improved annual returns in 28 out of 85 years. Importantly, timing equalled or improved ALSI returns in 49 out of 85 years or 57.65% of the time.

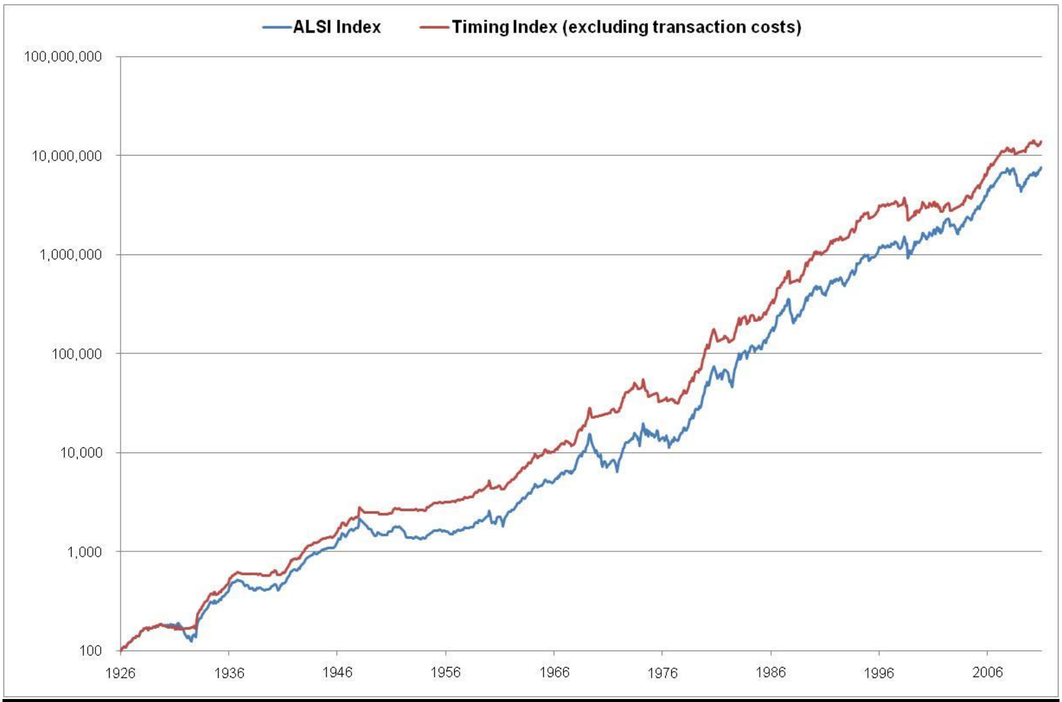
The reduced volatility of the timing system together with improved total returns illustrates the attractiveness of the timing approach.

Table 4: ALSI timing underperformance, 1925 to 2010

	Years	%
Timing underperformance	36	42.35%
Timing failure to improve returns	57	67.06%
Timing outperformance	28	32.94%

Comparing the average returns with compound returns (the return an investor would actually realise); the average return for the ALSI since 1925 is 16.40%, while timing returned 16.65%. The compounded returns for the two are 14.10% and 14.91%, respectively. Notice that the buy-and-hold crowd takes a 230 basis point hit from the effects of volatility, while timing suffers a smaller 174 basis point decline. Figure 4 (a logarithmic scale) makes it apparent that timing is superior over the past 85 years. Ignoring the impact of transaction costs timing tracks above the ALSI for the entire period. Also, notice how timing results in shallower troughs emphasing the model's ability to reduce downside risk.

Figure 4: ALSI total returns and timing total returns, 1925 to 2010



5.4.1. ALSI and Timing Analysis by Decade

This section breaks the return and volatility measurements down by decade for the ALSI and the timing model. The timing model outperforms the index in five out of eight decades (1930s, 1940s, 1950s, 1960s and 2000s) on an absolute and risk-adjusted basis. Timing reduces volatility in all eight decades and reduces downside risk in all but one (1990s).

5.4.1.1. 1925 to 1939

Table 5 confirms that timing was superior during the period between 1925 and 1939, returning a CAGR of 13.92% compared to a CAGR for buy-and-hold of 11.37%. Timing also improved volatility as the standard deviation reduced from 0.23 to 0.19. Timing improves risk-adjusted returns as the Sharpe ratio increases from 0.5381 to 0.72. The maximum drawdown for the period reduces from -33.74% to -5.87%.

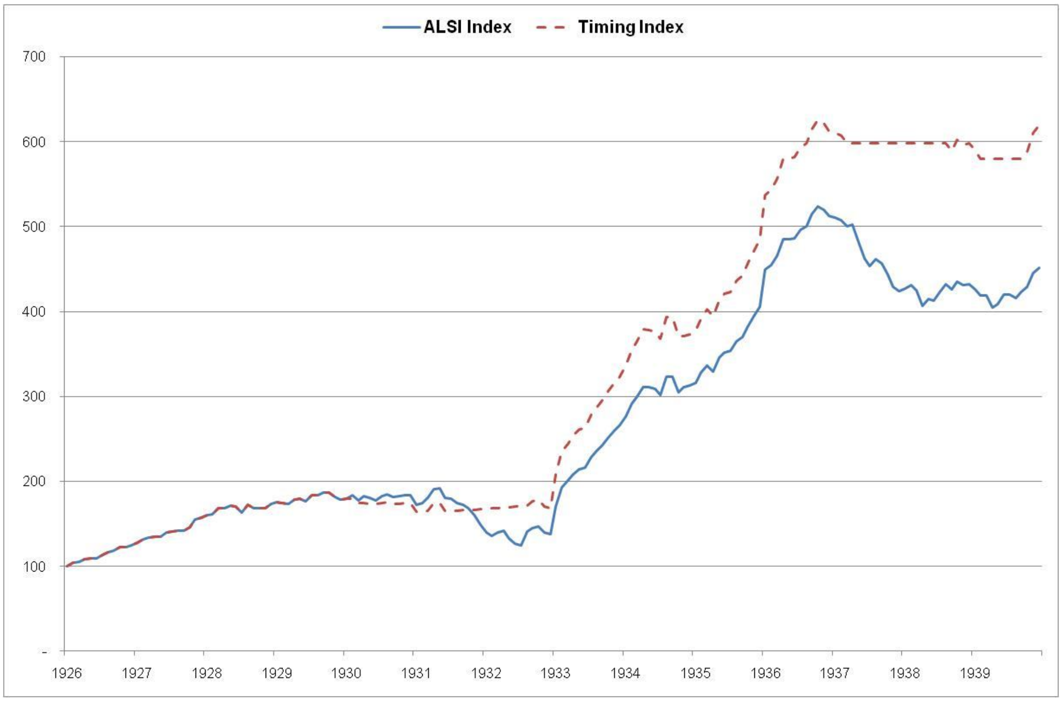
Table 5: ALSI total returns versus timing total returns, 1925 to 1939

Measurement	ALSI	Timing
Compound annual growth rate	11.37%	13.92%
Standard deviation	0.2179	0.1928
Sharpe ratio	0.5381	0.7150
Maximum drawdown	-33.74%	-5.87%
Drawdown correlation	0.2772	0.2772
STeFI	1.57%	1.57%

Figure 5 (1925 base year) illustrates the timing model's outperformance by comparing the ALSI total return index and timing total return index for the period between 1925 and 1939. The reason for timing's superior performance is due to its ability to avoid the worst two market downturns during the period. The ALSI returned -18.87% in 1931 and -16.47% in 1937 versus timing returns of 1.84%

and -2.02%, respectively. Notice how the timing index flattens out mid 1931 and early 1937, avoiding the full extent of the respective drawdowns. Importantly, timing was invested for the majority of the bull market between 1932 and 1937 were the market returned a CAGR of 29.51%. The drawdown correlation between the ALSI and timing was low at 0.28.

