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MARKET TIMING ON THE
JOHANNESBURG STOCK EXCHANGE
UNDER DIFFERENT MARKET
CONDITIONS

Prepared by

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Submitted in fulfilment of the requirements of the degree of Masters of Business Science, special field Finance, in the School of Management Studies, University of Cape Town.

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Declaration

Apart from significant contributions and quotations from the work of other people which has been attributed, cited and specifically referenced, and the assistance which has been acknowledged, this dissertation is entirely my own work and has not been submitted for degree purposes at any other university.

I have not allowed, or will not allow, anyone to copy my work with the intention of passing it off as his or her own work.

Marc Dumont de Chassart
October 2002
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Thank you all

Marc Dumont de Chassart
Synopsis

The objective of this study is to evaluate the performance and risk characteristics of three market timing strategies, namely traditional, bull and bear timing, and how different market conditions affect these strategies.

The market is segmented into bullish and bearish phases and three independent but corroborative studies test how each of the timing strategies perform under the identified market conditions by measuring the returns, the required predictive accuracy and the degree of risk taken. The results of the various studies are compared across the three timing strategies as well as across the different market conditions. This gives an indication of each strategy’s performance and risk characteristics.

The results of the three studies indicate that potential rewards from market timing are high if perfect forecasting is achieved. This return will also be achieved at a lower level of risk compared to that of the market. However as the forecasting ability falls the advantages of market timing are quickly eroded. The potential returns are not only lower but will generally be achieved at a higher level of risk compared to perfect timing, unless a bull timing strategy is employed. To be guaranteed success at market timing, predictive ability of approximately 80% is required. For timing abilities below this threshold the success and risk profile of such a strategy will largely be dependent on which review periods are incorrectly predicted.

For predictive ability below about 60% investors are more likely to under perform the market than to beat it. On a risk adjusted basis this falls to 55% suggesting that investors need at least some level of predictive ability to be successful at market timing. The results also suggest that it is generally more important to predict the bullish periods than the bearish ones.

It is also evident that the market condition has a significant effect on all the market timing strategies analysed. When the market is in a bullish phase, extremely high levels of predictive accuracy are required just to have an even chance of beating the
index, even to the extent that a bull timing strategy may not outperform the index regardless of the predictive ability. Only on a risk adjusted basis are returns above the market possible, albeit at high levels of predictive accuracy. Evidently, when the market is bullish, market timing is not a viable investment strategy.

Nevertheless this study does highlight that there exists pockets of time where market timing may be viable. When the market turns bearish the required forecasting ability necessary to outperform the market falls drastically such that random guesses as to the next review period’s performance are more than likely to produce a return above that of the market. Again, market timing during a bearish period achieves returns at a level of risk below that of the index.

The studies also give insight as to how each of the strategies themselves perform under the different market conditions. It is clear that, for very high levels of predictive accuracy, traditional timing performs the best on both a nominal and on a risk adjusted basis. However, poor timing using this strategy performs the worst on a nominal basis. Only when risk is taken into account does poor traditional timing outperform poor bull timing.

Comparing the two option strategies across the different market conditions does not fully resolve the question of which strategy is superior. However there are some observations that can be made. Firstly bear timing always produces a higher level of risk and secondly, except when the market turns bearish, the returns available at a given predictive accuracy are higher using a bear timing strategy. Only when the market turns bearish does bull timing outperform bear timing. This apparent advantage by bear timing over bull timing can largely be explained by the higher risk characteristics experienced by bear timing. This is evident when the risk analysis is applied to the total time series which indicates that bull timing outperformed bear timing on a risk adjusted basis.
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1 Introduction

Many investors engage in some form of active portfolio management in an attempt to increase their returns above that of a passive buy-and-hold strategy. This active management can be broadly segmented into two forms, stock selection and market timing. Stock selection involves analysing individual companies and shares in an effort to identify mispriced securities and then trading on such information to enhance returns. Market timing, on the other hand, involves predicting how the market is going to move as a whole and then adjusting a portfolio’s exposure to the market to either enhance or protect returns.

It is clear that if one could predict market swings perfectly, then returns well above a passive buy-and-hold strategy would be achieved. All the market rallies would be caught and all the market slumps would be avoided. This would also result in a lower risk profile since the ‘downward variability’ of the market would be excluded. However it is also obvious no one can consistently predict every market swing correctly and any incorrect prediction will result in lower returns and almost certainly a higher variability of returns. Nevertheless it is understandable that one does not have to possess perfect foresight in order to be successful at market timing. Less than perfect forecasting ability could produce returns above that of the market. The question is, how good is good enough. This study aims to investigate this question as well to assess the risk characteristics of different market timing strategies.

A further consideration is how the market’s performance affects such an investment strategy. Intuitively when the market enters a bearish phase it is likely that the returns generated will be less owing to the market’s poor performance. However, despite the lower returns, is it easier or more difficult to achieve a return above that of the market and how are the portfolio risk characteristics affected. Likewise, how do bullish market conditions affect market timing? A period of high market returns is likely to increase the available returns to market timing but what are the chances of obtaining these returns and again, how are the risk characteristics affected?
In the past the practical implementation of a market timing strategy was a challenge in itself. Buying and selling shares to create the desired exposures were often met with liquidity problems and expensive transactions costs. Today, with the use of derivative instruments, the desired exposures can be created rapidly and at relatively low cost, thus providing investors with a practical means of implementing a timing strategy.

This study seeks to analyse the potential rewards as well as the risks associated with market timing using both derivative and traditional timing methods. There is a wealth of literature analysing traditional timing, highlighting the rewards and possible pitfalls of market timing, but the literature on option timing is relatively sparse, possibly due to derivatives having only recently become a mainstream investment tool.

Three timing strategies are analysed namely, traditional timing, bull timing and bear timing. Traditional timing involves committing the whole portfolio to the market when a rise is predicted and investing in money market instruments when a fall is anticipated, thus attempting to participate in all the positive market movements but avoiding exposure to the downward market movements. Bull timing involves continuously holding money market instruments and purchasing call options on the market when a rise is anticipated. The quantity of options purchased creates an exposure equal to selling the money market portfolio and investing fully in the stock market. Bear timing holds the market continuously and purchases put options whenever a fall in the market is predicted. The quantity of puts purchased is such that a fall in the market is perfectly offset by a gain on the options.

The option timing strategies have the advantage of not requiring a portfolio of shares that is representative of the market every time such an exposure is desired. Constructing a portfolio of shares can be a cumbersome and time consuming process as well as being expensive. By contrast the option strategies can rapidly achieve their desired exposure at a relatively low cost. By employing an option strategy the transactions charges associated with traditional timing are largely avoided. This obviously can have a sizable effect on a portfolio's return if frequent switches are made.
2 Literature Review

This review first discusses the attempts by researchers and academics to detect whether there is any evidence of successful market timing in existing investment funds. The discussion examines the complexity in attempting to detect timing ability through the use of various models as well as the results obtained in applying such models to a time series of returns generated by a fund. This is followed by a critique and testing of the different models by other researches. Studies attempting identify certain economic factors and hence creating models that may assist in predicting future market movements, as well as testing them for market timing purposes, are also presented.

Finally a discussion on the various studies conducted to analyse the difficulties and risks associated with market timing is reviewed. An examination of the various methodologies and results is performed as many of the methodologies are replicated in this study, primarily for comparison purposes. This forms a foundation of understanding of the tools used to assess market timing as well as the results produced in past studies indicating the risks and rewards of such an investment strategy.

2.1 Detecting Market Timing Ability

Institutional investors shift their funds under management between stocks and bonds or money market instruments in order to protect or enhance returns based on future expectations of the market's performance. Such actions can be considered to be a form of market timing. Consequently many studies have attempted to detect successful timing ability amongst different investment funds. One of the first such studies is that of Treynor and Mazuy (1966).

They argued that if a fund manager possesses timing ability, then when the market rises the returns of the fund should similar to that of the market and when the market falls, the returns should be similar to non risky assets such as Treasury bills. Thus if the returns of a successfully timed fund were graphed against the returns of the market then a curved line should appear as shown in Figure 1.
The blue ‘Buy and Hold Characteristic Line’ represents the expected return achieved by a fund relative to the market if a passive buy and hold strategy is employed. The red line represents the returns of a successfully timed portfolio relative to the market. Observing the red line, it is evident that when the market rises the returns of the timed portfolio are similar to that of the market and when the market falls the returns on the timed portfolio are unrelated to the market i.e. the market lull does not affect the successfully timed portfolio.

The curved red line can be mathematically represented by the following equation (Bello and Janjigian, 1997)

\[ R_{pt} = \alpha_p + \beta_1 R_{mt} + \beta_2 R_{mt}^2 + \epsilon_{pt} \]

where

- \( R_{pt} \) is the excess return on the portfolio in time \( t \)
- $\alpha_p$ is the estimated selectivity performance of the portfolio
- $\beta_1$ is the estimate of systematic risk, similar to CAPM beta.
- $R_{mt}$ is the excess return on the market in time $t$
- $\beta_2$ is the measure market timing performance
- $e_{pt}$ is the random error term with $E[e_{pt}] = 0$

Treynor and Mazuy (1966) performed various regression analyses to detect whether the returns on a sample of mutual funds was best described by the curved line or the straight 'buy and hold' line. They assessed the performance of 57 mutual funds between 1953 and 1962 and concluded that, except for one fund, none of the funds' regressed returns were best described by a curved line but rather by a straight line. This led Treynor and Mazuy (1966) to conclude that there is no substantial evidence that mutual funds could time the market successfully.

Lee and Rahman (1991) used a model developed by Bhattacharya and Pfleiderer (1983) which is an extension of Treynor and Mazuy's (1966) quadratic model. This new model measures the correlation between the fund manager's forecast and the excess return on the market and uses this statistic as a measure of market timing ability.

Lee and Rahman (1991) applied this model to 93 mutual funds' performance between 1977 and 1984 and concluded that only 16 of the funds showed significant timing ability and only 14 of the funds demonstrated significant positive selective ability. The correlation between the timing and selective ability was 0.47 with 10 of the funds demonstrating significant timing and selective ability.

Bello and Janjigian (1997) attempted to measure market timing ability using a different variation of the Treynor and Mazuy (1966) model. Bello and Janjigian (1997) argued that many mutual funds invest in stocks that are not represented by the benchmark index, such as the S&P 500. Because of this they hypothesised that the Treynor and Mazuy (1966) model could produce inaccurate or misleading results. To
adjust for this and for the fact that mutual funds hold other securities such as bonds, two more factors were added to the regression model. The additions were the Wilshire 4500 index, which excludes S&P 500 stocks, and the Shearson Lehman index which is a bond index.

Bello and Janjigian (1997) applied the Treynor and Mazuy (1966) model and their extended model to 633 mutual funds grouped into five different categories namely aggressive, small company, growth, equity-income and balanced funds and the resulting coefficients were averaged among the funds in each category.

The results from the Treynor and Mazuy (1966) model indicated that each category, except the balanced category, exhibited significant negative timing ability and all the categories exhibited significant positive selective ability. However the extended model showed that each category, except the balanced category, had significant positive timing ability with only the growth and equity-income showing significant positive and negative selective ability respectively. Surprisingly the correlations between timing and selective ability results were negative for both models.

Chang and Lewellen (1984) also investigated whether mutual funds could time the market by using a parametric model developed by Henriksson and Merton (1981). This model is an extension of a single factor model, similar to that of the Capital Asset Pricing Model (CAPM), in order to cater for the fact that a timed portfolio will not have a stationary beta over time as is often assumed by typical single factor portfolio evaluation models. The model has the form

\[ Z_p(t) - R_f(t) = \alpha_p + \beta_1 X(t) + \beta_2 Y(t) + \epsilon_p(t) \]

where

- \( Z_p(t) \) is the return on the portfolio in time \( t \).
- \( R_f(t) \) is the return on the risk free asset (Treasury bills) in time \( t \).
- \( \alpha_p \) is the average residual return on the portfolio \( p \).
• \( X(t) \equiv \max[0, R_m(t)] \) where \( R_m(t) \) is the return on the market less the risk free rate in time \( t \).
• \( \beta_1 \) is the measure of the portfolio's exposure to 'up-markets'.
• \( Y(t) \equiv \max[0, -R_m(t)] \).
• \( \beta_2 \) is the measure of the portfolio’s exposure to ‘down-markets’
• \( \varepsilon_p(t) \) is the random error term were \( E[\varepsilon_p(t)] = 0 \).

An 'up-market' is when the market outperforms Treasury bills and a ‘down-market’ is when Treasury bills outperform the market. Therefore when this model is applied to a perfectly timed portfolio \( \beta_1 \) will equal its maximum value of one and \( \beta_2 \) will equal zero indicating that the portfolio is exposed to all ‘up-markets’ and to no ‘down-markets’. If no timing ability exists then \( \beta_1 = \beta_2 \) indicating that the portfolio is equally exposed to ‘up-markets’ as to ‘down-markets’. Thus the statistical test for market timing ability is whether \( \beta_1 \) is significantly different to \( \beta_2 \) implying a null hypothesis of \( H_0 : \beta_1 = \beta_2 \). The \( \alpha_p \) in the model is similar to Jensen’s alpha as a measure of selective ability for the analysed portfolio.

Chang and Lewellen (1984) applied this model to 67 mutual funds from 1971 to 1979. The results were surprising in that most funds indicated a presence of negative timing ability with \( \beta_2 \) being greater than \( \beta_1 \) but not statistically significant at the 5% level except for three funds. Of the 67 mutual funds only one demonstrated significant positive timing ability.

The selective ability results indicated that the majority of the funds exhibited positive selective ability but this was not statistically significant at the 5% level. Out of the 67 funds only five of the funds had a significant \( \alpha_p \) of which two were positive. Surprisingly the two positive \( \alpha_p \) related to two of the three funds that exhibited significant negative timing ability.
These results lead Chang and Lewellen (1984) to conclude that mutual funds do not have the ability to time the market or select superior stocks to enhance their funds performance.

Henriksson (1984) also applied the same statistical model as well as a non-parametric model to a sample of 116 open-end mutual funds. The time period under investigation was from 1968 to 1980.

The parametric model showed that 12 out of the 116 funds demonstrated statistically significant timing ability but with only 3 of the 12 showing positive timing ability. Surprisingly the majority of the sample (62%) exhibited negative timing ability but not significantly so. Also the results indicated that most of the funds possessed some form of positive selective ability, with 8 of these results being statistically significant.

These results prompted Henriksson (1984) to analyse the correlation between the selective ability and timing ability. This test gave strong evidence that these two parameters are indeed negatively correlated, indicating that funds that possess selective ability cannot time the market and vice versa. As a result Henriksson (1984) commented “this is quite disturbing, as Treynor and Black (1973) showed that investment managers can effectively separate their stock-selection activities from their decision regarding the market risk of their fund.”

The non-parametric model has the advantage that the probabilities of correct forecasts, conditional on which asset class performs best, are not dependent on the distributions of market returns or on any model of security valuation such as the CAPM. The null hypothesis is that the fund managers do not possess any timing ability and Henriksson and Merton (1981) demonstrated that this null hypothesis is defined by a hypergeometric distribution.

The results of the non-parametric tests were less convincing with only 4 of the funds demonstrating timing ability. Unfortunately this test does not differentiate between positive and negative timing ability on the assumption that if a fund demonstrated
negative timing ability then one could achieve positive timing by merely taking the opposite position of the imperfect timer. Henriksson (1984) noticed that these 4 funds actually had positive selective ability and negative timing ability in the parametric test casting further doubt on whether mutual funds can time the market.

Jagannathan and Korajczyk (1986) assessed the performance the parametric model developed by Henriksson and Merton (1981). Jagannathan and Korajczyk (1986) believed that the model is sensitive to the benchmark portfolio used to represent the market as well as the securities selected by the fund when evaluating timing ability. They argued that small-stocks had 'put option' like properties relative to large-stocks and that large-stocks had 'call option' like properties relative to small-stocks. They reasoned that when the market performs well both large- and small-stocks are subjected to similar risk factors but when the market performs badly small-stocks are more likely to be in financial distress than large-stocks. This has the effect of further reducing the expected returns on small-stocks relative to large-stocks due to the additional risk and it is this extra risk factor that causes the relative option-like properties to develop. Jagannathan and Korajczyk (1986) believed that many mutual funds held a greater proportion of large-stocks in their portfolio relative to the index thus resulting a negative timing ability conclusion when evaluated by the parametric model.

The negative correlation between the timing ability and selective ability is derived from the 'premium' of the 'option'. If this did not exist then one could use a passive strategy of selecting small-stocks and show positive market timing ability at no cost. Thus the negative selective ability compensates for the passive timing ability.

To test this hypothesis Jagannathan and Korajczyk (1986) selected two passive indices on the NYSE constructed by Centre for Research in Security Prices (CRSP). One index is a market-value-weighted index (VW) and the other an equal-weighted index (EW). The VW index will, by construction, hold more large-stocks than its equally weighted counterpart (EW).
By using one index as the benchmark and the other to represent a fund Jagannathan and Korajczyk (1986) demonstrated that statistically significant results were produced when the parametric model was applied. Having the VW index as the benchmark and the EW index as the fund resulted in significant positive timing ability but significant negative selective ability. When the roles of the indices were reversed significantly negative timing ability resulted with significant positive selective ability. This led Jagannathan and Korajczyk (1986) to conclude that the parametric model was not strong enough to detect timing or selective ability.

A similar study was conducted by Zimmermann and Zogg-Wetter (1992) on five passively constructed indices on the Swiss stock market. The correlation between the five indices was exceptionally high with the lowest correlation coefficient being 0.97. Tests were conducted by applying the Jensen’s Unconditional Alpha test and the Henriksson and Merton (1981) parametric model to the indices. Each index was used in turn as the benchmark portfolio with the remaining four indices representing ‘managed’ funds. When the Jensen’s Alpha test was applied to calculate selective ability, 10 of the 20 tests revealed significant alphas. This is surprising because, by construction, none of the indices have attempted to select stocks yet significant selective ability was shown to exist.

When the Henriksson and Merton (1981) model was applied, further unexpected results emerged. Of the 20 timing coefficients calculated 5 were significantly positive and 5 were significantly negative.

Of further concern, the tests showed that the indices’ timing and selective ability coefficients had a much higher statistical significance than when compared to the results of the managed funds in the Chang and Lewellen (1984) and Henriksson (1984) studies. Zimmermann and Zogg-Wetter (1992) concluded “these results cast serious doubt on the ability of this test to detect effective timing ability. They demonstrate that statistically significant timing coefficients are likely to be detected for completely passive portfolio return series.”
Biger and Page (1994) assessed whether 16 Flexible Investment Unit Trusts (FIUT), trading on the Tel Aviv Stock Exchange showed any indication of timing or selective ability. Data relating to what proportion of each FIUT’s asset value was invested in one of four asset classes at different time intervals was collected. The four asset classes being common stock, forex-linked bonds, CPI-linked bonds and cash. The method of detecting timing ability involved calculating the returns on the FIUT relative to a passive strategy of holding the original weighting invested in each asset class constant over a period of time. Selective ability detection involved calculating the advantage gained or lost within each asset class relative to an index of each asset class.

For the time period 1989 to 1992 eleven of the sixteen FIUT showed positive timing ability but not significantly so. Selective ability analysis was conducted by evaluating each FIUT against “sixteen synthetic macro designed, full diversification portfolios.” The results indicated that none of FIUT could select assets that yielded additional returns. These results are based on a more useful data set thus allowing for a more robust statistical analysis. Unfortunately the results indicated that FIUT cannot time the market nor select superior stocks.

MoniResearch Corporation collects trading information from funds whose investment objective is to time the market, and publishes newsletters on their performance. Wagner, Shellans and Paul (1992) analysed the returns of 25 of such funds that report to MoniResearch. These funds have a track record of at least five years and manage amounts of at least $7 million. Wagner et al. (1992) did not analyse the actual portfolio returns but applied the individual buy and sell signals to the monthly S&P 500 index returns and the monthly Treasury bill returns in order to construct a series of returns for each fund that is only dependent on the timing decision.

Wagner et al. (1992) discovered that, from 1985 to 1990, 12 out of the 25 funds had returns superior to that of the S&P 500 index with the returns ranging from 8.7% to 22.3% compared to the index’s return of 14.6%. Not only was the performance superior but the standard deviation of the funds was typically half of that of the index.
Thus these firms were able to generate superior returns at lower risk. On a risk adjusted basis, 20 of the funds were able generate returns above that of a passive strategy. 20 of the funds exhibited positive alphas indicating that the funds were able to achieve some level of selective ability. Unfortunately no statistical tests were conducted to determine whether such results were significant of not. Nevertheless Wagner et al. (1992) concluded that this was empirical evidence that certain funds can time the market reliably and consistently thus adding value.

Brocato and Chandy (1994) did not agree with the results and conclusions drawn by Wagner et al. (1992) and commented “We take exception to this conclusion. We suspect the optimistic results presented are the consequence of a common problem in financial research, survivorship bias.”

Brocato and Chandy (1994) discovered that the 25 funds that were analysed by Wagner et al. (1992) were from a select group defined by MoniResearch Corporation. This group effectively represents the top half of all the funds that report to the MoniResearch Corporation and are selected on stringent criteria, such as fund size and a continuous record. Thus any fund that fails to report for whatever reason will fall out of this elite category and it is conceivable that if a fund experiences poor performance then it will abstain from reporting and drop out of the group.

To prove survivorship bias, Brocato and Chandy (1994) constructed 50 (25x2) portfolios in the same manner as that of Wagner et al. (1992), but the buy and sell signals were based on a random guess thereby resulting in an equal chance of selecting the index or the Treasury bills. As a result these portfolios, by construction, have no timing ability. The portfolios were then ranked according to their alphas and spilt in half with the top half representing the Wagner et al. (1992) sample. This process was repeated 10 times for comparison purposes.

The results of the top 25 no-timing-ability portfolios were compared to the results of Wagner et al.’s (1992) sample. Unfortunately Wagner et al. (1992) only had one set of results thus no statistical hypotheses could tested. Despite this, the top 25
no-timing-ability portfolios had almost identical results and characteristics to those of the Wagner et al. (1992) sample. This held for each of the 10 simulations as well as their aggregated results. This led Brocato and Chandy (1994) to conclude that if Wagner et al. (1992) had used a complete or more representative sample, then their conclusion would have been different.

From these studies it is difficult to conclude whether funds can time the market or not. To date there does not appear to be a model that can reliably detect or quantify timing ability of managed funds. The models discussed here all have their merits but also have their downfalls. Clearly to measure timing ability accurately one needs more than just a time series of returns and a benchmark, but also information on the decision to shift asset classes.

2.2 Predicting Future Market Movements

If investors intend to time the market then any decision to perform an asset switch would have to be based on some form of information. Obviously no information set is available that will allow investors to predict markets perfectly. So the question is how good does the information need to be in order for it to give investors enough of an advantage to enable them to benefit from a market timing strategy? Clarke, FitzGerald, Berent and Statman (1989) attempted to answer this question.

Clarke et al. (1989) developed a one factor model, similar to a simple regression model which attempted to predict the return on the market for the next period. Based on historical data they assumed a risk free rate of 7.0%, a constant risk premium of 8.5% and a market standard deviation of 20.5%. They also assumed that the factor was normally distributed with a mean of zero and a standard deviation of one. Clearly any real factor that is normally distributed can be adjusted to fit these parameters. The model had the form

\[ S_{t+1} = \bar{S} + \beta F_t + e_{t+1} \]
where

- \( S_{t+1} \) is the return on the index in the coming period, \( t+1 \).
- \( \bar{S} \) is the historical mean return on the index and, in the absence of further information, is assumed to be the best estimate of the next period's return.
- \( \beta \) is the sensitivity of index returns to the factor
- \( F \) is the factor
- \( e_{t+1} \) is the residual error term.

The factor, \( F \), represents any set of information, for example change in GDP or change in interest rates, which could demonstrate some predictive power. The beta in the model represents the sensitivity of the index to the information (represented by the factor). The higher the beta the better the factor can predict future market movements.

Results were derived by randomly selecting a value for the factor, based on its underlying distribution, and then calculating the expected return on the market using the model. If the model predicted a return below that of the risk free rate then it was assumed that investors achieved the risk free rate i.e. held Treasury bills. If the predicted return was greater than the risk free rate then it was assumed that the index was held. If the index was held an 'actual' index return was generated by randomly selecting a value from the index's underlying conditional probability distribution. This probability distribution is conditional on the selected value of the factor as well and the correlation coefficient between the factor and the market, which is directly proportional to the beta in the model. This process was repeated 40,000 times for various levels of correlation coefficients.

For any selected value of the correlation coefficient, denoted by \( r \), the \( r^2 \) (R-squared) is the percentage of the dependent variable (the market) which is explained by the independent variable (the factor). Consequently the R-squared value measures how 'good' the information is.
Clarke et al. (1989) estimated that if the factor had an \( r \) value greater than 0.3 then investors could achieve a return in excess of the market. This excess return was 5.9% for monthly review periods with no transactions costs, and dropped to 1.2% if a 1% transactions charge was levied. Consequently they concluded that if investors could find an information set that could explain 9% \( (r^2 = 0.3^2) \) or more of the market movements, they could achieve a return above that of the market by utilising the model to time the market.

Lee and Solt (1986) investigated whether using information on insider trading could be used to predict future market movements and hence time the market. The Securities Exchange Act requires \textit{inter alia} for owners and directors to file any purchase or sale of shares in companies in which they own or control with the Securities Exchange Commission (SEC) during the month in which the trade takes place. Vickers Stock Research Corporation collects this information from the SEC and releases it to the market with the lag between the transactions date and the reporting date being roughly four weeks.

Lee and Solt (1986) analysed whether such information could be used as a market timing decision tool. By calculating a buy/sell ratio based on the insider trading information they investigated whether a high ratio indicated a future rise in the market and a low ratio indicated a future fall in the market. They discovered that this ratio did give an indication of future market direction, but not in a statistically significant manner. That is to say that insider trading information cannot be used reliably to predict future market movements. This was confirmed when trading rules based on this information did not yield returns statistically different from the passive strategy and in some cases yielded returns below that of the market.

The main setback in using this information is that it is only available approximately one month after the trades have occurred. Lee and Solt (1986) did however demonstrate that the ratio was statistically reliable in predicting market swings but only during the month in which the trades took place. So any information content in the trades would have been incorporated in the share price before the insider trading
statistics have been made available to the market timer, thus rendering this information useless for market timing purposes.

One of the most important factors affecting stock markets is believed to be the short-term interest rate. It is conceivable that this interest rate and changes in this interest rate could help identify future market movements. This hypothesis was tested by Lee (1997) using the one month interest rate and the S&P index. He noticed that from 1952 to 1964 there was a definite negative correlation between the index and the short-term interest rate. Between 1964 and 1986 the relationship remained negatively correlated but less significantly so. After 1986 there appeared to be no correlation between the short-term interest rate and the S&P index. As time passed from 1957 to 1994 the R-squared value moved from 0.15 to almost zero. This gives a clear indication that the short-term interest rate may have been used fairly reliably to predict market movements in the past but from 1986 onwards it has lost its forecasting power. Nevertheless Lee (1997) analysed whether this factor could have aided investors in market timing decisions.

Using the short-term interest rate to predict future market movements from 1957 to 1970 would have resulted in a return of 0.8% greater than the buy-and-hold return. However for the periods 1970 to 1986 and 1986 to 1994 returns of 0.5% and 2.3% below the index would have been achieved respectively. These results are not statistically different from zero but do highlight a trend that short-term interest rates are becoming less reliable in predicting future market movements.

In search of a model to aid the market timing decision, Larsen and Wozniak (1995) constructed a multi-factor discrete regression model. The model contained nine factors ranging from spreads between different types of bonds, statistical attributes of the S&P 500 index as well as macro economic indicators. As time passed the model was updated to include the latest information thus ensuring it contained the most relevant information before being used to predict the next market movement.
Having the timing decision made by the model, a timed portfolio, reviewed monthly, produced returns superior to that of a buy and hold strategy for the period 1981 to 1992. The annual return advantage was approximately 3.3% and it was achieved at a standard deviation of roughly two thirds of that of the passive strategy. These results included a 0.5% transactions charge per switch. This led Larsen and Woznaik (1995) to conclude that it is possible to enhance risk adjusted returns from market timing by using a discrete regression model such as the one demonstrated.

These studies highlight that it may be possible to time the market using certain information sets and sophisticated models. However regardless of what technique is used it is obvious that it will not be able to perfectly predict market movements. So the question remains, how good do investors and their models have to be at predicting the market in order to achieve a return above that of a passive strategy?

2.3 Analysing the Risks and Returns of Market Timing

One of the first studies conducted to measure the possible gains from market timing and the forecasting proficiency necessary to outperform a buy-and-hold the market strategy was that of Sharpe (1975). He used the Standard and Poor’s Composite Index as the risky asset and U.S. Treasury bills as the riskless asset for the period 1929 to 1972. Using these two assets he calculated that a return of 14.0% would have been obtained if perfect timing was accomplished. This is in contrast to a return of 8.5% produced by the index over the same time period with Treasury bills generating a mere 2.4% return. The 14.0% return was achieved by assuming that investors were able to predict perfectly which asset class, index or Treasury bills, would produce the highest return for the following year. For each switch performed a 2% transaction charge was accounted for.

Sharpe (1975) also observed that the standard deviation of the returns generated by the timed portfolio was 6.5% lower than its passive counterpart (14.6% verses 21.1%). This was due to perfect timing reducing the downward variability of the index’s returns thus reducing the overall portfolio variance. To investigate this further, Sharpe (1975) constructed a passive portfolio of stocks and bonds that resulted in a
variance equal to that of the timed portfolio. This new portfolio only achieved a return of 7.2% thus giving the timed portfolio a return advantage of 6.8% for the same level of variability. Sharpe (1975) concluded that perfect timing has the effect of increasing returns and reducing the volatility of such returns.

However it is obvious that no investor is capable of perfectly predicting market movements. This led Sharpe (1975) to assess the gains from less than perfect timing. He used a simple tree model, similar to a binomial tree, to estimate the expected return of timers assuming that they do not predict market swings perfectly. By calculating the probability of a bullish or bearish year as well as the returns generated by each asset in each phase Sharpe (1975) could substitute different levels of predictive ability into his model to give an expected return for a given timing ability.

For the period 1934 to 1972 Sharpe (1975) calculated that if the timing decision was based on a random guess, a return of 5.7% with a standard deviation of 13.9% would have resulted. This return is 5.7% below the buy-and-hold return of 11.4% and 3.8% below a risk adjusted return for the same period. It suggests that a random guess produces sub optimal returns even when risk is taken into account. The returns on the timed portfolio only surpassed the returns on the risk adjusted portfolio when the timing ability reached 73%. That is to say that investors forecasts must be correct more than 73% of the time in order to outperform a risk adjusted passive portfolio. Only when the timing ability is greater than 82% did the timed portfolio achieve superior returns compared to the passive buy-and-hold portfolio unadjusted for risk. Therefore if investors cannot predict market swings accurately more than 82% of the time then they would be better off investing in the index passively. However perfect predictability produced substantial gains at a lower level of risk and it is conceivable that these exceptional returns may entice investors to attempt market timing despite the downside risk.

Chua, Woodward and To (1987) investigated the potential gains from stock market timing in Canada. The methodology employed was similar to that of Sharpe's (1975) except that Chua et al. (1987) separated the investors' ability to predict bull versus
bear markets. They argued that investors may have different abilities of predicting bull markets compared to bear markets and speculated that being able to predict one market direction may have more of an influence on returns than being able to predict the other. Thus they investigated the potential returns obtainable for varying combinations of bull and bear market predictive accuracy.

Their strategy involved switching between common stock and Treasury bills with annual review periods on the Canadian stock market from 1950 to 1983. Perfect market timing with a 1% charge whenever stocks were purchased resulted in a return of 17.2% which was a 4.6% advantage over the buy-and-hold return. Again the timed portfolio had a lower standard deviation compared to its passive counterpart.