Figure 5: ALSI total returns and timing total returns, 1925 to 1939



5.4.1.2. 1940 to 1949

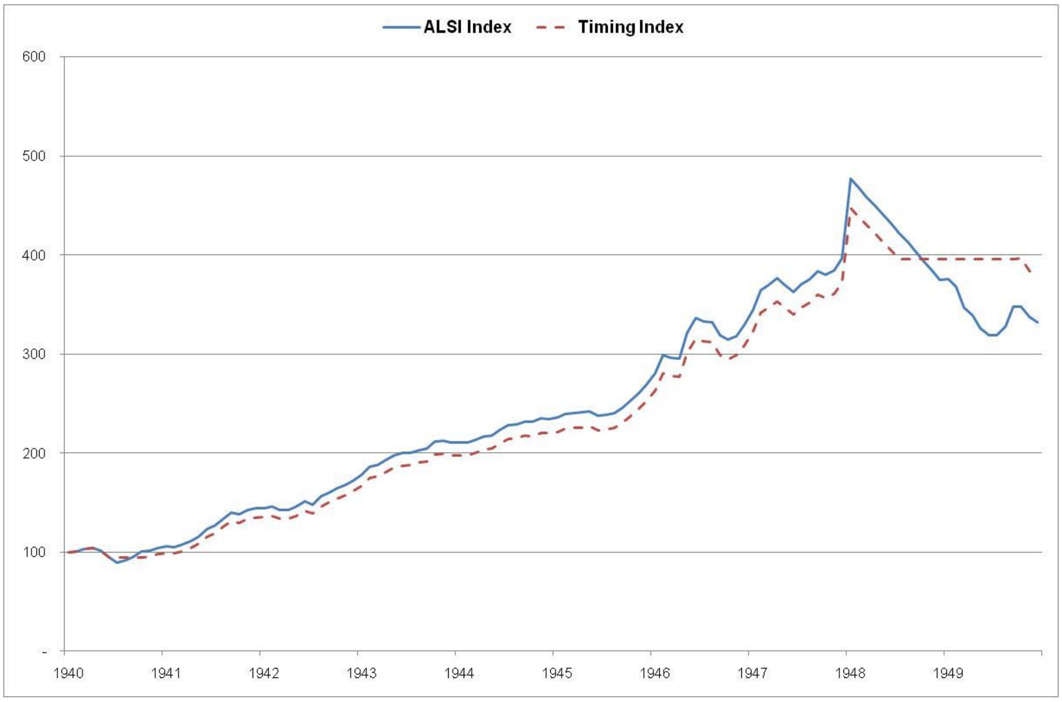
Table 6 confirms that timing was superior during the period between 1940 and 1949, returning a CAGR of 14.39% compared to a CAGR for buy-and-hold of 12.75%. Timing also improved volatility as the standard deviation reduced from 0.19 to 0.17. Timing improves risk-adjusted returns as the Sharpe ratio increases from 0.75 to 0.93. The maximum drawdown for the period reduces from -23.93% to -12.04%.

Table 6: ALSI total returns versus timing total returns, 1940 to 1949

Measurement	ALSI	Timing
Compound annual growth rate	12.75%	14.39%
Standard deviation	0.1918	0.1664
Sharpe ratio	0.7473	0.9317
Maximum drawdown	-23.93%	-12.04%
Drawdown correlation	0.0808	0.0808
STeFI	0.00%	0.00%

Figure 6 (1940 base year) illustrates the timing model's outperformance by comparing the ALSI total return index and Timing total return index for the period between 1940 and 1949. The reason for timing's superior performance is due to its ability to avoid the significant market downturns experienced during 1948 and 1949. The ALSI returned -21.16% in 1948 and -11.66% in 1949 versus timing returns of -11.45% and -3.12%, respectively. Notice how the timing index tracks below the ALSI but flattens out mid-1948 thereby avoiding a further 22.22% decline in the market. Importantly, timing was invested for the majority of the bull market between 1941 and 1948, for 93 consecutive months before it exited the market in July 1948. During this up trend the market returned a CAGR of 18.46%. The drawdown correlation between the ALSI and timing was low at 0.08.

Figure 6: ALSI total returns and timing total returns, 1940 to 1949



5.4.1.3. 1950 to 1959

Table 7 confirms that timing was superior during the period between 1950 and 1959, returning a CAGR of 6.82% compared to a CAGR for buy-and-hold of 4.33%. Timing also improved volatility as the standard deviation reduced from 0.1087 to 0.0693. Timing improves risk-adjusted returns as the Sharpe ratio increases from 0.29 to 0.80. The maximum drawdown for the period reduces dramatically from -25.44% to -3.56%.

Table 7: ALSI total returns versus timing total returns, 1950 to 1959

Measurement	ALSI	Timing
Compound annual growth rate	4.33%	6.82%
Standard deviation	0.1087	0.0693
Sharpe ratio	0.2890	0.7998
Maximum drawdown	-25.44%	-3.56%
Drawdown correlation	0.0666	0.0666
STeFI	1.84%	1.84%

Figure 7 (1950 base year) illustrates the timing model's outperformance by comparing the ALSI total return index and timing total return index for the period between 1950 and 1959. Again, the timing system's superior performance is due to its ability to avoid drawdowns. The ALSI returned -18.18% in 1952 versus timing returns of 0.94%. Notice how the timing index tracks below the ALSI but flattens out in late 1951 avoiding a further 18.18% decline in the market before re-entering in February 1953. Timing tracked comfortably above the ALSI for the remainder of the decade. The drawdown correlation between the ALSI and timing was low at 0.07.

Figure 7: ALSI total returns and timing total returns, 1950 to 1959

5.4.1.4. 1960 to 1969

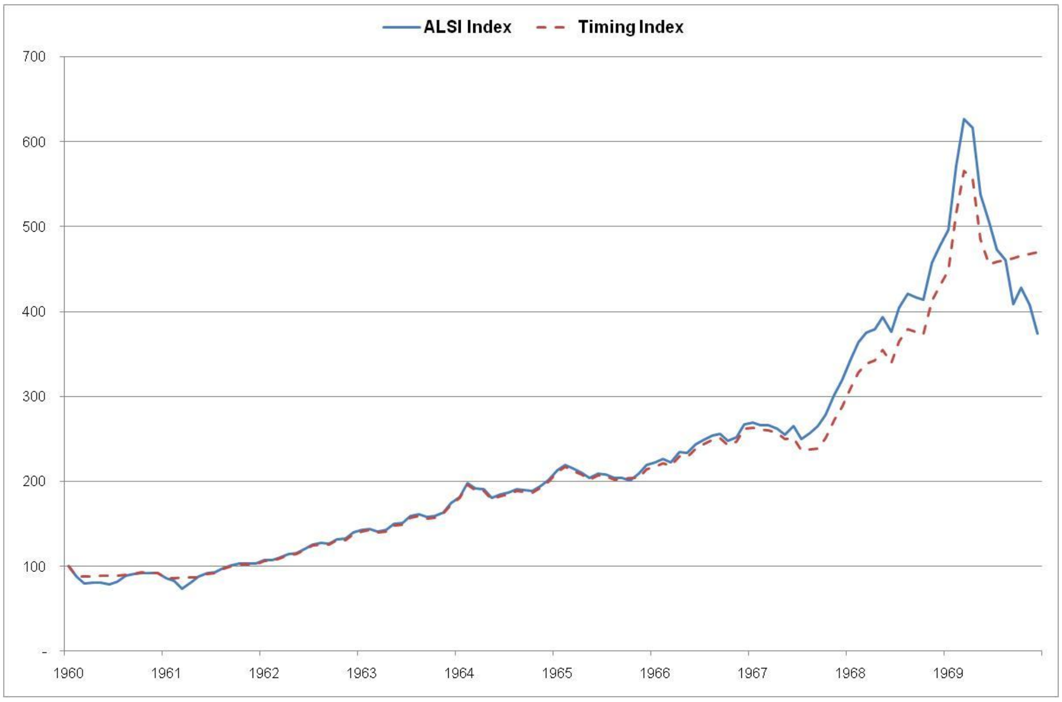
Table 8 confirms that timing was superior during the period between 1960 and 1969, returning a CAGR of 16.73% compared to a CAGR for buy-and-hold of 14.11%. Timing also improved volatility as the standard deviation reduced from 0.22 to 0.17. Timing improves risk-adjusted returns as the Sharpe ratio increases from 0.57 to 0.84. The maximum drawdown for the period halved, from -40.83% to -20.50%.

Table 8: ALSI total returns versus timing total returns, 1960 to 1969

Measurement	ALSI	Timing
Compound annual growth rate	14.11%	16.73%
Standard deviation	0.2156	0.1662
Sharpe ratio	0.5648	0.8431
Maximum drawdown	-40.83%	-20.50%
Drawdown correlation	0.0730	0.0730
STeFI	3.97%	3.97%

Figure 8 (1960 base year) illustrates the timing models out performance by comparing the ALSI total returns and timing total returns for the period between 1960 and 1969. The reason for timing's superior performance is due primarily to the ALSI returning -24.63% in 1969 versus timing of 4.83%. The timing index flattens out post 1969 as the timing model avoids the full extent of the -40.30% drawdown between April and December 1969. The drawdown correlation between the ALSI and timing was low at 0.07.

Figure 8: ALSI total returns and timing total returns, 1960 to 1969



5.4.1.5. 1970 to 1979

Table 9 confirms that timing was inferior during the period between 1970 and 1979, returning a CAGR of 17.76% compared to a CAGR for buy-and-hold of 16.98%. Timing marginally improved volatility as the standard deviation reduced from 0.32 to 0.30. Timing fails to improve risk-adjusted returns as the Sharpe ratio decreases from 0.43 to 0.41. The maximum drawdown for the period improves marginally from -27.01% to -25.20%.

Table 9: ALSI total returns versus timing total returns, 1970 to 1979

Measurement	ALSI	Timing
Compound annual growth rate	17.76%	16.98%
Standard deviation	0.3155	0.3009
Sharpe ratio	0.4256	0.4049
Maximum drawdown	-27.01%	-25.20%
Drawdown correlation	0.3914	0.3914
STeFI	7.84%	7.84%

Figure 9 (1970 base year) illustrates the timing models under performance by comparing the ALSI total returns and timing total returns for the period between 1970 and 1979. Timing outperformed buy-and-hold until July 1974, when it dropped below the ALSI and largely remained there for the rest of the decade. Timing was in cash for the entire 1970 returning 6.96% versus the ALSI return of -17.58. However, in 1973 the ALSI returned 22.72% versus timing of 5.75%. The drawdown correlation between the ALSI and timing was 0.39, substantially higher than the prior measurement periods.

Figure 9: ALSI total returns and timing total returns, 1970 to 1979

5.4.1.6. 1980 to 1989

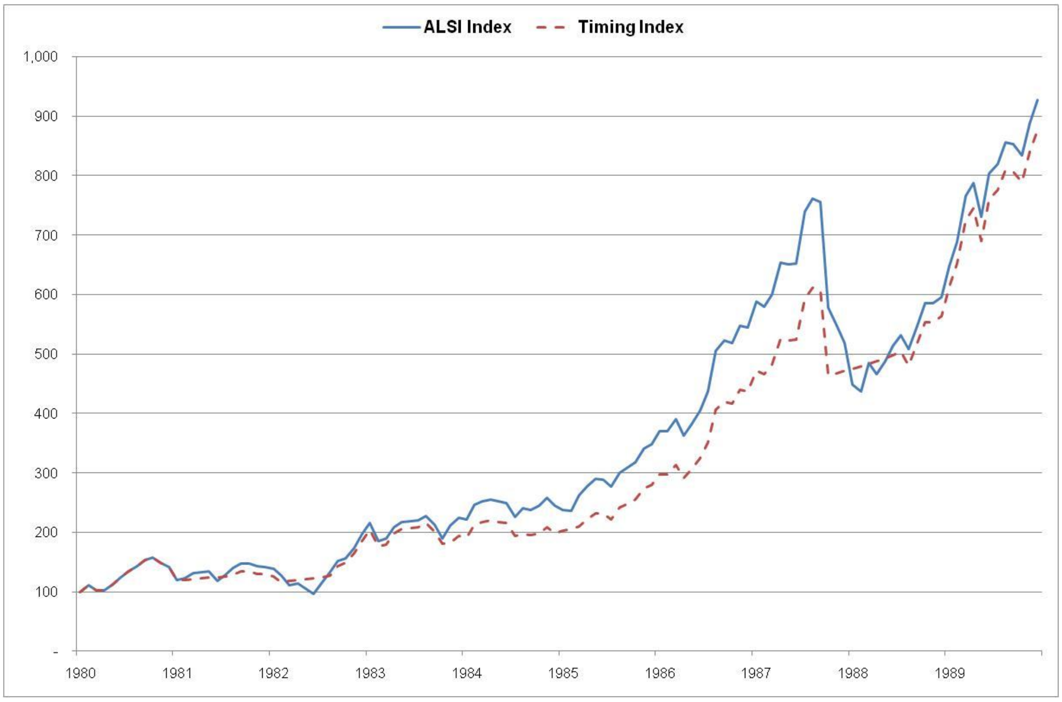
Table 10 confirms that timing was inferior during the period between 1980 and 1989, returning a CAGR of 24.25% compared to a CAGR for buy-and-hold of 24.94%. Timing led to a marginal decline in volatility, as the standard deviation reduced from 0.28 to 0.25. Timing failed to improve risk-adjusted returns as the Sharpe ratio decreased from 0.5717 to 0.5705. The maximum drawdown for the period reduced from -50.97% to -26.39%.

Table 10: ALSI total returns versus timing total returns, 1980 to 1989

Measurement	ALSI	Timing
Compound annual growth rate	24.94%	24.25%
Standard deviation	0.2774	0.2510
Sharpe ratio	0.5717	0.5705
Maximum drawdown	-50.97%	-26.39%
Drawdown correlation	0.3841	0.3841
STeFI	13.05%	13.05%

Figure 10 (1980 base year) illustrates timing's inferior performance by comparing the ALSI total returns and timing total returns for the period between 1980 and 1989. Whilst timing tracked below the ALSI for most of the decade, it was able to avoid the bear market following the 1987 market crash. Timing exited in October 1987 re-entering the market in July 1988. During this time, timing was able to avoid most of the 38.84% drawdown experienced by the ALSI between August 1987 and April 1988. Timing returned 0.63% in 1987 versus the ALSI return of -23.61%, but the reverse was true in 1988 when timing returned 29.17% versus the ALSI return of 44.44%. This was due to timing entering the market too late in the recovery. The drawdown correlation between the ALSI and timing was 0.38, similar to the prior decade which saw timing underperform on an absolute and risk-adjusted basis.

Figure 10: ALSI total returns and timing total returns, 1980 to 1989



5.4.1.7. 1990 to 1999

Table 11 confirms that timing was inferior during the period between 1990 and 1999, returning a CAGR of 12.36% compared to a CAGR for buy-and-hold of 13.48%. Timing led to a marginal decline in volatility as the standard deviation reduced from 0.2570 to 0.2234. Timing fails to improve risk-adjusted returns as the Sharpe ratio decreases from 0.04 to -0.03. Timing had no impact on drawdown for the period which remained at -29.71% for both the ALSI and timing model.

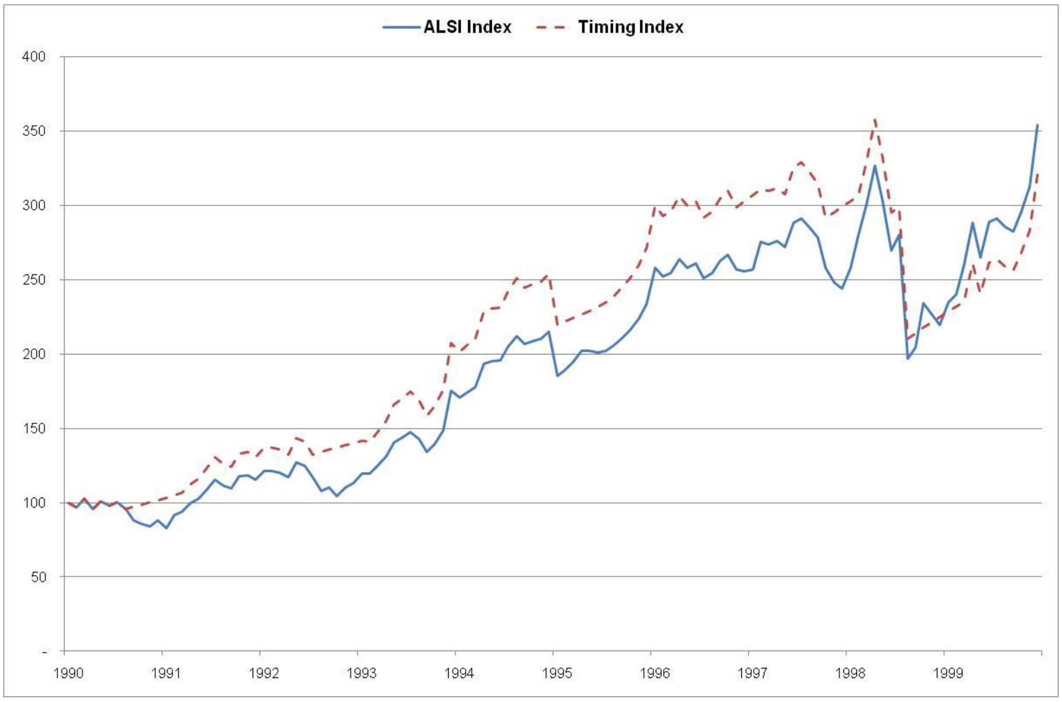
Table 11: ALSI total returns versus timing total returns, 1990 to 1999

Measurement	ALSI	Timing
Compound annual growth rate	13.48%	12.36%
Standard deviation	0.2570	0.2234
Sharpe ratio	0.0382	0.0255
Maximum drawdown	-29.71%	-29.71%
Drawdown correlation	0.7209	0.7209
STeFI	15.00%	15.00%

Figure 11 (1990 base year) illustrates the timing systems underperformance by comparing the ALSI total returns and timing total returns for the period between 1990 and 1999. Timing outperformed the ALSI for most of the decade tracking well above the ALSI. However, in 1998 timing dropped below the ALSI and remained there for the remainder of the period. Despite this lengthy period of outperformance, the overall underperformance of the timing model was as a result of the model’s failure to exit the ALSI early enough to avoid the 1998 market crash. Timing returned -24.54% in 1998 versus the ALSI return of -9.05%. Timing was mostly ineffective, by way of example, between April 1998 and August 1998 when the market fell by 39.73% in five months timing was invested 60% of the time. When the market rebound and returned 78.85% from

August 1998 to the end of the decade timing was only invested 58.82% of the time. Interestingly, the ALSI and timing drawdown correlation was 0.72 suggesting timing was ineffective during this decade at improving downside volatility.