By using the adjusted Sharpe (1975) model Chua et al. (1987) demonstrated that being able to predict bull markets is far more important than being able to predict bear markets. They illustrated that even if investors were able to predict bear markets perfectly but had no ability to predict bull markets (random guess) then these investors’ returns are likely to be inferior to that of a passive strategy. If investors were able to predict bear markets perfectly then they would need to be able predict at least 70% of the bull markets in order to have a better than average chance of outperforming a passive strategy.

However if market timers were able to predict 90% of the bull periods then even a random guess for bear markets would have given such investors a better than average chance of outperforming the index. If market timers could predict 80% of the bull periods accurately then they only required a 60% forecasting accuracy for bear markets in order to have an above average chance of beating the market.

Droms (1989) extended Chua et al.’s (1987) research by investigating what effect the length of the review period had on the results. He performed his analysis using the S&P index and Treasury bills from 1946 to 1986. He used annual, quarterly and monthly review periods but ignored transactions costs.
For annual review periods the results were similar to those of Chua et al. (1987) indicating that perfect bear market forecasting ability with no bull market forecasting ability resulted in returns below that of a buy-and-hold strategy. Perfect bear market predictability still required about 60% bull market forecasting ability in order to have a better than average chance of beating the index. With bull market forecasting ability above 80% no bear market forecasting ability was necessary to beat the passive strategy.

However these parameters change when the review period is reduced to a quarter. Firstly the gains from perfect timing of both bull and bear markets resulted in a return of 12.4% above that of the index. This is almost three times the excess returns generated when annual review periods are used. However, on the down side, the returns from 100% imperfect timing (hereafter referred to as totally imperfect timing) using quarterly review periods are substantially lower than when using annual review periods.

For quarterly review periods, perfect bear market forecasting ability with no bull market forecasting ability resulted in a return of 3.3% above the buy-and-hold return. The results also indicated that only a 70% bear market predictive accuracy with no bull market forecasting ability would achieve returns equal to a buy-and-hold strategy. With a bull market predictive accuracy of 60% no ability to predict bear markets is needed in order to have an even chance at beating the passive portfolio.

For monthly review periods the results were even more favourable with only 60% forecasting accuracy required for either bear or bull markets in order to beat the index. Again the maximum potential gains and maximum losses increased with the shorter review period.

These results do not include transactions charges. Droms (1989) did however estimate that transactions charges for monthly review periods would have reduced returns by roughly 2.5% and increased predictive accuracy by about 7% for both bull and bear.
The important evidence that emerged from Droms' (1989) research is that as the review period is decreased the range of returns increased i.e. higher possible maximum gains but lower possible maximum losses, and that the required predictive accuracies for both bull and bear markets are reduced. However, with shorter review periods more switches took place, causing total transactions costs to rise and reducing returns marginally.

There appears to be an error in Droms' (1989) calculations. According to his paper perfect bull and zero bear predictive ability, using monthly review periods, results in a return of 7.1% above that of the index. However this combination of forecasting ability is precisely achieved by buying-and-holding the index therefore should result in a zero return advantage over the index. At the other end of the scale Droms (1989) recorded that zero bull and perfect bear timing ability resulted in a return of 8.0% below that of the index. Again this combination of forecasting ability can be achieved by merely buying-and-holding the Treasury bills and therefore should have resulted in a return of 6.8% below the index. Unfortunately it is difficult to ascertain exactly to what extent the error has on the required predictive ability needed to beat the market. Given that there appears to be more upside bias it is likely to have reduced the breakeven accuracy results.

Kester (1990) observed that what provides market timing with its high possible returns is a volatile risky asset, the more volatile the higher the potential gains. He therefore investigated market timing between small capitalisation shares, which were shown to be more volatile than the S&P 500 index, and Treasury bills. For comparison purposes market timing between the S&P 500 and Treasury bills was also investigated as well as market timing between the small capitalisation shares and the S&P 500 index.

The small capitalisation shares were derived from the fifth (smallest) capitalisation quintile of the New York Stock Exchange for the time period 1934 to 1988. These shares had a volatility of 29.9% and an average return of 19.3% compared to the index's volatility of 18.2% and return of 12.7% and the Treasury bills volatility of
3.5% and return of 3.8%. Timing simulations were run using Sharpe’s (1975) model with annual, quarterly and monthly review periods.

The results indicated that the advantage to be gained by using the more volatile asset class is an improvement in the maximum possible return by 2.3% for annual review periods and by 9.7% for monthly review periods. Unfortunately the maximum potential losses also increased by much the same magnitude.

Switching between the small capitalisation shares and the S&P 500 index resulted in marginally lower returns than when compared to S&P 500 index and Treasury bill switching, this lower return difference increased as the review period decreases. This is caused by the fact that when the market falls any exposure to stocks, large or small, will result in lower returns and the only way investors can protect themselves is to reduce their exposure to the market altogether i.e. switch to Treasury bills.

For each of the three strategies the required predictive accuracy needed to beat the buy-and-hold remained high at around 70% for annual review periods. This predictive accuracy rose for each strategy as the review period was decreased to monthly. For small to large firm stock switching accuracies of up to 86% were needed, and with small firm stocks and Treasury bill switching, 74%. This is in contrast to other studies which generally showed that this required predictive accuracy decreased as the review period decreases.

These results all assume a 2% transactions charge per switch. Kester (1990) also conducted a sensitivity analysis by reducing the charges to 0.5%, which obviously increased the possible returns. For each of the three strategies the maximum possible returns for annual review periods rose by about 2% with monthly review period returns rising by about 9%. The reduced transactions charges also caused the required breakeven predictive accuracies to fall. For annual review periods this predictive accuracy level fell by about 5% for each of the three strategies. For monthly review periods the fall was far more substantial. The breakeven predictive accuracy for small firm/Treasury bill switching fell by 16% to 58%. With small firm/large firm switching...
the fall was far more significant, down by 29% to 57%. This indicates how sensitive the results are to transactions costs, especially for the shorter review periods. Clearly having more switches executed using monthly review periods had a significant effect on the returns and required predictive accuracy needed to outperform a passive strategy.

Jeffrey (1984) investigated market timing from a different point of view. He noted that for any given level of predictive accuracy, except at the perfect and totally imperfect levels, there existed a range of possible returns depending on which sub periods were incorrectly forecasted. His study established the upper and lower return boundaries that could have been obtained at various levels of predictive accuracy. The upper boundary represented the return achieved if the incorrectly forecasted periods had the least effect on the portfolio, and the lower boundary the return generated if the incorrectly forecasted periods had the greatest effect on the portfolio. When graphed a ‘football’ shaped space is formed with the upper boundary indicating the returns in the best case scenario and the lower boundary indicating the worst case as shown in Figure 2. The ‘Middle’ line represents the average return between the upper and lower boundaries for each level of predictive accuracy.

Figure 2 Typical Football Graph
For the period 1926 to 1982 Jeffrey (1984) demonstrated that perfect timing would have achieved a return of 15.2% compared to the index’s return of 9.3%. This was obtained by switching between the S&P 500 index and Treasury bills with annual review periods and transactions charges set a 1% per switch. On the downside, the return for incorrectly forecasting each year would have resulted in a return of −3.3% which is 12.6% less than the index.

Jeffrey (1984) used this as a measure of the risk borne by market timers and showed that the maximum potential loss was about twice the maximum potential gain. He also calculated that if investors held the S&P 500 index yet missed only the top 18% best years then such investors would have achieved a return equal to that of the Treasury bills. This demonstrates how few periods actually make up the entire positive return on the index. Thus if market timers miss these few periods then their potential returns are severely reduced. He also noticed that these sharp rises typically occurred after market declines indicating that if market timers remained bearish too long they would have missed these important upturns.

Jeffrey (1984) examined the potential range of returns available to investors whose forecasts were only correct half the time. Their return is obviously dependent on which periods are incorrectly forecast. In the best case scenario the timed portfolio would have achieved a return of 10.6% which is 1.3% above the buy-and-hold return. However the worst case only produces a 1.0% return which is 8.3% below the index return. This leaves investors with a loss/gain ratio of 5.6 indicating that there is a far greater chance of under performing the index if market predictions are based on a random guess. Jeffrey (1984) also observed that for such investors the “best case real dollar return is only about two times greater than what would come from continuous investment in the S&P, while the worst case produces about 100 times less!”

He also examined the scenario where investors correctly predicted two thirds of the market swings. The resultant returns ranged from 3.6% to 19.3% with the loss/gain ratio remaining high at 1.45.
Jeffrey's (1984) research highlighted that market timing can produce additional returns at medium to high levels of predictive accuracy but there is a greater chance of underperforming the index than producing superior returns. Again, this research acknowledges that market timing can produce exceptional returns but the chances of obtaining such returns are extremely unlikely.

Firer, Ward and Teeuwisse (1987) repeated and extended Jeffrey's (1984) study on the Johannesburg Stock Exchange (JSE) for the years 1967 to 1986. Perfect timing using annual review periods and switching between the All Share Index and Treasury bills, produced a return of 5.5% above the index's return of 20.2%. However, totally inaccurate timing resulted in a return of 17.7% below that of the index resulting in a loss/gain ratio of 3.22 thus reaffirming Jeffrey's (1984) observation that the downside risk substantially outweighs the potential gain. Firer et al. (1987) repeated the strategy using monthly timing intervals and discovered that the potential upside return increased to 28.8% above the benchmark, but on the downside the potential loss increased to 44.0% resulting in a loss/gain ratio of 1.53.

For annual review periods Firer et al. (1987) also identified three significant levels of forecasting ability, the first, 91.5%, being the forecasting ability required to guarantee a return greater than that of the buy-and-hold return. The second, 81.0%, the accuracy level needed to have an equal chance of beating the market. The last, 50.1%, the lowest predictive ability below which it is impossible to beat the benchmark regardless of which periods were incorrectly forecasted. For monthly review periods these three levels decreased marginally to 87.1%, 68.3% and 37.6% respectively.

They also calculated the compression ratio. This is a ratio of how many of the periods which have the most influence on returns if incorrectly forecasted investors can miss, relative to the total number of periods, before the return falls below that of the buy-and-hold return. For the monthly review periods the compression ratio was 12.9%, therefore if investors missed the top 12.9% periods they would not have been able to
beat the buy-and-hold benchmark. This gives an indication of how difficult market timing can be and how dependent the returns are on such a few important periods.

Firer et al. (1987) also researched the possibility of switching between two other indices, the Industrial Holdings index and the Banks and Financial Services index and Treasury bills as well as switching between the indices themselves. The results indicated that no advantage could be obtained by using a different index to reduce the required predictive accuracies necessary to beat the passive portfolio.

Nevertheless an analysis of the range of returns from perfect to imperfect timing, and using this as a measure of risk, led Firer et al. (1987) to conclude that, “For TB/Index switching strategies there is a near linear relationship between risk and return. Index/Index strategies achieve lower returns for the same levels of risk. This is a result of the high correlation between the different equity sectors. When the market declines, all sectors decline, and investors who do not switch into more stable assets (eg TBs) achieve lower returns and higher levels of risk.”

To further gauge the risks of market timing Firer et al. (1987) suggested that the number of switches needed to obtain the maximum return may be an indication of the risk. However the results indicated that the maximum return is independent of the number of switches and that in the majority of cases roughly 42% of all possible switches were made in order to obtain the maximum return.

In a further study Firer, Sandler and Ward (1992a) investigated the effects of switching between the All Gold Index and Treasury bills compared to switching between the ALSI and Treasury bills. A similar conclusion to that of Kester (1990) was drawn in as much as the All Gold Index/Treasury bill switching provided higher possible returns for perfect timing but greater losses for totally inaccurate timing, this being caused by the higher volatility of the All Gold Index relative to the ALSI. However the required predictive accuracies necessary to guarantee a return greater than the buy-and-hold remained in the high eighties regardless of which index was
used. To have an equal chance of beating the passive portfolio investors required predictive accuracies, depending on the review period, of between 65% and 79%.

The study was extended to examine the effect of legalisation forcing unit trusts to hold at least 5% of their portfolio in liquid assets. Given this legalisation, it is impossible for unit trusts to fully commit all their assets to the market when an upswing is predicted. It was assumed that unit trust managers typically switched between 95% of assets in the market when bullish and 65% in the market when bearish. These amounts were established based on the Knight's (1987) observations that unit trusts typically held between 5% and 35% of their total portfolio in liquid assets.

Limiting the amount that could be invested in the market during bull runs and having a portion of the portfolio committed to the market during bear periods had the effect of reducing the possible returns for a perfect market timer. On the other hand the totally imperfect timer is protected from the severe losses that can result from 100% commitment to the wrong asset. This results in the gain/loss spread falling from 23.3% to 7.0% with the perfect timing reduced by 4.7% and incorrect timing gaining 11.8%. This clearly shows that the risks have been substantially reduced but the rewards are not as profitable. It was also noted that the ‘football’ was much narrower indicating that for any given level of predictive accuracy the range of possible returns was reduced. However, except for certain gain, there was a marked increase in the required predictive accuracies needed to beat the market. For certain loss there was a 5.8% increase and a 3.1% increase for an equal chance of beating the buy-and-hold return.

In a similar study Firer, Sandler and Ward (1992b) attempted to further quantify the risks associated with market timing on the JSE. Using the All Share Index and Treasury Bills from 1967 to 1989 ‘football’ graphs similar to Jeffrey (1984) and Firer et al. (1987) were derived. The results again indicated that the potential gains from market timing are high but so are the potential losses with the loss/gain ratio ranging
from 3.21 for annual review periods and 1.52 for monthly review periods. The compression ratio also remained high averaging around 11.3%.

Firer et al. (1992b) simulated possible obtainable returns at various levels of predictive accuracy so as to determine *inter alia* the distribution of returns at the various predictive accuracy levels. The results indicated that for predictive accuracies between 60% and 30% the distributions were normally distributed but at the at the higher and lower levels of predictive accuracy the distributions were negatively and positively skewed respectively indicating that the proficient timers are more likely to achieve returns near best case boundary whereas poor timers are more likely to obtain returns closer to the worst case boundary.

Firer et al. (1992b) also calculated the standard deviation of returns at various levels of predictive accuracy and graphed this against a passive strategy of holding a fixed amount in the market with the remainder invested in Treasury Bills i.e. diversification within each time period. Included in this analysis were the results of diversification across time which involves committing 100% of the portfolio to the market for a certain time periods and in Treasury Bills for the remainder. Samuelson (1989) argued that diversification across time would lead to lower returns at higher risk than diversification within each time period.

The results demonstrated that that diversification across time yielded lower returns at a higher risk as suggested by Samuelson (1989). They also indicated that market timing always yielded a lower level of risk compared to the index regardless of the level of predictive ability. However this advantage is lost when compared to a portfolio which exposes 70% of its value to the market. The analysis also revealed that that market timers need to be correct about 70% of the time to outperform the benchmark on a risk adjusted basis.

Two major obstacles that hinder a successful market timing strategy are illiquidity and the presence of transactions costs. However derivatives can be used to achieve the same desired market exposures at a very low cost. This led Waksman, Sandler, Ward
and Firer (1996) to revisit the question of market timing through the use of such instruments.

Option timing strategies can be split into two types namely bull timing and bear timing. Bull timing involves constructing a portfolio of the risk free asset (Treasury bills) and purchasing call options on the index when a market rise is anticipated. The upside exposure created is the same as if the Treasury bill portfolio was liquidated and invested in the market. The downside exposure is the cost of the options. If no market rise is forecasted then no options are purchased.

Bear timing involves holding the market index and purchasing put options when a market decline is predicted thus protecting the portfolio from a fall in the market, with the cost of an incorrect decision being the cost of the options. If no fall is predicted then no options are purchased.

Perfect traditional timing generated a return of 43.2% compared to the market’s 18.3% with perfect bear and bull timing providing a 38.1% and 35.4% return respectively. However perfect traditional timing’s advantage was quickly eroded as the forecasting ability fell. At the other extreme, totally imperfect timing, option timing far outperformed its traditional counterpart with bear and bull timing producing returns of 0.3% and −6.1% respectively, far outperforming traditional timing’s return of −22.1%.