Figure 11: ALSI total returns and timing total returns, 1990 to 1999



5.4.1.8. 2000 to 2010

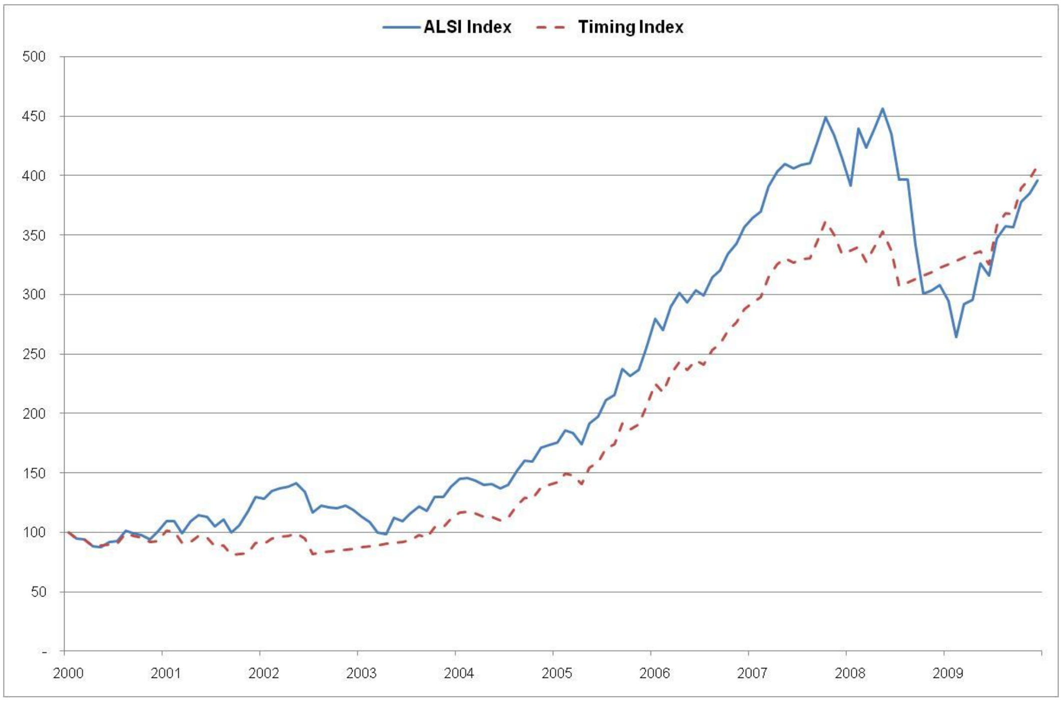
Table 12 confirms that timing was superior during the period between 2000 and 20009, returning a CAGR of 15.11% compared to a CAGR for buy-and-hold of 14.76%. Timing led to a decline in volatility as the standard deviation reduced from 0.2376 to 0.21.49. However, timing fails to improve risk-adjusted returns as the Sharpe ratio decreases from 0.32 to 0.34. The maximum drawdown for the period improves from -39.29% to -17.85%.

Table 12: ALSI total returns versus timing total returns, 2000 to 2009

Measurement	ALSI	Timing
Compound annual growth rate	14.76%	15.11%
Standard deviation	0.2376	0.2149
Sharpe ratio	0.3222	0.3424
Maximum drawdown	-39.29%	-17.85%
Drawdown correlation	0.3399	0.3399
STeFI	8.98%	8.98%

Figure 12 (2000 base year) illustrates timing's performance by comparing ALSI total returns and timing total returns for the period between 2000 and 2009. Timing underperformed the ALSI tracking below the index for most of the decade until late 2008, when it rose above the ALSI by avoiding the lengthy bear market following the market crash during the global financial crisis. The ALSI returned -24.70% in 2008 versus a more respectable -3.50% return achieved by the timing. However timing failed to capture the 34.50% returned by the ALSI in 2009, returning a much lower 25.55%. The drawdown correlation between the ALSI and timing for the period was 0.34.

Figure 12: ALSI total returns and timing total returns, 2000 to 2009



5.5. GOVI and Timing from 1925 to 2010

The next step was to test whether the results from timing the ALSI are consistent when the model was applied to the GOVI. Table 14 presents the yearly returns for the GOVI and the timing method since 1925. Consistent with the first half of results observed when testing the ALSI, the results for the GOVI reveal that timing improved returns. The CAGR increased from 7.53% for the GOVI to 8.38% for timing. Furthermore, timing reduced volatility. The standard deviation, drawdown, downside deviation and worst year all showed improvements. This all while being invested in the market 81.67% of the time and making less than one round trip trade per year (0.37).

Table 13: GOVI total returns and timing total returns, 1925 to 2010

Measurement	Bonds	
	GOVI	**Timing**
Compound annual growth rate	7.53%	8.38%
Standard deviation	0.1015	0.0937
Sharpe ratio	0.1938	0.3172
Maximum drawdown	-23.83%	-8.37%
Downside deviation	0.0393	0.0231
Sortino ratio	0.4277	1.0621
% time in market	100.00%	81.67%
Round trip trades per year	-	0.37
Best year	40.58%	42.67%
Worst year	-9.06%	-1.98%

Table 14 confirms that the timing system under-performed the GOVI in only 26 out of 85 years since 1925. Timing fails to improve returns in 48 out of 85 years, thus improving returns in 37 out of 85 years, or 43.53%.

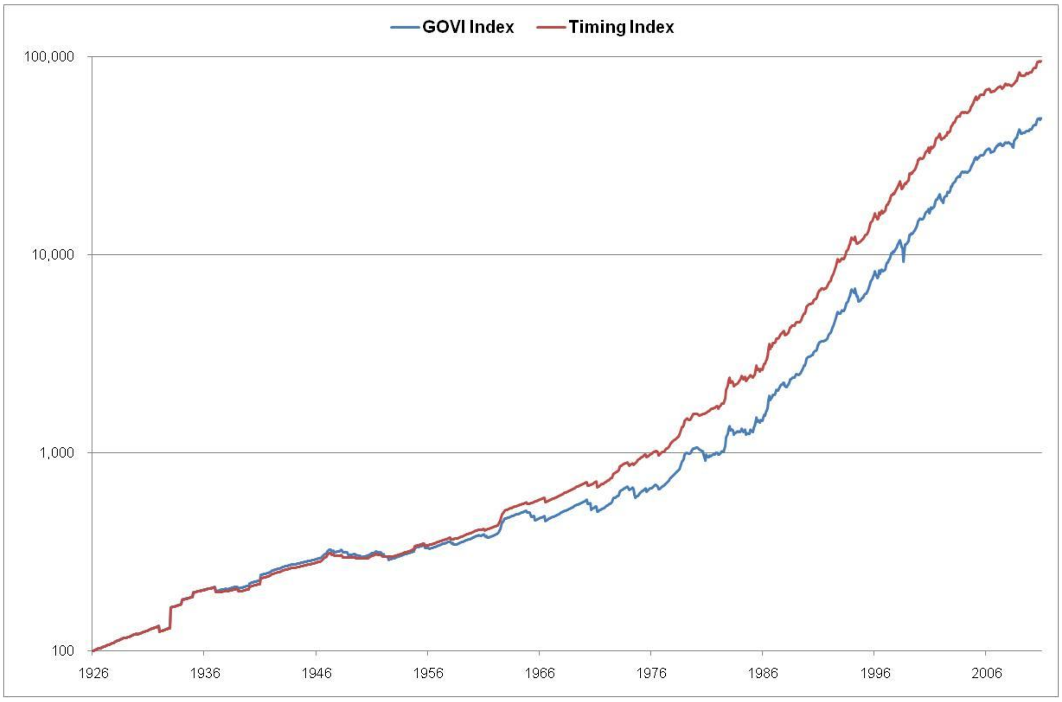
Table 14: GOVI timing underperformance, 1925 to 2010

	Years	%
Timing underperformance	26	30.59%
Timing failure to improve returns	48	56.47%
Timing outperformance	37	43.53%

Comparing the average returns with compound returns (the return an investor would actually realise); the average return for the GOVI since 1925 is 8.01%, while timing returned 8.78%. The compounded returns for the two are 7.53% and 8.38%, respectively. Notice that the buy-and-hold crowd takes a 47 basis point hit from the effects of volatility, while timing suffers a smaller 40 basis point decline.

Figure 13 (a logarithmic scale) makes it apparent that timing is superior to buy-and-hold over the past 85 years.

Figure 13: GOVI total returns and timing total returns, 1925 to 2010



5.6. Systematic Tactical Asset Allocation

Given the ability of this simplistic market timing rule to add value to various asset classes, it is instructive to examine how the returns would look in the context of an investor's portfolio (Faber, 2007). This section compares the returns for a buy-and-hold and timing allocation. The two asset classes for both buy-and-hold and timing are equally weighted and each asset class is treated independently – the allocation is either long the asset class or in cash with its 50% allocation of the funds.

Table 15 illustrates the percentage of months in which the two asset classes were held. It is evident that the system keeps the investor invested in both asset classes 64.51% of the time and in one asset class 25.98% of the time.

Table 15: Percent of time invested, 1925 to 2010

No. Positions	% Invested	No. Months	% Months
0 (all cash)	0.00%	97	9.51%
1	50.00%	265	25.98%
2	100.00%	658	64.51%
Total		1020	100.00%

Figures 14 and 15 below present the results for the buy-and-hold, two asset class equal-weighted allocations versus the timing portfolio. Referring to Figure 14 it is evident that timing has outperformed buy-and-hold over the period 1925 to 2010 as the timing index tracks above the buy-and-hold index. The power of the timing model is best evidenced by its ability to reduce downside volatility. Figure 15 compares the two indices since 1975, notice how the timing method was able to avoid the sharp drop experienced by the buy-and-hold index during the global financial crisis in 2008.

Figure 14: Buy-and-hold versus timing model (log scale), 1925 to 2010

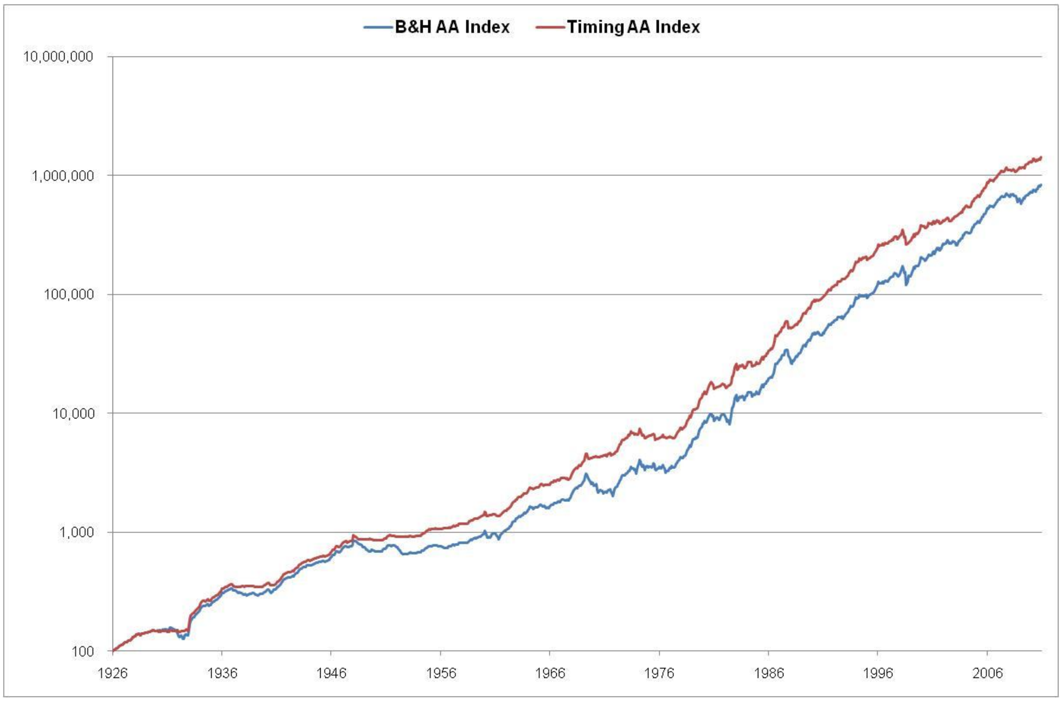
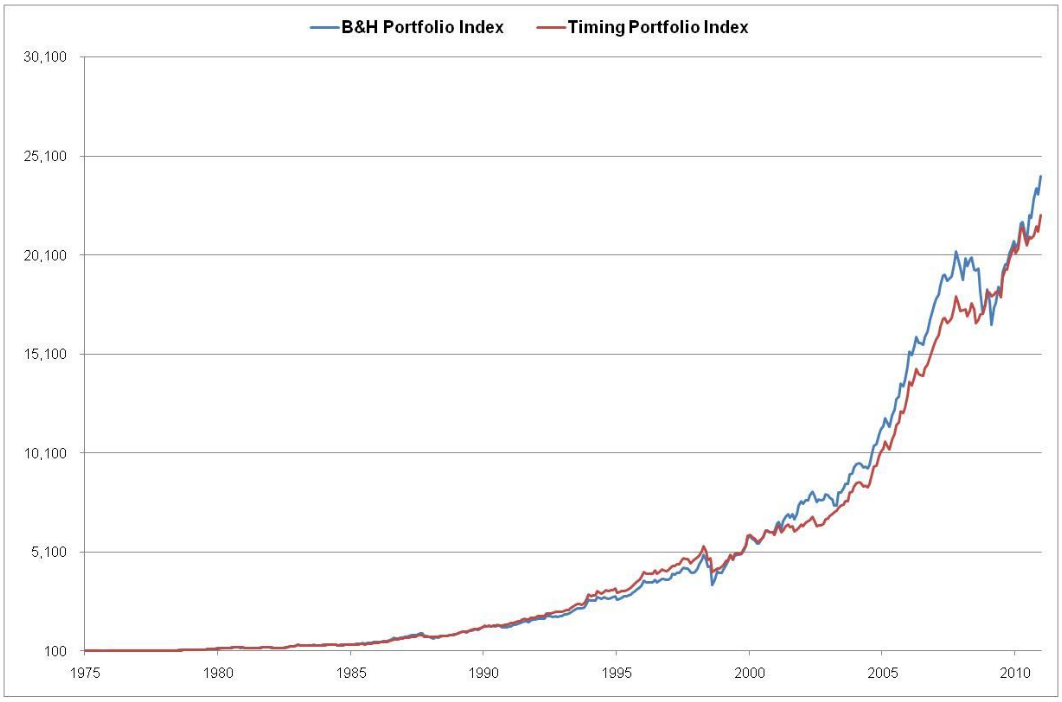


Figure 15: Buy-and-hold versus timing model (non-log scale), 1975 to 2010



The buy-and-hold returns are positive and the reduction in volatility presents evidence of the benefits of diversification. As reflected in Table 16, the benefits of timing are evident. Timing improved returns from 11.30% to 12.02% and improved the best year recorded from 48.21% to 52.37%. Timing reduced volatility from 0.15 to 0.13 and improved the Sharpe ratio from 0.43 to 0.52. Also, maximum drawdown reduces from -26.46% to -14.08%.

Table 16: Asset allocation versus timing, 1925 to 2010

Measurement	Buy and Hold	Timing
Compound annual growth rate	11.30%	12.02%
Standard deviation	0.1449	0.1294
Sharpe ratio	0.4294	0.5163
Maximum drawdown	-26.46%	-14.08%
Best year	48.21%	52.37%
Worst year	-12.85%	-8.20%

Table 17 details the yearly returns for buy-and-hold and timing since 1925. Table 18 highlights timings over or underperformance for the period.

Table 17: Yearly returns for buy-and-hold versus timing, 1925 to 2010

Year	B&H	Timing	Year	B&H	Timing
1926	16.52%	16.52%	1969	-7.39%	7.96%
1927	15.68%	15.68%	1970	-11.88%	4.13%
1928	6.88%	6.88%	1971	7.95%	6.73%
1929	3.43%	3.25%	1972	31.75%	31.75%
1930	0.68%	-1.49%	1973	14.77%	6.27%
1931	-10.39%	-0.04%	1974	-4.85%	-3.04%
1932	27.18%	28.08%	1975	0.59%	-3.22%
1933	35.42%	35.42%	1976	-3.73%	0.72%
1934	11.63%	10.59%	1977	25.84%	20.44%
1935	22.69%	22.69%	1978	37.47%	37.47%
1936	5.87%	5.87%	1979	42.19%	42.19%
1937	-7.05%	-0.87%	1980	5.32%	10.84%
1938	0.35%	-0.31%	1981	8.65%	5.02%
1939	6.55%	5.27%	1982	48.21%	52.37%
1940	7.89%	4.60%	1983	-1.90%	-3.64%

1941	21.23%	21.23%	1984	3.69%	3.88%
1942	13.65%	13.65%	1985	36.52%	30.20%
1943	10.51%	10.51%	1986	44.42%	44.42%
1944	7.54%	7.54%	1987	-6.64%	5.47%
1945	10.97%	10.97%	1988	29.69%	22.43%
1946	16.01%	16.01%	1989	37.79%	37.79%
1947	19.58%	18.99%	1990	-0.09%	10.01%
1948	-12.85%	-6.51%	1991	29.71%	23.08%
1949	-7.22%	-2.37%	1992	13.74%	16.04%
1950	7.20%	4.13%	1993	34.40%	34.40%
1951	0.50%	1.90%	1994	1.53%	5.10%
1952	-11.22%	0.94%	1995	36.47%	35.18%
1953	2.09%	1.30%	1996	3.73%	5.19%
1954	13.35%	13.19%	1997	13.00%	12.08%
1955	-0.89%	1.36%	1998	-1.90%	-8.20%
1956	1.98%	4.05%	1999	38.80%	33.60%
1957	6.13%	6.13%	2000	10.51%	6.26%
1958	8.69%	9.79%	2001	14.93%	1.02%
1959	15.71%	15.71%	2002	4.68%	8.49%
1960	-4.59%	-4.55%	2003	20.80%	23.74%
1961	6.27%	7.30%	2004	20.14%	20.14%
1962	27.83%	27.83%	2005	34.20%	34.20%
1963	14.85%	14.85%	2006	17.92%	16.49%
1964	8.82%	9.17%	2007	5.35%	9.36%
1965	0.98%	6.01%	2008	-5.01%	4.93%
1966	11.25%	10.89%	2009	15.63%	11.31%
1967	13.05%	8.34%	2010	17.38%	9.32%
1968	28.07%	28.07%			

It is evident from Table 18 below that timing was equal to or better than buy-and-hold in 53 out of 85 years or 65.63%. Importantly, timing also reduced the number of down months from 341 for buy-and-hold to 228 for timing and reduced the number of annual negative returns by 31.25% from 16 to 11.