These results can be explained as follows. As the forecasting ability falls the cost of incorrect predictions penalises the traditional timers more because they often found themselves in the wrong asset thus losing the difference in returns between the two asset classes. Option timers on the other hand only lose the cost of the options which is often far less than the loss suffered by the traditional timers. On top of this the option timers frequently benefit from the underlying asset held.

As for the timing ability needed to outperform the market Waksman et al. (1996) produced the results shown in Table 1. For the same reasons stated previously, the
required predictive accuracies are lower for the option timers. In comparing the two option strategies bear timing was superior to bull timing both on a returns basis as well as on the required predictive accuracy basis. A possible reason for this is that the market performed positively throughout the period under investigation. This has the effect of making the bull timer purchase more options thus adding to the costs of this strategy whereas the bear timer merely has to hold the underlying asset for the majority of the time.

### Table 1 Required Predictive Accuracies (Waksman et al. 1996)

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Predictive Accuracy Level %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sure Gain</td>
</tr>
<tr>
<td>Bear</td>
<td>81.0</td>
</tr>
<tr>
<td>Bull</td>
<td>85.0</td>
</tr>
<tr>
<td>Traditional</td>
<td>87.2</td>
</tr>
</tbody>
</table>

A portfolio insurance investment strategy was also analysed. This involved holding the market portfolio and purchasing put options in every period. This approach would have achieved a return of 15.3%, which is 3.1% below that of the buy-and-hold strategy.

Market speculation produced similar results with a return of 15.0%. This strategy involved holding Treasury bills and purchasing call options in every period. Waksman et al. (1996) attributed the similar results between the portfolio insurance and market speculation to put-call parity and a riskless arbitrage rationale.

Sy (1990) objected to the notion that investors need to be correct more than 75% of the time in order to gain from market timing and that the maximum expected gain is only about 5% above that of the passive strategy, as was demonstrated by Sharpe (1975). To dispel these ‘myths’ Sy (1990) repeated Sharpe’s (1975) study using selected time periods between 1929 and 1988. He commented that between 1929 and 1932 Treasury bills outperformed the S&P 500 index in every year, hence any degree of market timing would have resulted in outperforming the S&P benchmark. Also in
1974 the returns from the equity market were negative in every month except one. This resulted in a required predictive accuracy of only 21% in order to beat the market if one used monthly review periods. These selected time periods highlight the fact that market timing is very sensitive to a few unusual periods.

Sy (1990) repeated Sharpe’s (1975) study using monthly review periods but with no transactions costs. He claimed that large investment funds do not have to contend with large transactions costs and argued that by using derivatives these funds could create the desired exposures to the market a negligible cost.

From analysing the time period 1970 to 1989 Sy (1990) demonstrated that, by using monthly review periods, a maximum possible return of 24% above the index was possible, this being far greater than the 5% available for perfect annual timing. In order to beat the index by 5% the monthly timer would require a predictive accuracy of approximately 60%, which may be achievable by the larger fund managers.

For the time period investigated and for various review periods, the required predictive accuracies in order to beat the index also appeared to be lower than previous studies. Annual timing only required a 60% predictive accuracy to beat the market with monthly timing only requiring a 53% predictive accuracy level.

Dumont de Chassart, Firer, Grantham, Hill, Pryce, and Rudden (2000) repeated Waksman et al. ’s (1996) study on the JSE for the period 1990 to 1998. During these years, Treasury bills achieved an average return of 15.1% compared to the ALSI’s 10.2%. For the three strategies analysed the maximum potential gains and losses were lower than those calculated by Waksman et al. (1996). This was attributed to the poor performance of the equity market.

Contrary to Waksman et al. ’s (1996) results, the bull timing strategy outperformed the bear strategy. This was the result of the out performance of the risk-free asset which caused a reduction in number of options that the bull timers need to purchase thus reducing costs.
However the most striking findings were the reduction in the required predictive accuracies. For traditional timing using annual review periods a predictive accuracy of only 63.3% was necessary for sure gain, 38.3% for equal chance and 21.5% for sure loss. Bear timing required similar predictive accuracies. But it was bull timing that experienced the greatest reduction in required forecasting ability. For annual review periods, sure gain only required a predictive accuracy of 39.9%, equal chance 18.7% and sure loss 9.0%. These required predictive accuracies are below that of a random guess. These low levels are obtained because of the 4.9% out performance of Treasury bills, which gives bull timers a 4.9% 'cushion' in which forecasting errors can be absorbed before the return falls below that of the buy-and-hold return.

Portfolio insurance under the bearish market produced returns of 15.0%, outperforming the ALSI by 4.8%. This return was largely achieved by the put options maturing in-the-money due to the poor performance of the market. Market speculation resulted in a return of 14.9% again outperforming the ALSI. This additional return is generated predominately from the high return on the Treasury bills. This is in contrast to Waksman et al.'s (1996) results in which portfolio insurance and market speculation both under performed the index by 3.1% and 2.8% respectively.

These studies highlight that market timing as an investment strategy can provide returns well in excess of the buy-and-hold return. However in order to achieve such returns market timers must display formidable forecasting skills and it is debateable whether such levels can be obtained. Using conventional measures of risk (volatility of returns) market timing appears to reduce the overall risk of the portfolio when compared to the index. Nevertheless even on a risk adjusted basis market timing still remains to be a daunting investment strategy. The studies also highlight that the risks associated with market timing should not be confined to the conventional measures but other factors such as the range of possible returns and the number of periods that actually make up the excess returns must be taken into consideration.
A few of the latter studies did however hint at the possibility of market timing becoming a viable investment strategy during a bearish market phase. Under these conditions the risks also appear to be reduced further supporting the possibility of using this investment strategy successfully. It is hoped that by segmenting the market into bullish and bearish phases that this study will be able to shed further light on what effect the different market conditions have on the various market timing strategies.
3 Objectives of the Study

The main objective of this study is to evaluate the effectiveness and risk characteristics of three market timing strategies, namely traditional, bear and bull timing, under different market conditions.

The market is segmented into bullish and bearish phases and the various studies test how each of the timing strategies perform under the identified market conditions by measuring the returns, the required predictive accuracy and the degree of risk taken. The bull and bear phase results are compared to the results from the complete time series.

For each strategy under the different market conditions, the following analysis will be undertaken:

• Maximum possible gain from perfect timing.
• Maximum possible loss from totally imperfect timing.
• Required predictive accuracy needed to guarantee a return above that of the market.
• Required predictive accuracy below which it is impossible to beat the market.
• Required predictive accuracy where market timers will have an equal chance of outperforming the market.
• Whether it is more important to be able to predict the bull review periods or the bear review periods.
• The risks and variances of returns for the three strategies at various levels of predictive accuracy.
• The distribution of returns for each strategy various levels of predictive accuracy.
• Other pertinent risk parameters such as the loss/gain ratio and compression ratio.

The results of the various studies will be compared across the three timing strategies as well as across the different market conditions. This will give an indication of each
strategy's performance and risk characteristics and may identify which strategy is superior. It is unlikely that one strategy will totally dominate the others as this may potentially allow arbitrage opportunities.

Analysing across the different market conditions will gauge how each strategy is affected and to what degree. Further, it is not inconceivable that certain market conditions may suit one strategy better than the others. How this advantage is affected with the changing of the market condition may shed light on the risk characteristics of each strategy.

No attempt is made in this study to forecast future market movements or develop a model to be used for market timing purposes, but rather to assess the available returns and risk characteristics of the three timing strategies under different market conditions. This assessment will aid market timers in deciding which strategy would be the best to employ given their attitude towards risk and their presumed forecasting ability.
4 Methodology

Equity market and money market data from 1925 to 1998 was sourced from the Firer and McLeod (1999) study on the historical performance of equities, bonds and cash in South Africa. This study was the first long term time series of index data published in South Africa and extended back by 35 years the history previously available. As long a time series as possible was sought, so as to have substantial periods of time which could be identified as either bear or bull phases on the market. The equity performance consists of 74 years of monthly returns achieved by an investor on the JSE holding a large diversified portfolio of the available shares on the market. From 1978 the index consisted of the JSE Actuaries All-Share Index (ALSI). Prior to that the RDM 100 and data from the Bureau for Economic Research at Stellenbosch University was used. The remainder of the data to 2000 was obtained from I-Net Bridge.

The performance on the money market instruments (cash) is based on a portfolio of three 90 day cash instruments purchased in successive months. The returns therefore represent the earnings of investors who hold a portfolio of three 90 day cash instruments, each with a different maturity month.

4.1 Choice of Asset Classes

As noted above, market timing involves switching funds between two or more different asset classes in an attempt to enhance or protect returns. In this study switching will take place between the market, represented by the Firer and McLeod (1999) equity index, hereafter referred to as the ALSI index, and short term money market instruments, represented by Negotiable Certificates of Deposit (NCDs) and bankers’ acceptances. Not only are these asset classes uncorrelated but are perceived to be risky and non-risky respectively. They are also the conventional asset classes used for market timing.

---

1 Firer and McLeod (1999) p23 show a correlation coefficient of 0.08
4.2 Returns on the Asset Classes

The ALSI index is used to simulate a well diversified portfolio exposed to the risky asset class. Monthly returns achieved from holding the index are calculated as if the index is purchased at the beginning and sold at the end of the month according to the indexes values. An assumption that dividends are paid evenly throughout the year is made and thus the monthly dividend received is one twelfth of the quoted annual dividend yield. Dividends are assumed to be received half way through the month and reinvested at the average monthly index value. The return received is therefore a combination of the capital return generated by the index and the income return generated by the dividends. These combined values are divided by the initial investment to calculate the return for the month.

Mathematically (adapted from Firer and McLeod 1999), the monthly performance for month \( t \) is:

\[
 r_{(t)} = \frac{PI_{(t)}}{PI_{(t-1)}} \left[ 1 + \frac{d_{(t)}}{ap_{(t)}} \right] - 1
\]

where:
- \( PI_{(t)} = \) index value (price index) at time \( t \)
- \( ap_{(t)} = \) average index value for month \( t \)
  \[ ap_{(t)} = \frac{[PI_{(t-1)} + PI_{(t)}]}{2} \]
- \( DY_{(t)} = \) dividend yield at time \( t \)
- \( d_{(t)} = \) dividend received for month \( t \)
  \[ d_{(t)} = \frac{[DY_{(t-1)}PI_{(t-1)} + DY_{(t)}PI_{(t)}]}{2400} \]

To determine the return on the cash instruments it is customary in financial research to use the 90-day Treasury bill rate. However the return generated by this instrument in South Africa has often been influenced by the country’s monetary policy. Such policies prescribed this instrument for insurers and pension funds to maintain imposed
liquidity levels as well as allowing this instrument to be used for Central Bank accommodation by commercial banks. As a result an artificial demand was created causing this instrument not to reflect the true return available on the money market. This study therefore makes use of the returns generated by 3 month fixed deposits from 1925 to 1959, bankers’ acceptances to 1966 and negotiable certificates of deposit (NCDs) for the remainder of the time series. The choice of these assets over the time series is largely determined by the availability of data, particularly in the early years.

The life span of these instruments is 3 months or, more precisely, 91 days. Since use is made of monthly review periods it is conceivable that different returns could be achieved on the same type of instrument in the same month depending on the maturity purchased. It is therefore assumed that when investors invest in cash, three different maturities are purchased at the same time. Each third of the portfolio is invested in instruments with one, two and three months to maturity. This provides an equal exposure across the available cash instruments and represents a more realistic reflection of the return available on this asset class.

Returns available on individual NCDs and fixed deposits are quoted as yields thus the return produced on the prescribed portfolio is calculated as follows:

\[
Y_{(t)} = \text{interest rate (yield) on a 3 month NCD/fixed deposit at time (t)}
\]

\[
mv_{(t)} = \text{the maturity value of the instrument purchased at time (t)}
\]

\[
= 100 + (91/365)Y_{(t)}
\]

\[
rm_{(t)} = \text{the return each instrument held for the full 3 month period}
\]

\[
= \left[\frac{mv_{(t)}{100}}{100}\right]^{1/3} - 1
\]

\[
r_{(t)} = \text{the monthly performance for the prescribed portfolio in month (t)}
\]

\[
= \frac{[rm_{(t-3)} + rm_{(t-2)} + rm_{(t-1)}]}{3}
\]

Since bankers’ acceptances are quoted at a discount, this rate is converted into a yield using the following formula:
\[ \text{Yield} = \frac{d}{1 - d(91/365)} \]

where \(d\) is the quoted discount rate on the bankers acceptance.

### 4.3 Segregation of the Time Series into Bull and Bear Trends

In order to split the market’s performance over time into bull and bear trends, use is made of Polakow’s (2000) study on a memory effect on the JSE. Using distributional theory he identified outliers, or extreme events, and then discovered that there is a statistically significant mean reversion effect between such extreme events. That is to say that after an extreme event like a ‘crash’ the market return is more likely to revert back to the mean return and then continue to rise until an extreme ‘rise’ occurs. This then will more likely be followed by a fall in returns thus reverting back to the mean and continue to fall until another ‘crash’ occurs. This can be seen graphically as shown by Figure 3.

**Figure 3** Time series of returns from 1925 to 2000

Extreme events indicated by dots

![Graph showing time series of returns from 1925 to 2000](image)

Adapted from Polakow, “Market Crashes: Predicting Extreme Market Movements. A Memory Effect on the JSE (1925-1999)”

By using the Fisher-Tippett distribution, Polakow (2000) demonstrated that all annual returns greater than 35.3% or less than –2.0% can be considered to be extreme events.
As the market's returns mean revert between such extreme events there exist periods where the returns are above the market's average followed by periods where the returns are below the average. Simply from inspection (Figure 3) it appears that once an extreme event occurs the returns tend to mean revert and continue to the next extreme event. This is particularly evident in the last twenty years with very few exceptions.

In order to segment the market into bull and bear periods the following process is used.

- Identify the market average (15.8%)
- Identify the extreme events as per Polakow (2000)
- Identify where the market mean reverts between two consecutive extreme events (eg 1937 and 1941)
- Identify in which year the return intersects the market mean between such extreme events (eg during 1941).
- Between two successive intersecting points the majority, if not all the market returns are either above or below the market average return depending on which phase the market is in.
- For the purpose of this study, the time periods in which the returns are above average will be deemed to be bull periods and the time periods in which the returns are below average will be deemed to be bear periods.

Monthly intervals are used for timing decisions. It is therefore necessary to identify the month during which the market switches from one condition to the other. This obviously happens during the years in which the return intersects the market's mean as identified above. Since the market is mean reverting, the index is either peaking or troughing during these years. The month in which the market switches from one condition to another is deemed to occur when the index is at its maximum value for peaks or at its minimum value for troughs.

Using this methodology, the time series divides as shown in Table 2. It is clear from the table that the market is well segmented into bull and bear trends. What will be
noticed is the omission of certain time periods. The first two periods to be omitted are 1/25 to 4/28 and 8/00 to 12/00, these being at the ends of the time series and there is no complete cycle to comply with the above methodology.