Table 18: Portfolio timing performance, 1925 to 2010

Timing over/under performance	**# Occurrences**	**Improvement**
Over (or equal) performance	53	65.63%
Under performance	32	
Negative returns		**Improvement**
B&H	16	
Timing	11	-31.25%

5.7. The Impact of Transaction Costs

The studies results so far have excluded the impact of transaction costs on returns. To illustrate their impact a commission of 0.5% on each trade under the timing model was assumed. Transaction costs reduce timing returns for the ALSI from 14.91% to 14.24%. Timing returns under the GOVI reduce from 8.38% to 8.01%. Timing returns under the asset allocation framework are reduced from 12.02% to 11.46%. In all three scenarios, after deducting transaction costs, timing still outperforms a buy-and-hold strategy.

Table 19: Impact of transaction costs on timing returns, 1925 to 2010

Equities	**ALSI**	**Timing**
CAGR excl. transaction costs	14.10%	14.91%
CAGR incl. transaction costs	14.10%	14.24%
Bonds	**GOVI**	**Timing**
CAGR excl. transaction costs	7.53%	8.38%
CAGR incl. transaction costs	7.53%	8.01%
Asset Allocation	**Buy-and-Hold**	**Timing**
CAGR excl. transaction costs	11.30%	12.02%
CAGR incl. transaction costs	11.30%	11.46%

CHAPTER 6: DISCUSSION OF RESULTS

6.1. Timing Model Performance

The research paper attempts to provide evidence that South African markets are inefficient making it possible to capture alpha through a quantitative approach to tactical asset allocation. Three broad variables namely total return, volatility and risk-adjusted return were calculated for a buy-and-hold strategy and compared to a timing strategy for each assets class and within an asset allocation framework. The results described in the previous chapter reveal that the timing model did in fact produce superior returns across the board when back-tested over the period between 1925 and 2010.

6.1.2. ALSI Timing Performance

Timing increased the absolute return measure, CAGR, from 14.10% for the ALSI to 14.91%. If transaction costs are included (assumed for the purpose of this study to be 0.50% per trade) timing still outperforms the ALSI with a CAGR of 14.24%.

The timing system also reduced volatility and downside risk. The standard deviation, drawdown, downside deviation and worst year all showed improvements. These results were achieved while being invested in the market 73.33% of the time. In terms of trading activity timing resulted in less than one round trip trade per year (0.61), implying that the impact of transaction costs are minimised.

The timing system improved annual returns in 28 out of 85 years. Importantly, timing equalled or improved ALSI returns in 49 out of 85 years or 57.65% of the time. The reduced volatility of the timing system together with improved total returns illustrates the attractiveness of the timing approach when applied to the South African All Share index.

Risk-adjusted returns (excluding transaction costs) were improved with the Sharpe ratio increasing from 0.44 to 0.50. A second measure, Jensen’s alpha, was calculated at 0.18. Jensen’s alpha is a risk-adjusted performance measure that represents the average return on a portfolio over and above that predicted by the capital asset pricing model, given the portfolio's beta and the average market return (Bodie, et al., 1999, p. 755). When analysing the performance of an investment strategy the overall return of a portfolio as well as the risk of that portfolio must be assessed. A positive alpha value means that the portfolio is earning excess returns. In other words, a positive value for Jensen's alpha implies that timing system has "beaten the market". Table 20 details the risk-adjusted performance measure calculated.

Table 20: ALSI versus timing risk-adjusted returns, 1925 to 2010

	ALSI	**Timing**
Monthly Risk Free Rate		10.87%
Covariance		0.0514
Variance (ALSI)		0.0686
Beta	1.0000	0.7500
Alpha (Jensen)		0.1640
Information Ratio		-0.1367
Minimum Accepted Return (MAR)		10.87%
Downside Deviation	0.1332	0.0855
Sortino Ratio	0.7581	0.9835
Sharpe Ratio	0.3810	0.3630

6.1.3. GOVI Timing Performance

In the case of bonds, timing improved CAGR to 8.38% from 7.53% for the index. Timing maintains its outperformance of the index even after deducting transaction costs (assumed for the purpose of this study to be 0.50% per trade) with CAGR reducing to 8.01%.

The timing system also reduced volatility and downside risk. The standard deviation, drawdown, downside deviation and worst year all showed improvements. These results were achieved while being invested in the market 81.67% of the time. In terms of trading activity timing resulted in less than one round trip trade per year (0.37), implying that the impact of transaction costs are minimised.

The timing system improved annual returns in 37 out of 85 years. Importantly, timing equalled or improved GOVI returns in 59 out of 85 years or 69.41% of the time. The reduced volatility of the timing system together with improved total returns illustrates the attractiveness of the timing approach when applied to the RSA government bond markets.

Risk-adjusted returns (excluding transaction costs) were improved with the Sharpe ratio increasing from 0.19 to 0.32.Jensen's alpha was calculated at 0.04.

6.1.4. Asset Allocation Framework Timing Performance

Within a portfolio context where equities and bonds have been equally allocated timing again outperforms buy-and-hold increasing CAGR from 11.30% to 12.02%. Factoring in transactions costs reduces timing returns to 11.46% still above the buy-and-hold returns. The timing system reduced volatility and downside risk. The standard deviation, drawdown and worst year all showed improvements.

Risk-adjusted returns (excluding transaction costs) were improved with the Sharpe ratio increasing from 0.43 to 0.52. Jensen's alpha, was calculated at 0.11.

6.1.5. ALSI Timing Results per Decade

Period testing was extended to test separately how timing performed against the ALSI in each decade since 1925. The results of a stable model should translate to all asset classes but also to all timescales. In this regard the results are mixed. Table 21 conveys the results of timing's performance measured against the ALSI. From 1925 to 1970 and for the period 2000 to 2010 timing outperformed across all four measures, CAGR, standard deviation, Sharpe ratio and maximum drawdown, for each decade. However, during the 1970s and 1980s timing underperformed on return measures but managed to reduce volatility and drawdown. The 1990s was the worst period for timing where it failed to improve CAGR, Sharpe ratio or drawdown.

Table 21: Risk and return metrics for buy-and-hold versus timing returns, 1925 to 2010

	Measurement			
Time Period	**CAGR**	**Std Dev**	**Sharpe**	**Max DD**
1925 to 2010	+	+	+	+
1925 to 1939	+	+	+	+
1940 to 1949	+	+	+	+
1950 to 1959	+	+	+	+
1960 to 1969	+	+	+	+
1970 to 1979	-	+	-	+
1980 to 1989	-	+	-	+
1990 to 1999	-	+	-	-
2000 to 2009	+	+	+	+

6.2. Bull versus Bear Timing Performance

Faber (2007) promotes the timing model as a risk management technique first and foremost as opposed to a model to consistently generate superior absolute returns over the buy-and-hold approach. This is best illustrated in Figure 16 below. Figure 16 is charted on a non-log scale to detail the differences in the two equity curves. Examining the most recent 20 years, a few features of the timing model stand out. First, a trend-following model will underperform buy-and-hold during a roaring bull market similar to that experienced by the ALSI in the 2000s. On the other hand, the timing model avoids lengthy and protracted bear markets. Consequently, the value added by timing is evident only over the course of entire business cycles.