### Table 2 Identified Bull and Bear Periods

<table>
<thead>
<tr>
<th>Bull Period</th>
<th>Months</th>
<th>Annual Return</th>
<th>Bear Period</th>
<th>Months</th>
<th>Annual Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/33 to 1/37</td>
<td>49</td>
<td>37.8%</td>
<td>5/28 to 1/33</td>
<td>57</td>
<td>0.3%</td>
</tr>
<tr>
<td>2/41 to 1/48</td>
<td>84</td>
<td>24.0%</td>
<td>1/37 to 2/41</td>
<td>50</td>
<td>-1.6%</td>
</tr>
<tr>
<td>1/66 to 4/69</td>
<td>40</td>
<td>39.1%</td>
<td>1/48 to 1/62</td>
<td>169</td>
<td>2.5%</td>
</tr>
<tr>
<td>1/72 to 6/73</td>
<td>18</td>
<td>56.5%</td>
<td>4/69 to 1/72</td>
<td>34</td>
<td>-15.5%</td>
</tr>
<tr>
<td>6/77 to 9/81</td>
<td>52</td>
<td>46.2%</td>
<td>6/73 to 6/77</td>
<td>49</td>
<td>-2.0%</td>
</tr>
<tr>
<td>6/82 to 8/87</td>
<td>63</td>
<td>45.9%</td>
<td>9/81 to 6/82</td>
<td>10</td>
<td>-35.7%</td>
</tr>
<tr>
<td>1/89 to 1/90</td>
<td>13</td>
<td>60.9%</td>
<td>8/87 to 1/89</td>
<td>18</td>
<td>-8.3%</td>
</tr>
<tr>
<td>2/93 to 12/95</td>
<td>35</td>
<td>25.8%</td>
<td>12/95 to 1/99</td>
<td>38</td>
<td>1.6%</td>
</tr>
<tr>
<td>1/99 to 8/00</td>
<td>20</td>
<td>34.1%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The period 2/62 to 1/65 is omitted because the market mean reverted but then tended hover around the market average, not exhibiting any bull or bear nature and therefore not falling into one of the two specified market conditions. Lastly 2/90 to 1/93 is a very volatile period with the market oscillating around the mean but not breaching any of the extreme event criteria. Again the returns in this period did not show typical bull or bear tendencies but rather the market average. The effect of these periods is captured when the analysis is applied to the whole time period under investigation.

Some of the analyses are conducted on each of the individual sub periods in Table 2 but the majority of the study focuses on the combined sub periods. For each market trend the returns of the relevant sub periods are chained together to form a continuous series of returns, one representing the bull trend and one the bear trend. Table 3 illustrates the results of segmenting the market's performance into bull and bear trends.
Table 3 Returns for each Market Trend

<table>
<thead>
<tr>
<th>Number of Years</th>
<th>Return on Index p.a.</th>
<th>Return on Cash p.a.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>76.0</td>
<td>15.8%</td>
</tr>
<tr>
<td>Bull</td>
<td>31.2</td>
<td>39.3%</td>
</tr>
<tr>
<td>Bear</td>
<td>35.4</td>
<td>-0.3%</td>
</tr>
</tbody>
</table>

4.4 Transactions Charges

Whenever financial assets change ownership, agents acting for the buyers and sellers charge a fee for the service provided. This covers any administrative expenses as well as compensation for the agent. Only as of March 1996 were brokers commissions fully negotiable on the JSE. Prior to this the commissions charged were regulated. There are currently additional charges such as marketable securities tax levied at 0.25% whenever shares are purchased as well as Value Added Tax (VAT) levied on the service charge.

It is obvious that the charge levied does not only depend on the timing but also the size of the transaction and the agent employed. It is also conceivable that these charges may influence the decision of market timers as they will obviously wish to achieve abnormal returns net of such fees. Incorporating these charges would influence the essence of this study, the broad objective of which is to evaluate the effectiveness and risk characteristics of market timing strategies based on forecasting accuracy and not the costs incurred. It is for these reasons that the study does not account for any charge when an asset is purchased or sold.

4.5 Calculation of the option prices

In order to analyse the option timing strategies, premiums on the options purchased are required to account for the cost of such strategies. Since these options did not exist for the majority of the study period the premiums had to be estimated. This was achieved by using the Black-Scholes formula adjusted for dividends with the Merton continuous dividend adjustment. In doing so, it is assumed that this model gives a fair price for the required options. Reilly and Brown (2000, p1010) indicate that the
Black-Scholes option pricing formula provides the best estimate of option value for at-the-money options thus this dividend adjusted model is used to estimate such premiums for European Options.

4.5.1 The Adjusted Black-Scholes Option Pricing Model

The adjusted Black-Scholes formula is a method of valuing a call option using the current price of the underlying asset, the exercise price, a risk-free rate, the time to maturity, the volatility of the underlying asset’s return, the continuous dividend rate and has the form:

\[ C_0 = S_0 e^{-\delta T} N(d_1) - X e^{-rT} N(d_2) \]

where

\[ d_1 = \frac{\ln(S_0 e^{-\delta T} / X) + (r + \sigma^2 / 2)T}{\sigma \sqrt{T}} \]

\[ d_2 = d_1 - \sigma \sqrt{T} \]

and where

- \( C_0 \) = Call option value (call premium)
- \( S_0 \) = Current price of the underlying asset
- \( \delta \) = The continuous dividend rate
- \( N(d) \) = The probability that a random draw from a standard normal distribution will be less than \( d \).
- \( X \) = Exercise price
- \( r \) = Risk-free interest rate
- \( T \) = Time to maturity of the option, in years
- \( \sigma \) = Standard deviation of the annualised continuously compounded rate of return of the underlying asset

This dividend adjustment model is considered robust if the dividends are paid continuously over time, hence the name ‘continuous dividend adjustment’. Having the index as the underlying asset results in dividends accruing on a regular basis since
each company in the index declares and pays dividends at different points in time. This makes the model more robust for the purpose of this study.

### 4.5.2 Valuation of the Put Premiums

The Black-Scholes formula only estimates the call option price, therefore use is made of the put-call parity theorem to estimate the value of the put options. This equation must hold to eliminate riskless arbitrage and has the form:

\[ P_0 = C_0 - S_0 + X e^{-rT} \]

where

- \( P_0 \) = the current put premium.

with the other variables being previously defined.

### 4.5.3 The Volatility Input in the Option Pricing Models

The most difficult to estimate input in the Black-Scholes model is the volatility (\( \sigma \)). Ideally the model requires the future volatility of the underlying asset but this is obviously impossible to obtain. In order to overcome this problem, the volatility is usually estimated by calculating the volatility of the most recent asset returns.

In this study, monthly returns for the most recent 12 months are used to estimate the future volatility. The only exception is in the first year, 1925 where the required data does not exist. In this case the volatility of the returns during this year are used instead.

The historical volatility was calculated using the Maximum Likelihood Estimator which has the form:

\[
\sigma = \frac{1}{n-1} \sum_{k=1}^{n} [\ln(R_k) - \mu]^2
\]
where

$$\mu = \frac{1}{n} \sum_{k=1}^{n} \ln(R_k)$$

and where

- $n$ = the number of observations
- $R_k$ = return for period $k$ = $P_k/P_{k-1}$
- $P_k$ = Price at period $k$

It is assumed that fractions of options can be purchased thus allowing a naïve hedge ratio to be generated. This enables the bull timing strategy to create an exposure equivalent to liquidating the portfolio and investing the proceeds in the index. This also allows the bear timing strategy to perfectly offset any fall in the index by an equal but opposite gain on the put options held.

### 4.6 Holding Period Returns for Each Timing Strategy

To evaluate each strategy, holding period returns are calculated for both correct and incorrect timing decisions for each review period. A review period is the length of time in which the composition of the portfolio remains unaltered. At the end of the period investors review their position and make the necessary timing changes depending on their prediction for the next review period. For the purposes of this study monthly review periods are used, hence monthly holding period returns are calculated.

#### 4.6.1 Traditional Timing

The returns generated by traditional timing in each review period will be equal to the return generated on the particular asset class held during such a period, these returns being calculated as described above. No transactions charges are accounted for. Thus the risk and return results will reflect the true characteristics of this timing strategy for the various levels of predictive accuracy analysed and is not distorted by such exogenous variables.
4.6.2 Bear Timing

The returns generated by bear timing consist of two components namely the index and the options, if purchased. The return on the index, including dividends, is realised in each review period regardless of the timing decision or the markets performance and is denoted by HPR\textsubscript{c+d}. However the return on the option component is dependent on the performance of the market. Firstly the cost of the option is accounted for and then, depending on the markets performance, the options will either mature in- or out-of-the money. If the options mature in-the-money then the return gained will be equal to the fall in the index (-HPR\textsubscript{c}) and this is added to the return on the portfolio. If the option expires out-of-the money then no gain is achieved.

To finance the put premium it is assumed that investors can borrow short term at the risk-free rate (HPR\textsubscript{r}), which is assumed to be identical to the return on the cash instruments. The cost of the borrowing is assumed to be paid off at the end of the period by liquidating a small portion of the portfolio. To account for the correct number of options purchased, the cost is expressed as a percentage of index’s value at the beginning of the review period and is denoted %Put.

Consequently, for bear timing the payoff structure consists of four possible outcomes, a correct or incorrect decision for a rise or fall in the market. The calculations of returns from each of these permutations are shown in Table 4.

<table>
<thead>
<tr>
<th>Table 4 Formulae for Calculating Returns for Bear Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bull Period</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Bear Period</strong></td>
</tr>
</tbody>
</table>

The returns generated for portfolio insurance are calculated by assuming the put options are purchased in every review period.
4.6.3 Bull Timing

For bull timing the return on the cash instruments (HPRc) is achieved in every review period regardless of the market’s performance. The return generated by the options, if purchased, is as follows. Firstly the cost of the options is accounted for then, depending on the markets performance, the option will mature in- or out-of-the money. If the market rises then the return gained is equal to that of the index (HPRc) and this is added to the return on the portfolio. If the market falls then the option will mature out-of-the money and no gain will be made.

To finance the call premium it is assumed that investors liquidate a small portion of their portfolio at the beginning of the review period. To account for the correct number of options purchased the cost is expressed as a percentage of index’s value at the beginning of the review period and is denoted %Call.

Thus for bull timing, the payoff structure consists of four possible outcomes, a correct or incorrect decision for a rise or fall in the market. The calculations of returns from each of these permutations are shown in Table 5.

<table>
<thead>
<tr>
<th>Bull Period</th>
<th>Correct Decision</th>
<th>Incorrect Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bull</td>
<td>[(HPRc + (1 - %Call) (1 + HPRr))] - 1</td>
<td>HPRr</td>
</tr>
<tr>
<td>Bear</td>
<td>HPRr</td>
<td>[(1 - %Call) (1 + HPRr)] - 1</td>
</tr>
</tbody>
</table>

The returns generated for market speculation are calculated by assuming that call options are purchased in every review period.

4.7 Analysis of the Market Timing Strategies

To analyse the three market timing strategies under the defined market conditions three methodologies will be used, namely the Chua Woodward To (1987) model, the
‘football’ graph analysis developed by Jeffrey (1984) and the risk analysis conducted by Firer et al. (1992b). Other relevant parameters will also be calculated to further assess each timing strategy under the identified market conditions.

4.7.1 The Chua Woodward To Model

The Chua et al. (1987) model is an extension of Sharpe’s (1975) model which analyses the possible returns achievable for varying degrees of bull and bear predictive accuracy. It is similar to a decision tree model as shown in Figure 4.

**Figure 4 The Chua Woodward To Model**

\[
\begin{align*}
\pi_g & \quad \text{The investor predicts a good month and holds stocks} \\
1 - P_{\text{Bull}} & \quad \text{The investor predicts a bad month and holds cash} \\
\pi_b & \quad \text{The investor predicts a good month and holds stocks} \\
P_{\text{Bear}} & \quad \text{The investor predicts a bad month and holds cash}
\end{align*}
\]


\(\pi_g\) is the probability that the next month’s index return will be greater than that of the cash instruments and \(\pi_b\) being the probability that next month’s cash instruments will outperform the index. \(P_{\text{Bull}}\) is the probability that investors correctly forecast a bull month and thus hold the index. \(1 - P_{\text{Bull}}\) is the probability that investors incorrectly forecast a bull month thus invest in cash instruments. \(P_{\text{Bear}}\) is the probability that investors correctly forecast a bear month and thus hold cash instruments and \(1 - P_{\text{Bear}}\) is
the probability that investors incorrectly forecast a bear month thus invest in the index.

For each returns series, the value of $\pi_g$ is obtained by calculating the proportion of months in which the index outperformed the cash instruments, and vice versa for the $\pi_b$ value. Different combinations of $P_{Bull}$ and $P_{Bear}$ ranging from 0.0 to 1.0 are substituted into the model to produce the four probabilities as indicated on the right hand side of the diagram. Each probability is then multiplied by their respective expected return i.e. $\pi_g(P_{Bull})$ is multiplied by the expected return on the index during a bull month, $\pi_g (1-P_{Bull})$ is multiplied by the expected return on cash instruments during a bull month, $\pi_g (P_{Bear})$ is multiplied by the expected return on cash instruments during a bear month and finally $\pi_g (1-P_{Bear})$ is multiplied by the expected return on the index during a bear month. The four products are then summed to give an expected return for the specific combination of $P_{Bull}$ and $P_{Bear}$ tested. This process is repeated for all possible combinations of $P_{Bull}$ and $P_{Bear}$ to produce a matrix showing the possible returns for the various combinations of bull and bear predictive accuracy.

4.7.2 The 'Football' Analysis

This methodology was first developed by Jeffrey (1984) and has since been used to address specific questions relating to market timing. The output of the analysis produces a graph indicating the possible range of returns for a given level of predictive accuracy and has the appearance of a ‘football’ as shown in Figure 5.

The upper boundary indicates the return available if each of the incorrect timing decisions had the least effect on the portfolio with the lower boundary indicating the return available if the incorrect timing decisions had had the greatest affect on the portfolio. Five key points are identified as indicated in Figure 5. A and E are the maximum and minimum returns from perfect and imperfect timing respectively. Point B represents the predictive accuracy needed to be guaranteed a return greater than the buy-and-hold (sure gain), and point C is the midpoint between the two boundaries and
represents the predictive accuracy required to have an equal chance at beating the market (equal chance) and finally point D represents the predictive accuracy below which it is impossible to beat the market regardless of which periods are incorrectly forecasted (sure loss).

![Figure 5 Typical Football Graph](image)

Perfect timing (point A) results in the portfolio achieving the highest possible return and is accomplish by investors making correct predictions as to market movements in every review period. These returns are calculated by selecting the highest return obtainable in each review period depending on the strategy being investigated. Similarly point E represents the return generated if the investors' timing decisions are incorrect in every review period i.e. totally imperfect timing.

As the investors’ ability to predict market movements decreases they will find themselves incorrectly positioned in the market, thus realising less than optimal results. The impact of the incorrect decision is dependent on the marginal difference in returns between the “correct” and “incorrect” portfolios. When one incorrect decision is made investors will miss, in the worst case, the period in which the marginal difference between the returns is the greatest, or will miss, in the best case, the period where the marginal difference is the least.
As the forecasting accuracy declines the number of incorrect selections naturally increases. The best possible and worst possible returns at each predictive accuracy are calculated by ranking the differences between the “correct” and the “incorrect” portfolio returns and allocating the large differences to the worst case scenario and the smallest differences to the best case scenario. This process is facilitated through the use of multipliers.

These multipliers successively replace each correct decision with an incorrect decision in a systematic manner for each review period. The multipliers do this by calculating the ratios of returns between the “correct” and “incorrect” portfolios. If the multipliers are ranked in ascending order, then the differences in returns are ranked from largest to smallest and are used to calculate the worst case scenario thus producing lower boundary of the football. If ranked in descending order then the differences are ranked from smallest to largest and correspond to the best case scenario thus producing the upper boundary of the football.

The multipliers are calculated using the following formula:

\[
m = \frac{(1 + R_L)}{(1 + R_H)}
\]

where

- \( m \) = Multiplier
- \( R_L \) = Lower return in a holding period
- \( R_H \) = Higher return in a holding period

### 4.7.2.1 Information Produced from the Football Analysis

Running the football analysis produces a variety of results that allows for the assessment of the timing strategies as well as what effect the market conditions have on the timing strategies. The first set of results produced is the maximum and minimum returns available for perfect and totally imperfect timing respectively (points A and E in Figure 5). Relating these returns to the passive buy-and-hold strategy gives an indication of the effectiveness of each strategy. Furthermore from
these three returns a loss/gain ratio can be calculated. This ratio measures the absolute ratio of potential loss from totally inaccurate timing to potential gain on perfect timing, relative to the buy-and-hold return. If this ratio is greater than one it indicates that investors will be more likely to achieve a return below that of the passive strategy. For the two option timing strategies returns generated from portfolio insurance and market speculation are also calculated and compared to the passive return.

The football analysis also indicates the required predictive accuracy necessary to outperform the index. From this information the compression ratio can be calculated. This ratio measures how many of the most influential periods investors can miss, relative to the total number of periods, before the returns fall below that of the buy-and-hold. If investors miss all of these periods then it would be impossible for them to outperform the index.

4.7.3 Risk Analysis

As indicated by the football analysis there exists a range of possible returns for every level of predictive accuracy except at the two end points of perfect and totally imperfect timing. Clearly between the best and worst case boundary there exists a distribution of possible returns for a given level of predictive accuracy. The objective of this part of the study is to use a simulation technique to estimate these distributions at various levels of predictive accuracy. To accomplish this, use is made of a computer simulation model to simulate the possible trading process of timers who are correct exactly 10%, 20% ...90% of the time.

The simulation process was conducted as follows. For each time series and strategy, correct and incorrect timing decisions per month are identified. For say a 90% predictive accuracy level the computer generates a random number between 0 and 1 based on a uniform distribution. If the random number is less than 0.9 (representing the 90% timing ability) then the correct timing return for that month is selected, if greater than or equal to 0.9 the incorrect return is selected. This process is repeated for all months in the time series. The actual timing decisions are then assessed to ensure
that exactly 90% of the choices are correct, if not the series is rejected. This process is repeated until 500 series of returns are obtained from which an annual returns and other statistics are calculated. This process is repeated for each of the identified levels of predictive accuracy.

From the simulation results two sets of analysis were performed. Firstly, an analysis of the underlying distribution at the various levels of predictive accuracy was carried out. This consisted of identifying the standard deviation of the distribution, its mean, degree of skewness and kurtosis. A test for normality is also conducted.

Secondly an overall risk analysis was conducted to measure the return generated relative to its standard deviation for each level of predictive accuracy. This analysis was repeated for each timing strategy under each market condition and graphically represented in risk-return space to obtain further understanding of each strategy’s risk/return profile.
5 Results

After dividing the time series of returns into bull and bear phases, the three sets of analyses were run under each of the market conditions. The analyses were repeated using the entire time series. The results from each analysis are discussed separately followed by a general discussion across the three sets of results.

5.1 The Chua Woodward and To Model Results\(^2\)

Running the Chua et al. (1987) model on the three time series of returns produced the following results.

5.1.1 Analysis of the Total Time Series.

Table 6 shows the results of traditional timing on the entire time series. The results displayed are the annualised returns less the buy-and-hold return of the index for each combination of bull and bear predictive accuracy. Thus the returns shown are the excess returns over the passive strategy.

<table>
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<tr>
<th>Bear Predictive Accuracy</th>
<th>0.0</th>
<th>0.1</th>
<th>0.2</th>
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<td>11.5</td>
<td>14.7</td>
<td>18.1</td>
<td>21.5</td>
</tr>
</tbody>
</table>

As discussed previously, no transactions charges were included in these calculations. Obviously including such costs would reduce the returns. Droms (1989), who conducted a similar analysis, commented that “on average transactions costs would reduce the theoretical annual returns to timing by about 0.5% to 2.5% per year, depending on the frequency of timing. The corresponding levels of predictive accuracy required to match a buy-and-hold policy would increase by 3% to 7%.” This statement was based on a transaction charge of 1% per switch which may be considered a realistic charge for trading conditions today.

Table 6 indicates that there appears to be a considerable possibility of under performing the index unless investors possessed some degree of predictive ability above that of a random guess. However, the only quadrant of significance is the fourth quadrant since every other result could have been improved by merely substituting a random guess for either the bull or bear predictive accuracy.

What is also noticeable are the possible gains achieved from successful market timing. Perfect timing resulted in a return of 21.5% above that of the passive strategy which translates into a total return of 37.2%. However, on the downside the maximum possible loss was 26.3% below the buy-and-hold return or an annual return of −10.6% indicating that even though there are potentially high returns from market timing, there is also the risk of substantial underperformance.

The results also indicate that a random guess for both bull and bear periods produced a return below that of the passive benchmark. Thus some level of skill was required to be successful at market timing. Furthermore the results suggest that it was more important to be able to predict bull periods than bear periods, a conclusion similar to that drawn by Chua et al. (1987).

There are two other cells in the table worth commenting on, namely 100% bull and 0% bear predictive accuracy and 0% bull and 100% bear predictive accuracy. The first represents the case whereby whenever there was a bull period the market was
held (100% bull predictive accuracy) and whenever there was a bear period the market was held again (0% bear predictive accuracy) hence the market was held regardless of the market’s performance. This results in the achievement of the buy-and-hold passive return and the table reflects an excess return above the passive benchmark of 0%.

Using similar logic the other point (0% bull and 100% bear) results in the money market instruments being held regardless of the market’s performance. Here the return obtained is the buy-and-hold return of the money market instruments. This results in the return of -9.4% displayed in Table 6 \((P_{\text{bull}} = 0.0; P_{\text{bear}} = 1.0)\) being the difference between the return on the index and the return on money market instruments.

Table 7 displays the returns for the various levels of predictive accuracy achieved by the bull timing strategy when applied to the whole time series.

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<tr>
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<td>4.1</td>
<td>5.9</td>
<td>7.7</td>
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</table>

The first attribute worth noting is that the returns available for perfect timing using a bull timing strategy were lower than that of its traditional counterpart. Furthermore, not only did a random guess as to the market’s future direction lead to a sub optimal return but bull timers required a higher forecasting ability during both bull and bear periods, relative to traditional timers, to outperform the benchmark.
However, on the downside, bull timers lost less than the traditional timers. That is to say, despite the poor upside potential for bull timers, the downside potential losses were less severe. This arises because when an error is made using traditional timing the full loss of the excess market return is incurred whereas in bull timing only the cost of the call options is lost, which was often less than the fall in the market, and the bull timers were, of course, still rewarded for holding the money market instruments. So the downside is somewhat protected but the upside potential is reduced due to the cost of the options.

What is also noticeable is that even if bull timers could predict bull markets perfectly, some level of bear predictive accuracy was needed to outperform the index. This indicates that a strategy of purchasing call options for every review period, i.e. market speculation, would have under performed the benchmark by 5.3%. This is in contrast to traditional timing where perfect bull market forecasting ability would have, at very least, equalled the index.

Table 8 shows how the bear timing strategy performed when applied to the complete time series.

<table>
<thead>
<tr>
<th>Bear Predictive Accuracy</th>
<th>Bull Predictive Accuracy</th>
</tr>
</thead>
<tbody>
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</table>
The predictive accuracies required to beat the market are very similar to those of traditional timing for the same data set. However the maximum possible return was again substantially lower than that of traditional timing due to the cost of the put options. Furthermore the maximum potential loss was less using the bear timing strategy since, when a market rise was incorrectly predicted, the bear timing strategy still held the market, thus benefiting from the rise and only suffered the cost of the options. The traditional timer on the other hand could not benefit in the same manner. The ability to benefit from an incorrect bear period prediction marginally reduced the required bear predictive accuracy across the spectrum. Nevertheless a random guess as to the market’s movement remained unfavourable.

Also of interest is the observation that perfect bear predictive ability required some level of bull forecasting ability to beat the index. This implies that a protective put strategy, purchasing put options in every review period, would have under performed the market by 4.0%.

Comparing the bull and bear timing strategies, it is obvious that the bear strategy was superior on a returns basis as well as requiring lower forecasting abilities necessary to outperform the market. This apparent superiority at no cost can be explained in terms of the strategy’s risk profile, which is discussed later under the risk analysis results.

The results from the three strategies based on the total time series indicate that market timers did require some level of timing ability above that of a random guess, this level being somewhere between 60% and 75%, depending on the strategy employed. The results also indicate that it was more important to be able to correctly predict the bull periods as opposed to the bear periods. Except for bull timing, perfect bull period prediction did not require any bear period predictive accuracy to, at least, equal the benchmark return. However, perfect bear period forecasting required some level of bull period forecasting ability to outperform the index regardless of the strategy employed.
5.1.2 Analysis of the Bullish Market Trends.

As discussed earlier, the phase of the market may have a substantial effect on the possible gains and required predictive accuracies needed to beat the market. It is also conceivable that such conditions may affect the different strategies in different ways.

Table 9 displays the returns available for traditional timing during the identified bull market phases. The results indicate how difficult it appears to be to outperform the market under bullish market conditions. Firstly, to have a chance of beating the benchmark, investors would have had to correctly predict at least 80% of all bull periods. This in itself would have been a formidable challenge and on top of this investors would have also needed to correctly predict at least 80% of the bear periods to obtain a return greater than the buy-and-hold return. Only a 90% bull predictive accuracy would have allowed investors to have a random guess for bear periods and still obtain a superior return, yet a 90% bear predictive accuracy would still have required at least an 80% bull predictive accuracy to be in the same position, again indicating that being able to predict bull periods is more important.

<table>
<thead>
<tr>
<th>Bull Predictive Accuracy</th>
<th>0.0</th>
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<td>4.4</td>
<td>9.6</td>
<td>15.1</td>
</tr>
</tbody>
</table>

It is clear that employing this strategy to time the market during the bullish market phase required a formidable forecasting ability which is probably beyond the capability of most investors. However the market did provide an average annual
return of 39.3% over the same time period. Clearly if this strategy is employed, such investors must hold the index when the market is in a bullish phase. Any effort to increase returns by attempting to identify the odd bearish period under these conditions and switching to money market instruments is unlikely to have a substantial effect on the overall returns and could possibly result in a less than optimal return. The only sensible action would be to hold the index and benefit from the market’s strong performance, despite the occasional downturn.

Utilising a bull timing strategy under the same bullish market conditions provides the returns as shown in Table 10.

**Table 10 Predictive Accuracy Matrix for Bull Timing**

<table>
<thead>
<tr>
<th>Bull Market Trends</th>
<th>Bull Predictive Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.0</td>
</tr>
<tr>
<td>0.0</td>
<td>-40.8</td>
</tr>
<tr>
<td>0.1</td>
<td>-39.9</td>
</tr>
<tr>
<td>0.2</td>
<td>-39.1</td>
</tr>
<tr>
<td>0.3</td>
<td>-38.2</td>
</tr>
<tr>
<td>0.4</td>
<td>-37.3</td>
</tr>
<tr>
<td>0.5</td>
<td>-36.5</td>
</tr>
<tr>
<td>0.6</td>
<td>-35.6</td>
</tr>
<tr>
<td>0.7</td>
<td>-34.7</td>
</tr>
<tr>
<td>0.8</td>
<td>-33.8</td>
</tr>
<tr>
<td>0.9</td>
<td>-32.9</td>
</tr>
<tr>
<td>1.0</td>
<td>-32.0</td>
</tr>
</tbody>
</table>

It is clear from these results that regardless of the timing ability of bull timers, it was impossible to outperform the market under these conditions. This occurs because bull timers constantly hold the money market instruments and therefore the only way they can benefit from the strong market performance is at the cost of the call options which are roughly 1.9% of the value of the portfolio per review period. This constant cost obviously detracts from the returns available from the index and causes the strategy to underperform the market even if perfect forecasting is achieved. Evidently this strategy appears to be redundant during a market bull run with no way out except abandonment and investing the proceeds in the market directly.
In addition there appears to be no downside protection with the returns generated from poor predictive accuracy being similar to those of the traditional timers. That is to say this strategy has no upside benefit and all of the downside risk. Even a strategy of purchasing call options in every review period, namely market speculation, resulted in a return of 16.0% below that of the passive buy-and-hold strategy. This approach would catch every bull period resulting in the options maturing in-the-money but the few periods in which the options expire out-of-the-money appear to weigh heavily on the overall returns.

Table 11 shows the results of using a bear timing strategy during the identified bullish market conditions.

<table>
<thead>
<tr>
<th>Bull Predictive Accuracy</th>
<th>0.0</th>
<th>0.1</th>
<th>0.2</th>
<th>0.3</th>
<th>0.4</th>
<th>0.5</th>
<th>0.6</th>
<th>0.7</th>
<th>0.8</th>
<th>0.9</th>
<th>1.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>-21.9</td>
<td>-19.9</td>
<td>-17.8</td>
<td>-15.7</td>
<td>-13.6</td>
<td>-11.4</td>
<td>-9.2</td>
<td>-6.9</td>
<td>-4.7</td>
<td>-2.3</td>
<td>0.0</td>
</tr>
<tr>
<td>0.1</td>
<td>-21.3</td>
<td>-19.2</td>
<td>-17.1</td>
<td>-15.0</td>
<td>-12.9</td>
<td>-10.7</td>
<td>-8.5</td>
<td>-6.2</td>
<td>-3.9</td>
<td>-1.6</td>
<td>0.8</td>
</tr>
<tr>
<td>0.2</td>
<td>-20.6</td>
<td>-18.5</td>
<td>-16.4</td>
<td>-14.3</td>
<td>-12.2</td>
<td>-10.0</td>
<td>-7.7</td>
<td>-5.5</td>
<td>-3.2</td>
<td>-0.8</td>
<td>1.5</td>
</tr>
<tr>
<td>0.3</td>
<td>-19.9</td>
<td>-17.9</td>
<td>-15.8</td>
<td>-13.6</td>
<td>-11.5</td>
<td>-9.2</td>
<td>-7.0</td>
<td>-4.7</td>
<td>-2.4</td>
<td>-0.1</td>
<td>2.3</td>
</tr>
<tr>
<td>0.4</td>
<td>-19.3</td>
<td>-17.2</td>
<td>-15.1</td>
<td>-12.9</td>
<td>-10.7</td>
<td>-8.5</td>
<td>-6.3</td>
<td>-4.0</td>
<td>-1.7</td>
<td>0.7</td>
<td>3.1</td>
</tr>
<tr>
<td>0.5</td>
<td>-18.6</td>
<td>-16.5</td>
<td>-14.4</td>
<td>-12.2</td>
<td>-10.0</td>
<td>-7.8</td>
<td>-5.5</td>
<td>-3.2</td>
<td>-0.9</td>
<td>1.5</td>
<td>3.9</td>
</tr>
<tr>
<td>0.6</td>
<td>-17.9</td>
<td>-15.8</td>
<td>-13.7</td>
<td>-11.5</td>
<td>-9.3</td>
<td>-7.1</td>
<td>-4.8</td>
<td>-2.5</td>
<td>-0.1</td>
<td>2.2</td>
<td>4.7</td>
</tr>
<tr>
<td>0.7</td>
<td>-17.3</td>
<td>-15.1</td>
<td>-13.0</td>
<td>-10.8</td>
<td>-8.6</td>
<td>-6.3</td>
<td>-4.1</td>
<td>-1.7</td>
<td>0.6</td>
<td>3.0</td>
<td>5.4</td>
</tr>
<tr>
<td>0.8</td>
<td>-16.6</td>
<td>-14.5</td>
<td>-12.3</td>
<td>-10.1</td>
<td>-7.9</td>
<td>-5.6</td>
<td>-3.3</td>
<td>-1.0</td>
<td>1.4</td>
<td>3.8</td>
<td>6.2</td>
</tr>
<tr>
<td>0.9</td>
<td>-15.9</td>
<td>-13.8</td>
<td>-11.6</td>
<td>-9.4</td>
<td>-7.2</td>
<td>-4.9</td>
<td>-2.6</td>
<td>-0.2</td>
<td>2.2</td>
<td>4.6</td>
<td>7.0</td>
</tr>
<tr>
<td>1.0</td>
<td>-15.2</td>
<td>-13.1</td>
<td>-10.9</td>
<td>-8.7</td>
<td>-6.4</td>
<td>-4.1</td>
<td>-1.8</td>
<td>0.5</td>
<td>2.9</td>
<td>5.4</td>
<td>7.8</td>
</tr>
</tbody>
</table>

Again the results indicate that attempting to time the market using this strategy during the bullish phase was challenging. However the bear timing strategy fared better than its traditional counterpart on a required predictive accuracy basis. Nevertheless the required forecasting ability to be successful remained exceptionally high.