Figure 16: ALSI total return versus timing total return, 1990 to 2010

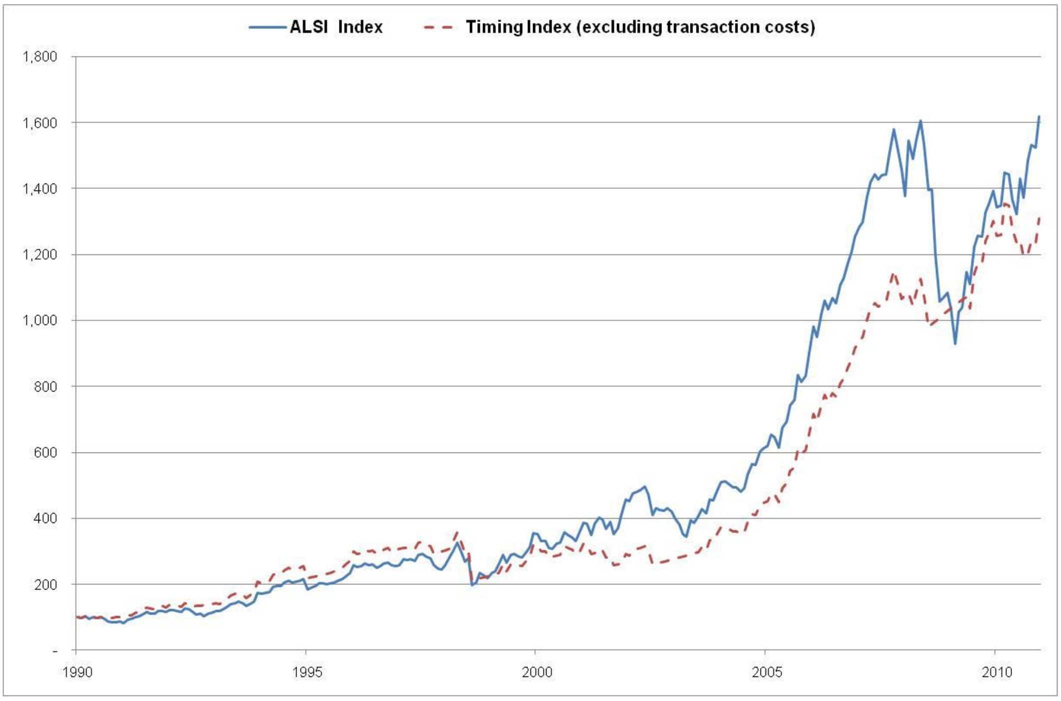


Table 22 illustrates that during the bull market between April 2003 and October 2007 the timing model underperforms the ALSI index by 18.70%, whilst being invested 94.54% of the time. However, the timing model's value is its ability to avoid protracted drawdowns. This is best evidenced during the two major bear markets of the past decade, the first which ran from May 2002 to April 2003; and the second, which ran from May 2008 to February 2009.

During the first bear market of the decade, during May 2002 and April 2003, timing exits the ALSI, switching into cash in July 2002, thus avoiding the remaining 10 months of the bear market and being invested only 16.67% of the time. Timing's drawdown of -15.95% is much shallower than the -30.43% setback suffered by the ALSI. The timing model again exited the ALSI in July, 2008, largely avoiding the second bear market. Timing's return of -33.38% outperforms the -42.01% return experienced by the ALSI and being invested only 20.00% of the time.

Table 22: Timing performance during bull and bear markets, 2000 to 2009

Period: April 2003 to October 2007 (55 months)		
Bull market performance	**ALSI**	**Timing**
Total return	357.36%	300.94%
% time invested	100.00%	94.55%
Period: May 2002 to April 2003 (12 months)		
Bear market performance	**ALSI**	**Timing**
Total return (drawdown)	-30.43%	-9.05%
% time invested	100.00%	16.67%
Period: May 2008 to February 2009 (10 months)		
Bear market performance	**ALSI**	**Timing**
Total return (drawdown)	-42.01%	-7.02%
% time invested	100.00%	20.00%

6.3. Downside Volatility

Table 23 presents the ten worst years for the ALSI since 1925, and the corresponding returns for the timing system. It is immediately obvious that the two do not move in lockstep. In fact, the correlation between negative years for the ALSI and the timing model is approximately -0.21, while the correlation for all years is approximately 0.91. This reflects the ability of the timing model to stay long in up markets while exiting the long position during down markets.

Table 23: ALSI ten worst years versus timing

Date	ALSI annual return	Timing annual return
2008	-24.70%	-3.50%
1987	-23.61%	0.63%
1969	-21.48%	9.21%
1948	-21.16%	-11.45%
1931	-18.87%	1.84%
1952	-18.18%	0.94%
1970	-17.58%	6.96%
1990	-16.90%	3.29%
1937	-16.47%	-2.02%
1960	-12.98%	-12.90%

Table 24 presents the ten worst years for the GOVI since 1925, and the corresponding returns for the timing system. It is immediately obvious that the two do not move in lockstep. In fact, the correlation between negative years for the GOVI and the timing model is approximately -0.12, while the correlation for all years is approximately 0.97. This reflects the ability of the timing model to stay long in up markets while exiting the long position during down markets. In six out of the ten worst years experienced by the GOVI, timing produced positive returns.

Table 24: GOVI ten worst years versus timing

Date	GOVI Annual Return	Timing Annual Return
1980	-9.06%	1.98%
1983	-6.71%	-0.99%
1965	-6.33%	4.89%
1970	-6.18%	1.30%
1994	-5.67%	1.46%
1948	-4.53%	-1.56%
1952	-4.25%	0.94%
1974	-2.78%	8.77%
1936	-1.98%	-1.98%
1931	-1.91%	-1.91%

Figure 17 plots the timing model excess returns over STeFI (r_t - r_f), versus excess returns of buy-and-hold over STeFI (r_m – r_f). From the scatterplot, it can be inferred that there exists a linear relationship for positive returns, while the negative returns are much more scattered. The polynomial trend-line illustrates the improved downside returns achieved through timing as the trend-line flattens.

Figure 17: ALSI excess returns (r_m – r_f) versus timing excess returns (r_t-r_f), 1925 to 2010

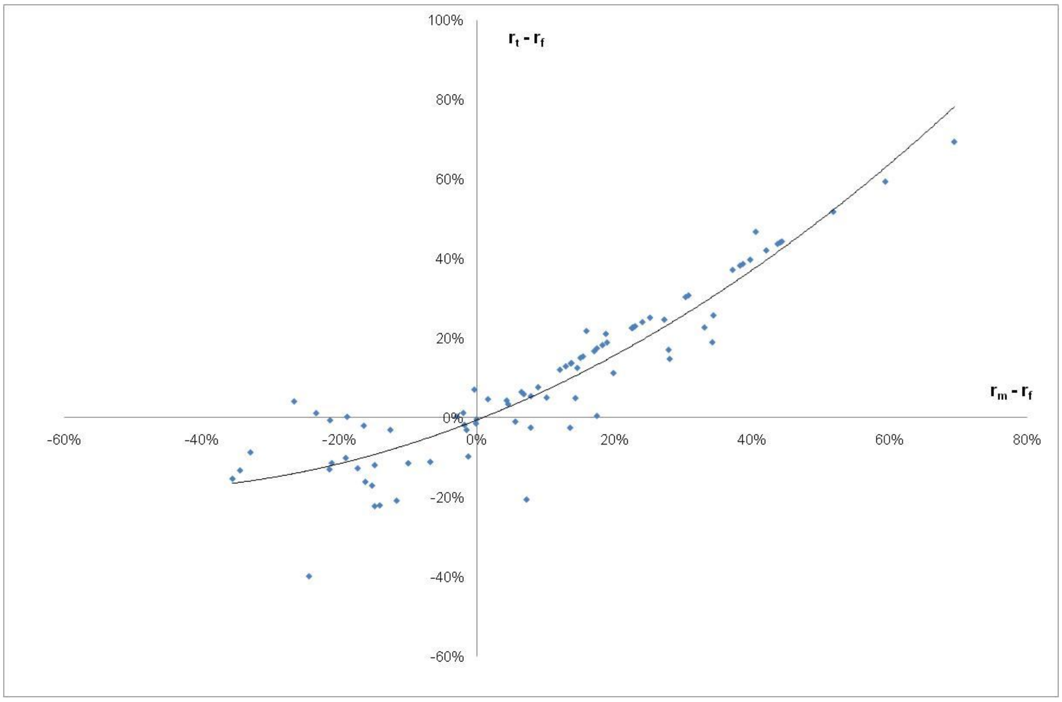
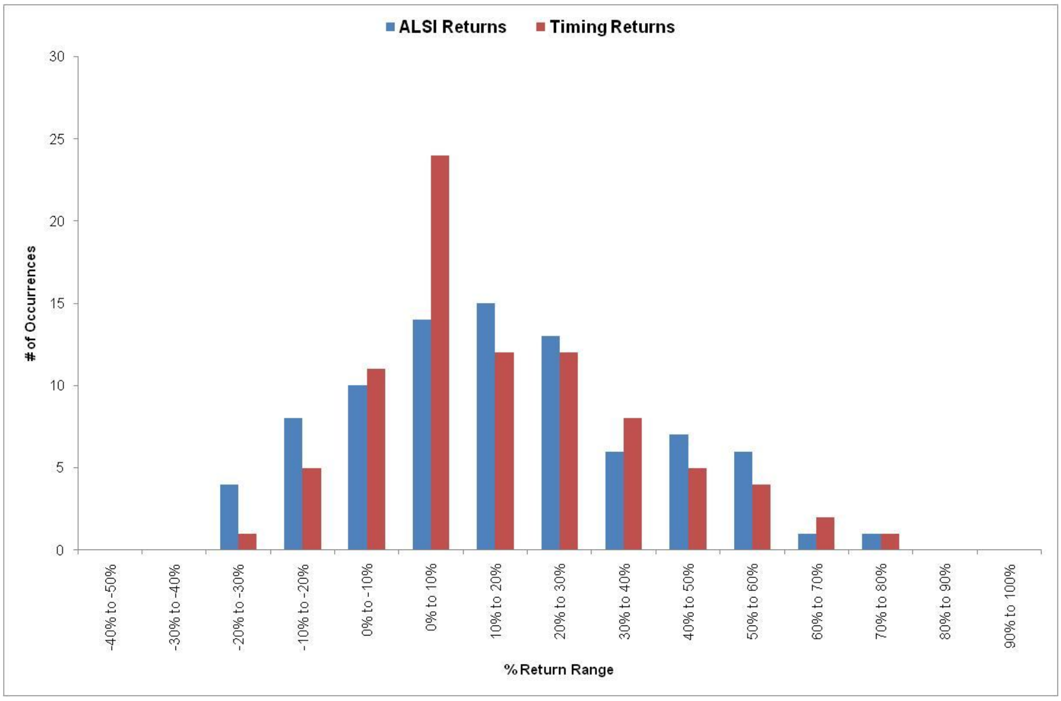


Figure 18 gives a good pictorial description of the results of the timing system applied to the ALSI. The timing system has fewer occurrences of both large gains and large losses, with correspondingly higher occurrences of small gains and losses (between the range of -10% and 10%). Essentially, the system is a model that signals when an investor should be long a riskier asset class with potential upside, and when to be out and sitting in cash. It is this move to a lower-volatility asset class (STeFI) that drops the overall risk and drawdown of the portfolio.