On a returns basis, perfect bear timing under performed traditional timing but it must be noted that the latter results do not include transactions costs. However on the downside totally imperfect bear timing significantly outperformed both the bull and
traditional strategies. This was largely due to the bear strategy holding the market throughout the time period and thus, by default, participating in every bull period at no cost. The majority of the loss experienced was caused by the put options maturing out-of-the-money, which was clearly less than the difference in return between the two asset classes, which was the loss suffered by traditional timers for an incorrect decision.

The protective put strategy under these market conditions obviously under performed the bullish market as indicated by the results, a return of 15.2% below the index.

Undoubtedly a bullish market makes market timing a challenging investment option regardless of the strategy used. Clearly under these market conditions market timing is a futile exercise and a passive approach should be adopted.

5.1.3 Analysis of the Bearish Market Trends.

Table 12 displays the results of applying a traditional timing strategy to the identified bearish market trends.

<table>
<thead>
<tr>
<th>Bear Predictive Accuracy</th>
<th>Bull Predictive Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>-17.1 -15.5 -13.9 -12.3 -10.6 -8.9 -7.2 -5.4 -3.7 -1.8 0.0</td>
</tr>
<tr>
<td>0.1</td>
<td>-15.1 -13.4 -11.8 -10.1 -8.4 -6.7 -4.9 -3.1 -1.3 0.6 2.4</td>
</tr>
<tr>
<td>0.2</td>
<td>-13.0 -11.3 -9.6 -7.9 -6.2 -4.4 -2.6 -0.8 1.1 3.0 4.9</td>
</tr>
<tr>
<td>0.3</td>
<td>-10.8 -9.1 -7.4 -5.7 -3.9 -2.1 -0.2 1.7 3.6 5.5 7.5</td>
</tr>
<tr>
<td>0.4</td>
<td>-8.6 -6.9 -5.1 -3.3 -1.5 0.3 2.2 4.1 6.1 8.1 10.1</td>
</tr>
<tr>
<td>0.5</td>
<td>-6.4 -4.6 -2.8 -1.0 0.9 2.8 4.7 6.7 8.7 10.7 12.8</td>
</tr>
<tr>
<td>0.6</td>
<td>-4.1 -2.3 -0.4 1.4 3.3 5.3 7.3 9.3 11.3 13.4 15.5</td>
</tr>
<tr>
<td>0.7</td>
<td>-1.7 0.1 2.0 3.9 5.9 7.8 9.9 11.9 14.0 16.1 18.3</td>
</tr>
<tr>
<td>0.8</td>
<td>0.7 2.6 4.5 6.4 8.4 10.5 12.5 14.6 16.7 18.9 21.1</td>
</tr>
<tr>
<td>0.9</td>
<td>3.1 5.1 7.0 9.0 11.1 13.1 15.2 17.4 19.6 21.8 24.0</td>
</tr>
<tr>
<td>1.0</td>
<td>5.6 7.6 9.6 11.7 13.7 15.9 18.0 20.2 22.4 24.7 27.0</td>
</tr>
</tbody>
</table>

These results indicate that traditional timing under these market conditions may be a viable investment strategy. This is due to the low levels of predictive ability required
to outperform the index. Most notable is that a random guess provided a return above that of the passive strategy. This finding is contrary to many earlier studies.\(^3\)

Again contrary to the findings of Chua et al. (1987), being able to predict bear periods was more important than predicting bull periods. Having the ability to predict 80% of the bear periods required no bull period forecasting ability to beat the market. This was largely due to the poor performance of the market (-0.3%) relative to that of the money market (5.4%).

Observing the returns achieved from perfect timing, relative to the index, the excess return generated is greater than the underperformance produced from totally imperfect timing. This again is contrary to previous studies. During this bearish phase perfect timers achieved excess returns of 27.0% which is almost twice the excess return generated for the bullish phase (15.1%). On the downside, totally imperfect timing during the bearish phase under performed the index by 17.1% compared to 42.8% for the bullish phase.

Table 13 shows the results of applying the bull timing strategy to the identified bear market trends. This table demonstrates that bull timing can be extremely successful during a bearish market. Most significantly a random guess as to the market direction achieved a return of 3.4% above that of the passive strategy and even if investors were only correct 40% of the time in predicting both bull and bear periods then returns above the market would have been obtained. As with traditional timing predicting the bear periods was more important than predicting the bull periods. If investors could predict 70% of the bear periods then they did not require any bull period predictive accuracy. However investors needed to forecast at least 90% of the bull periods before no bear predictive accuracy was necessary.

\(^3\) For example Chua et al. (1987), Droms (1989) and Firer et al. (1987)
On a returns basis, bull timers could have bettered the market’s performance by 16.9% yet, at worst, they would underperform the market by only 8.7%, indicating that the potential gains were about twice the potential losses. A strategy of purchasing call options in every review period produced an excess return of 1.2%. However if no options were purchased then a return of 5.6% would have been achieved from holding the money market instruments only.

The success of the bull timing strategy during the bear market trends can be attributed to the performance of the money market instruments relative to the index. Having the money market instruments outperform the market generates a cushion in which some timing errors can be absorbed before returns fall below the benchmark.

Table 14 displays the returns produced by the bear timing strategy when applied to the identified bear period. Again under these market conditions the timing strategy provided a return above the benchmark if random guesses were made as to the future market direction. This success comes from the fact that it is highly likely that the put options would mature in-the-money under these market conditions, thus reducing the effective cost of these options.
This combination of holding the index and having regular in-the-money put options easily pushes out the portfolios return above the passive benchmark. As seen previously the upside potential was greater than the downside under a bearish market and predicting bear periods remained more important. In this instance a protective put strategy outperformed the market by 3.0%. However this 3.0% over and above the market performance does not reach the return generated by holding the money market instruments.

It is clear from these results that the trend in the market does have a significant effect on a market timing strategy. It appears that attempting to time the market during bullish periods is unlikely to yield returns above that of a passive buy-and-hold market strategy unless formidable predictive ability is achieved. However, when the market turned bearish market timing was able to produce returns well above the index for reasonable levels of predictive ability indicating that this maybe a viable strategy. Nevertheless predicting when the market is in a bullish or bearish phase, let alone when these phases begin or end, could prove to be a demanding task.

The results for the total time series indicate that market timing can provide high returns but the potential downside loss is roughly twice the potential gain. On top of this investors must possess a reasonable level of forecasting ability just to match the
passive strategies return. Of the strategies investigated, bear timing appears to fare the best during the bull market phases and during the total time series. However it performed the worst when the market was bearish. Bull timing appears especially difficult when the market outperforms money market instruments and thus only provides value during bearish market conditions.

One limitation of this analysis is that it does not take into consideration which of the review periods were incorrectly forecast. Clearly there exists a range of possible returns that a less than perfect timer can achieve depending on which periods are in fact incorrectly forecast. The football analysis, discussed next, addresses this issue and identifies the possible range of returns for the various levels of predictive accuracy.

5.2 Range of Returns Available (Football Analysis)

The football analysis was run for the total time series, the combined bull returns (bull comb), the combined bear returns (bear comb) and on the individual bull and bear sub periods shown in Table 2 (p 41). The maximum and minimum potential returns as well as returns generated from portfolio insurance and market speculation are presented in Table 15 along with the returns generated from the market (B+H Index) and the money market instruments (B+H Cash). The points A and E refer to Figure 5 (p 50).

5.2.1 Analysis of the Range of Possible Returns.

Perfect traditional timing over the total time series generated a return superior to that of either perfect bull or bear timing. Even though the traditional timing results do not include transactions costs, it is by far the most effective strategy. Transactions costs would have to be about 1.85% per switch before perfect traditional timing would yield a similar return to that of perfect bear timing. Interestingly the cost of the put options purchased per review period is roughly 1.9% of the value of the portfolio.

---

Table 15 Returns from Market Timing During the Identified Time Periods

<table>
<thead>
<tr>
<th>Period</th>
<th>Date</th>
<th>B+H Index</th>
<th>B+H Cash</th>
<th>Annualised Returns</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>B+H</td>
<td>Bull</td>
<td>Bear</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum Return</td>
<td>Point A*</td>
<td>Minimum Return</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B+H</td>
<td>Bull</td>
<td>Bear</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Annualised</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Returns</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1/25 to 12/00</td>
<td>14.0 6.3</td>
<td>23.1 27.4</td>
<td>36.4</td>
</tr>
<tr>
<td>Bull Comb</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bull</td>
<td>1/33 to 1/37</td>
<td>37.3 7.3</td>
<td>33.0 45.7</td>
<td>53.2</td>
</tr>
<tr>
<td>Bull</td>
<td>2/41 to 1/48</td>
<td>24.0 0.0</td>
<td>21.4 40.5</td>
<td>42.5</td>
</tr>
<tr>
<td>Bull</td>
<td>1/66 to 4/69</td>
<td>39.1 5.5</td>
<td>35.4 45.6</td>
<td>51.2</td>
</tr>
<tr>
<td>Bull</td>
<td>1/72 to 6/73</td>
<td>56.5 6.6</td>
<td>35.9 56.8</td>
<td>62.0</td>
</tr>
<tr>
<td>Bull</td>
<td>6/77 to 9/81</td>
<td>46.2 8.0</td>
<td>46.3 64.8</td>
<td>74.6</td>
</tr>
<tr>
<td>Bull</td>
<td>6/82 to 8/87</td>
<td>45.8 16.7</td>
<td>52.1 62.3</td>
<td>79.0</td>
</tr>
<tr>
<td>Bull</td>
<td>1/89 to 1/90</td>
<td>60.9 19.2</td>
<td>59.7 72.3</td>
<td>83.9</td>
</tr>
<tr>
<td>Bull</td>
<td>2/93 to 12/95</td>
<td>25.8 12.9</td>
<td>28.5 36.2</td>
<td>44.4</td>
</tr>
<tr>
<td>Bull</td>
<td>1/99 to 8/00</td>
<td>34.1 13.6</td>
<td>36.6 44.6</td>
<td>63.9</td>
</tr>
<tr>
<td>Bear Comb</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bear</td>
<td>5/28 to 1/33</td>
<td>-2.0 5.3</td>
<td>16.3 15.8</td>
<td>26.0</td>
</tr>
<tr>
<td>Bear</td>
<td>1/37 to 2/41</td>
<td>0.3 3.2</td>
<td>14.0 14.3</td>
<td>20.9</td>
</tr>
<tr>
<td>Bear</td>
<td>1/48 to 1/62</td>
<td>-1.6 0.0</td>
<td>4.9 8.4</td>
<td>11.8</td>
</tr>
<tr>
<td>Bear</td>
<td>4/69 to 1/72</td>
<td>2.5 2.1</td>
<td>9.7 12.6</td>
<td>15.9</td>
</tr>
<tr>
<td>Bear</td>
<td>6/73 to 6/77</td>
<td>-15.5 7.2</td>
<td>22.7 17.9</td>
<td>38.7</td>
</tr>
<tr>
<td>Bear</td>
<td>9/81 to 6/82</td>
<td>-2.0 10.0</td>
<td>34.1 28.3</td>
<td>55.8</td>
</tr>
<tr>
<td>Bear</td>
<td>8/87 to 1/89</td>
<td>-35.7 17.2</td>
<td>17.5 -2.3</td>
<td>24.8</td>
</tr>
<tr>
<td>Bear</td>
<td>12/95 to 1/99</td>
<td>-8.3 12.6</td>
<td>25.8 21.6</td>
<td>48.4</td>
</tr>
</tbody>
</table>

* Points A and E refer to points on Figure 5 (p 50)
Bull timing did not fare as well as traditional or bear timing. This lack of performance can be explained in terms of the risk characteristics of the strategies which are discussed later.

A similar pattern of results emerges for perfect timing when the analysis is applied to the bullish market phases, except obviously that the returns generated are notably higher. As with the full sample period traditional timing performed the best followed by bear timing and lastly bull timing. Comparing the two option strategies, perfect bear timing outperformed perfect bull timing largely due to the bull timers having to purchase far more options than the bear timers to take advantage of the bullish market.

This added cost severely reduced the bull timers' returns whereas the bear timers generated the majority of their returns by merely holding the underlying index. Again the difference in returns between bear timing and traditional timing can be largely attributed to transactions costs.

For timers with zero timing ability, traditional timing under performed bear timing significantly. This was caused by the difference in returns between the two asset classes, which is the loss suffered by the traditional timers. Bear timers, on the other hand, only suffered the cost of the options which were often far less than the loss experienced by their traditional counterparts. The totally imperfect bull timing returns are similar to that of the totally imperfect traditional timers because, during the bullish market phases, both portfolios were predominately exposed to the money market instruments. Only in the few situations when the index under performed the money market instruments do the returns between these two strategies differ significantly.

Totally imperfect bear timing outperformed totally imperfect bull timing due to the performance of the underlying assets held. Bear timers always benefited from the market rises regardless of the timing decision made yet bull timers only experienced the returns generated by the money market instruments which were frequently lower than the index’s return during these bullish phases.
The effectiveness of each of the strategies is altered when the market enters a bearish phase. Obviously all the returns are lower due to the poor performance of the market. On the perfect timing front, traditional timing remained superior. However, contrary to Waksman et al.’s (1996) conclusions, bull timing outperformed its bear timing counterpart in all but the first three bear sub periods. This is largely due to the poor performance of the money market instruments in these first three sub periods as indicated in Table 15. The strong performance of bull timing relative to bear timing, during the bearish market phase, is largely due to perfect bear timers having to continuously purchase put options, at a cost, just to maintain their portfolio’s value. This is in contrast to the bull timers whose portfolio value actually grew from the return generated from holding the money market instruments.

During the bear market phases the totally inaccurate timing results again rank traditional timing as the worst strategy for the same reasons discussed earlier. Bull timing remained superior to bear timing largely due to the difference in performance of the two underlying asset classes. The market performed particularly poorly during these periods and combined with incorrect timing decisions resulted in the low bear timing returns. The bull timers, however, were supported by the performance of the money market instruments, which assisted in off-setting incorrect timing decisions.

The returns generated from portfolio insurance and market speculation were also calculated (Table 15). They do not differ substantially and this can be attributed to put-call parity and riskless arbitrage rational (Waksman et al. 1996). For the total time series these two investment strategies under performed the market marginally. Under the bullish market phases these two strategies again under performed the index and substantially so. However, under the bearish conditions the strategies outperformed the index in every period but one (1/48 to 1/62). Furthermore, portfolio insurance always marginally outperforms market speculation. This can be attributed to the risk profiles of the two strategies. Portfolio insurance, holding the market continuously, will have a more volatile return profile compared to market speculation, which continuously holds the less volatile money market instruments.
5.2.2 Analysis of the Required Predictive Accuracies.

It is clear from the analysis that the general trend in the market has a substantial effect on the returns available to timers. This will have an effect on the required forecasting accuracy needed to outperform the index. Table 16 shows the accuracies required for the three strategies to outperform the market under the different market conditions.

The results for the total time series are typical of previous studies. To be guaranteed a return greater than the market (point B) accuracy levels around the high eighties were required. There appears to be little difference among the required forecasting abilities between bear and traditional timing for the three identified levels (points B, C and D). Bull timing, however, required a higher degree of forecasting ability at all levels.

When the market turns bullish it becomes extremely difficult to beat the index regardless of which strategy is chosen. In most cases even perfect bull timing is not capable of outperforming the benchmark largely due to the costs of the many call options needed. Again there appears to be very little difference between bear timing and traditional timing. Both strategies required predictive accuracies in the high eighties to low nineties to be guaranteed a return greater than that of the index and in most cases the accuracy required just to have and equal chance of beating the market is in the low seventies. Clearly these results indicate that market timing during a bullish phase is unlikely to outperform the market and it would be advisable to merely invest in the index and benefit from the strong market returns.