Figure 18: Yearly return distribution, ALSI and timing, 1925 to 2010



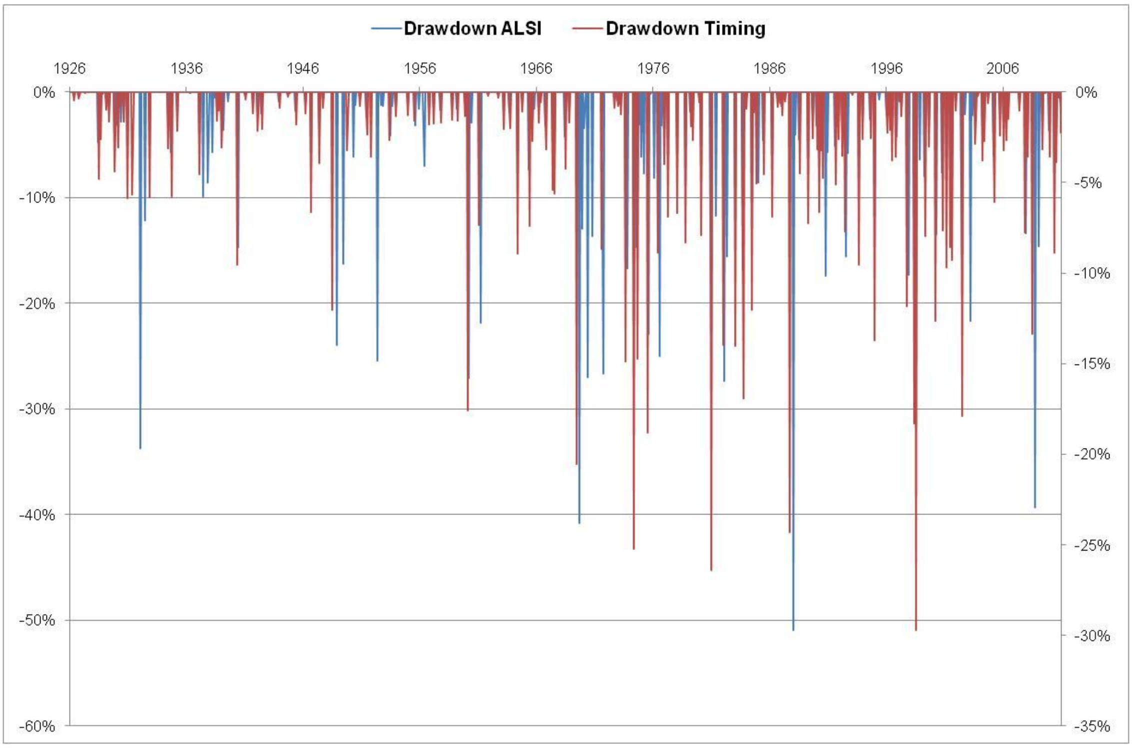
A drawdown is the peak-to-trough decline an investor would experience in an investment and is calculated on a monthly basis. Table 25 shows that timing results in fewer negative months as well as fewer and less severe drawdowns. Timing improves maximum drawdown for the period under review from -50.97% (1987) returned by the ALSI to -29.71% (1998). Timing also reduces the longest drawdown or consecutive number of down months from eleven to four.

Table 25: ALSI versus Timing Drawdown Analytics, 1925 to 2010

	ALSI	Timing	% difference
Number of Months	1020	1020	0.00%
Number Months Down	372	243	-34.68%
Number of Drawdowns	194	156	-19.59%
Max % Drawdown	-50.97%	-29.71%	-41.72%
Longest Drawdown	11	6	-45.45%

Figure 19 provides a graphic comparison between the ALSI and timing drawdowns for the past 85 years. ALSI drawdowns (left axis), calculated monthly, of between 10%-20% are fairly frequent; with 30%-40% drawdowns less so. Notice the significant improvement in drawdowns between the ALSI and timing system (right axis).

Figure 19: ALSI versus timing drawdown's, 1925 to 2010



CHAPTER 7: CONCLUSION

7.1. Significant Findings

The purpose of this study was to apply a simple to follow, quantitative approach to tactical asset allocation, as promulgated by Faber (2007), in a South African context in an attempt improve absolute and risk-adjusted returns over a buy-and-hold approach. The timing model was applied to equities and bonds as well as within an asset allocation framework, or portfolio of assets.

There is anecdotal evidence (Faber, 2007) to suggest that the above timing model when applied to South African markets produced inferior risk and return characteristics when compared to a simple buy-and-hold approach. Faber (2007) tested various risk and return metrics including the compound annual growth rate, Sharpe ratio, Ulcer index and maximum drawdown, over the period 1972 to 2005 to determine the effectiveness of the timing model in improving absolute and risk adjusted returns. Faber found that timing was inferior for each metric when compared to buy-and-hold.

The findings of this research when back-testing the model over the period 1925 to 2010 produced contrasting results to Faber’s 2007 study. Timing the ALSI since 1925 resulted in superior absolute returns (CAGR) and risk-adjusted returns (Sharpe ratio), excluding and included transaction costs. Timing also improved volatility (standard deviation) and downside risk (maximum drawdown). When tested on the GOVI, timing improved absolute returns (including and excluding transaction costs), risk-adjusted returns, volatility and downside risk. Finally, when timing was applied to an equally weighted portfolio of assets, absolute returns (excluding and including transaction costs) were improved. Timing also improved risk-adjusted returns and volatility, and reduced downside risk..

7.2. Implications for Findings

It is apparent that this non-discretionary trend-following model acts as a risk-reduction technique with limited to no impact on return. Utilising a monthly system since 1925, an investor would have been able to increase his risk-adjusted returns by employing a market timing solution within a diversified asset allocation framework. An investor would have been able to side-step many of the protracted bear markets experienced in the two asset classes during the period. Avoiding these significant losses would have resulted in equity-like returns with bond-like volatility and drawdown.

The timing model, when tested on U.S. markets by Faber (2007), produced superior results across all return metrics. This is consistent with the results of this research. However, when the model was tested out-of-sample it showed signs of weakness, for example, during the 1970s, 1980s and 1990s, timing failed to improve absolute and risk-adjusted returns (Sharpe ratio) against the ALSI. The inferior equity return characteristics evidenced in the South African market during these periods needs to be investigated further. Interestingly, these decades showed the highest volatility as measured by standard deviation as well as high drawdown correlation. This would suggest that timing performs worse in volatile markets or over volatile periods. This finding needs to be investigated further.

The U.S. and South African markets are fundamentally different, which could explain why the timing model performed worse in the South African context during the latter part of the 20th century. The main differences, which need to be investigated further, include the rate at which information is disseminated, for example, company financial reporting is undertaken quarterly in the U.S. as opposed to bi-annually in South Africa; the South African stock market is more institutionally dominant, meaning the market activity taken by large institutional investors has a relatively larger affect on prices; the South African stock market is more highly concentrated, with 10 stocks making up approximately 50% of the total market capitalisation; and the South African stock market has a resource bias, which results in currency volatility contributing significantly to market volatility.

7.3. Recommendations for Future Research

The impact that the limitations may have on the outcome of this study is unknown. It is therefore recommended that this investigation is extended to other assets classes as well as tested within asset classes, for example, using different asset proxies.

Considering the higher volatility common to the South African equity market compared to the US market, for the reasons raised above, testing the timing model using different period simple moving averages may improve results. For example, using a longer period simple moving average with less volatility may improve absolute and risk-adjusted returns.

It is evident that the timing model acts more as a risk management tool, rather than a tool to improve returns. One of the reasons suggested for timing's failure is the models inability to enter the asset class early enough in an upswing, thereby missing out on capturing significant rebound return. Adopting a shorter period moving average for the buy rule may facilitate earlier entry into the asset class.

Finally, the impact of asset class return volatility and timing performance should be investigated further. Understanding this relationship will strengthen the model.

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