However when the market turns bearish market timing appears to become a feasible strategy. For bear timing and traditional timing to result in out performance, the required predictive accuracies fell to around the high sixties or low seventies. What is more reassuring is that the required predictive accuracy to have an equal chance of beating the market for all sub periods bar one (1/48 to 1/62) fell below that of a random guess. Thus if investors randomly chose which asset class would perform best in the next review period then they would have a better than average chance of beating the index. This is a departure from previous studies that suggest that some level of timing ability is required to gain from such an investment strategy.
Table 16 Required Predictive Accuracies for the Identified Time Periods

<table>
<thead>
<tr>
<th>Period</th>
<th>Date</th>
<th>Bull Timing</th>
<th>Bear Timing</th>
<th>Traditional Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Sure Gain</td>
<td>Equal Chance</td>
<td>Sure Loss</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Point B*</td>
<td>Point C*</td>
<td>Point D*</td>
</tr>
<tr>
<td>Total</td>
<td>1/25 to 12/00</td>
<td>91.7</td>
<td>76.1</td>
<td>35.2</td>
</tr>
<tr>
<td>Bull Comb</td>
<td>1/33 to 1/37</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Bull</td>
<td>2/41 to 1/48</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Bull</td>
<td>1/66 to 4/69</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Bull</td>
<td>1/72 to 6/73</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Bull</td>
<td>6/77 to 9/81</td>
<td>100.0</td>
<td>99.9</td>
<td>96.7</td>
</tr>
<tr>
<td>Bull</td>
<td>8/82 to 8/87</td>
<td>97.0</td>
<td>93.6</td>
<td>70.0</td>
</tr>
<tr>
<td>Bull</td>
<td>1/89 to 1/90</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Bull</td>
<td>2/93 to 12/95</td>
<td>98.7</td>
<td>97.8</td>
<td>64.8</td>
</tr>
<tr>
<td>Bull</td>
<td>1/99 to 8/00</td>
<td>98.3</td>
<td>96.7</td>
<td>86.0</td>
</tr>
<tr>
<td>Bear Comb</td>
<td>5/28 to 1/33</td>
<td>68.5</td>
<td>20.4</td>
<td>7.4</td>
</tr>
<tr>
<td>Bear</td>
<td>1/37 to 2/41</td>
<td>60.6</td>
<td>14.0</td>
<td>2.8</td>
</tr>
<tr>
<td>Bear</td>
<td>1/48 to 1/62</td>
<td>52.5</td>
<td>24.5</td>
<td>11.1</td>
</tr>
<tr>
<td>Bear</td>
<td>4/69 to 1/72</td>
<td>93.9</td>
<td>78.9</td>
<td>24.9</td>
</tr>
<tr>
<td>Bear</td>
<td>8/73 to 6/82</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Bear</td>
<td>9/81 to 1/99</td>
<td>51.1</td>
<td>22.8</td>
<td>10.3</td>
</tr>
<tr>
<td>Bear</td>
<td>8/87 to 1/99</td>
<td>31.4</td>
<td>10.9</td>
<td>5.8</td>
</tr>
<tr>
<td>Bear</td>
<td>12/95 to 1/99</td>
<td>27.1</td>
<td>6.5</td>
<td>3.2</td>
</tr>
</tbody>
</table>

* Points B, C and D refer to points on Figure 5 (p 50)
What is of even more interest is the performance of bull timing during these bear periods. It is by far the superior strategy, requiring low predictive accuracies to guarantee a return greater than that of the market. In two cases, 4/69 to 1/72 and 9/81 to 6/82, any level of predictive ability, including totally imperfect timing, would have outperformed the index. This occurs due to the superior returns generated from the underlying money market instruments. This added return provides a buffer to absorb erroneous forecasts before the return falls below that of the benchmark. In many cases forecasting ability below that of a random guess would guarantee a return greater than the index. This is contrary to previous studies and reinforces what Sy (1990) highlighted, namely that there are pockets of time in which market timing could be a viable and successful investment strategy.

5.2.3 Loss/gain and Compression Ratios.

From the football analysis two further ratios, the loss/gain ratio and the compression ratio can be calculated. These facilitate the assessment of the risk associated with market timing. The loss/gain ratio is the absolute ratio of potential loss from totally inaccurate timing to potential gain on perfect timing, relative to the buy-and-hold return. The compression ratio measures how many of the most influential periods investors can miss, relative to the total number of periods, before the returns fall below that of the buy-and-hold. If investors miss all of these periods then it would be impossible for them to outperform the index. These results are shown in Table 17.

The loss/gain ratios for the total time series, being greater than 1 for each strategy, indicate that investors can lose more than they can gain. For bull timing, the ratio is above 2, indicating that range of possible returns from under performing the index is more than twice that for outperforming it.

For the bull market phases the loss/gain ratio rises substantially for all three strategies indicating that the range of possible returns available above the buy-and-hold return is significantly less than the obtainable range below the benchmark return.
When the market turns bearish this ratio falls below 1 for each strategy in each time period except one, 1/48 to 1/62. This indicates that the range of possible returns above the buy-and-hold return is greater than the range below. This suggests that investors can gain more than they can lose. For bull timing there are two cases where the loss/gain ratio is zero indicating that, regardless of their timing ability, investors would not have under performed the index, a similar conclusion to that deduced in Table 16.

### Table 17 Loss/Gain and Compression Ratios

<table>
<thead>
<tr>
<th>Period</th>
<th>Date</th>
<th>Loss/Gain Ratio</th>
<th>Compression Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Bull</td>
<td>Bear</td>
</tr>
<tr>
<td>Total</td>
<td>1/25 to 12/00</td>
<td>2.09</td>
<td>1.10</td>
</tr>
<tr>
<td>Bull Comb</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bull</td>
<td>1/33 to 1/37</td>
<td>n/a</td>
<td>2.53</td>
</tr>
<tr>
<td>Bull</td>
<td>2/41 to 1/48</td>
<td>n/a</td>
<td>8.32</td>
</tr>
<tr>
<td>Bull</td>
<td>1/66 to 4/69</td>
<td>n/a</td>
<td>6.34</td>
</tr>
<tr>
<td>Bull</td>
<td>1/72 to 6/73</td>
<td>n/a</td>
<td>2.36</td>
</tr>
<tr>
<td>Bull</td>
<td>6/77 to 9/81</td>
<td>716.47</td>
<td>1.55</td>
</tr>
<tr>
<td>Bull</td>
<td>6/82 to 8/87</td>
<td>7.19</td>
<td>1.59</td>
</tr>
<tr>
<td>Bull</td>
<td>1/89 to 1/90</td>
<td>n/a</td>
<td>105.54</td>
</tr>
<tr>
<td>Bull</td>
<td>2/93 to 12/95</td>
<td>9.67</td>
<td>1.86</td>
</tr>
<tr>
<td>Bull</td>
<td>1/99 to 8/00</td>
<td>16.69</td>
<td>2.98</td>
</tr>
<tr>
<td>Bear Comb</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bear</td>
<td>5/28 to 1/33</td>
<td>0.38</td>
<td>0.66</td>
</tr>
<tr>
<td>Bear</td>
<td>1/37 to 2/41</td>
<td>0.35</td>
<td>0.54</td>
</tr>
<tr>
<td>Bear</td>
<td>1/48 to 1/62</td>
<td>0.41</td>
<td>0.72</td>
</tr>
<tr>
<td>Bear</td>
<td>4/69 to 1/72</td>
<td>1.86</td>
<td>1.24</td>
</tr>
<tr>
<td>Bear</td>
<td>6/73 to 6/77</td>
<td>0.00</td>
<td>0.40</td>
</tr>
<tr>
<td>Bear</td>
<td>9/81 to 6/82</td>
<td>0.30</td>
<td>0.55</td>
</tr>
<tr>
<td>Bear</td>
<td>8/87 to 1/89</td>
<td>0.00</td>
<td>0.21</td>
</tr>
<tr>
<td>Bear</td>
<td>12/95 to 1/99</td>
<td>0.10</td>
<td>0.56</td>
</tr>
</tbody>
</table>

n/a indicates that perfect timing does not produce a return above that of the market

The compression ratios highlight the importance of predicting the most influential periods and how much of an effect these periods have on a market timing strategy. For the whole time series the compression ratio was about 14% for traditional and bear timing and even less for bull timing. This implies that if investors incorrectly predicted the top 14% of the periods then it would be impossible for them to outperform the market. The ratio gives an indication of how reliant a market timing strategy is on correctly predicting only a few significant periods.
When the market turns bullish the compression ratios fall further, indicating that almost any error in forecasting is likely to result in underperformance. For bull timing, five of the compression ratios are zero and correspond to the periods in which even perfect predictive ability would not have resulted in the out performance of the index.

For the bearish market phases the compression ratios are considerably higher in all but one period, 1/48 to 1/62. This indicates that when the market turns bearish there appears to be far more room for error. In some cases the compression ratio is greater than 50% indicating that even if the best half of the periods were incorrectly forecasted the strategy would still outperform the index.

The loss/gain and compression ratios reinforce the results of the required forecasting ability indicating that market timing during bullish periods should be avoided but during bearish market phases there appears to be a better than average chance of beating the market.

The time period 1/48 to 1/62 appears to be dissimilar to the other identified bear periods since it is the only bear period in which, despite being declared bearish, the market outperforms the money market instruments, albeit by only 0.34%. This will negate many of the benefits that the bull timing strategy enjoys which are largely provided by the additional return supplied by the money market instruments.

5.3 Risk Analysis Results
The focus of this section is to assess the risk characteristics of each of the three timing strategies under the different market conditions. These results assist in understanding the relative performance of the strategies and explain why one strategy appears to outperform another at no extra apparent cost. This hidden benefit can often be attributed to the risk as measured by the volatility of the returns produced.
5.3.1 Risk Analysis of the Total Time Series.

Apart from the volatility of returns, other parameters provide an insight to the risks associated with market timing. Table 18 displays a summary of results from the simulation studies for the whole time series. For each level of predictive accuracy 500 successful simulations were collected. The rows labelled max and min obtained reflect the maximum and minimum return achieved during the simulation which are presented alongside the mean and median for the sample. The standard deviation (Std Dev) gives a measure of dispersion of the 500 simulated returns, i.e. it gives an indication of how ‘fat’ the football is. The skewness and kurtosis are calculated for each simulation from which the Jarque-Bera statistic is calculated to test for normality at a 5% significance level. This normality test was done using Economic Views 2.0.

Table 18 Simulation Results. Total Time Series.

<table>
<thead>
<tr>
<th></th>
<th>Predictive Accuracy Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10% 20% 30% 40% 50% 60% 70% 80% 90%</td>
</tr>
<tr>
<td></td>
<td>Max Obtained</td>
</tr>
<tr>
<td>Min Obtained</td>
<td>-1.8 1.3 3.8 6.7 9.5 12.2 15.2 18.1 20.8</td>
</tr>
<tr>
<td>Median</td>
<td>-1.6 0.0 2.7 5.3 8.1 10.9 13.9 16.9 19.9</td>
</tr>
<tr>
<td>Mean</td>
<td>-2.6 0.0 2.7 5.3 8.1 10.9 13.9 16.9 19.9</td>
</tr>
<tr>
<td>Std Dev (%)*</td>
<td>0.28 0.35 0.39 0.45 0.45 0.46 0.44 0.41 0.32</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.31 0.06 0.03 0.04 -0.06 -0.10 -0.02 -0.16 -0.13</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>-0.06 0.15 0.13 -0.01 -0.06 -0.07 -0.28 0.03 -0.27</td>
</tr>
<tr>
<td>Normal*</td>
<td>No Yes Yes Yes Yes Yes Yes No</td>
</tr>
<tr>
<td></td>
<td>Min Obtained</td>
</tr>
<tr>
<td>Median</td>
<td>1.7 4.3 6.9 9.6 12.5 15.3 18.2 21.2 24.3</td>
</tr>
<tr>
<td>Mean</td>
<td>1.8 4.3 7.0 9.7 12.5 15.3 18.2 21.2 24.2</td>
</tr>
<tr>
<td>Std Dev (%)*</td>
<td>0.32 0.47 0.54 0.59 0.60 0.60 0.59 0.53 0.41</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.50 0.41 0.23 0.31 -0.08 0.12 -0.22 -0.25 -0.43</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>0.36 -0.01 0.01 -0.12 -0.34 -0.16 0.12 -0.07 -0.05</td>
</tr>
<tr>
<td>Normal*</td>
<td>No No Yes No Yes Yes Yes No</td>
</tr>
</tbody>
</table>

*Standard Deviation of the range of possible returns
*Tested at a 5% significance level

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The results give an indication of the range and nature of the distribution of possible returns at each selected level of predictive accuracy. Most apparent is that the normality tests indicate that the majority of distributions are normally distributed except at the extreme upper and lower levels of predictive ability.

The skewness results imply that the proficient timers are more likely to achieve returns closer to the best case scenario, but as the forecasting ability falls the skewness rises indicating that the less proficient timers are more likely to end up near the worst case boundary. This reinforces the findings of Firer et al. (1992b).

At each level of predictive accuracy traditional timing provides the widest range of returns (standard deviation) followed by bear timing and lastly bull timing. That is to say that traditional timing produces a ‘fatter football’ relative to the option strategies. A possible cause for this is when traditional timers make a timing error they suffer the difference in returns between the two asset classes which is often more than the loss suffered by the option timers, the latter being the cost of the options. Also option timers still benefit from incorrect decisions since they continue to hold the underlying asset, thus reaping the rewards of its superior performance despite making an incorrect decision.

The difference in the range of returns at each level of predictive accuracy between the two option strategies can be explained by the nature of the underlying assets. The money market instruments are far less volatile than the index thus reducing the potential range of returns for the bull timers.

The returns achieved by the simulations support the findings of Waksman et al (1996) and Dumont de Chassart et al (2000) in that at high levels of timing ability, traditional timing provides the highest return of the three strategies but at the other end of the scale the option strategies provide higher returns, thus reducing the downside risk.

In Figure 6 the simulated returns against the standard deviations of the time series of returns are graphed.
Figure 6 Risk Analysis Total Time Series
The line ‘Diversification Within’ represents the returns achieved by investing a certain portion of the portfolio in the market in each month throughout the time period. The line ‘Diversification Across’ indicates the returns obtained by committing the whole portfolio to the market for a certain period of time otherwise it is invested in the money market instruments. The results duplicate Firer et al.’s (1992b) findings and thus again support Samuelson’s (1989) view that diversification across time will yield lower returns at a higher risk than when compared to diversification within each time period. Each marker on the lines indicates the percentage, in increments of 10%, of time or value committed to the index. For the timing strategies each marker represents the predictive accuracy level, again in increments of 10%.

From the graph it can be seen that bear timing produced the most volatile returns followed by traditional and lastly bull timing. Clearly being invested in the market continuously, as with bear timing, results in a high standard deviation of returns. Bull timing, on the other hand, continuously holds the money market instruments thus reducing the overall variability of the strategy. Traditional timing causes the portfolio to be exposed to both asset classes thus resulting in an ‘average’ standard deviation therefore lying between the two option strategies.

Comparing across the timing strategies, traditional timing results in a higher and lower possible return at the extreme levels of predictive accuracy, again supporting the results of previous studies. Comparing the option strategies bear timing provides a higher return at each level of predictive accuracy but this is achieved at almost twice the level of risk.

The graph also gives an insight into the required timing ability necessary to beat the market on a risk-adjusted basis. For each strategy the timing line intersects the diversified within each time period line at roughly 55% indicating that investors only have be correct 55% of the time to have an equal chance of beating the risk adjusted benchmark return. This is significantly lower than Sharpe’s (1975) result.
The graph also indicates that for bear timing a reduction in forecasting ability causes the standard deviation of returns to rise, hence more risk. Perfect bear timing participates in every market rise but more importantly protects the portfolio from every market decline. As the forecasting ability falls the portfolio becomes more and more exposed to the downward market movements hence increasing the volatility.

In bull timing a reduction in volatility is experienced as the forecasting accuracy falls. Perfect bull timing has the ability to capture every market rise thus resulting in the high volatility. However as the forecasting ability falls less of these market up swings are captured, causing the volatility to fall.

An increase followed by a decrease in volatility is experienced in traditional timing as the timing ability falls. Perfect traditional timing avoids all the market downturns by switching to money market instruments, therefore escaping the market’s downward variability hence reducing the total variance of returns. At the other end of the scale, totally imperfect traditional timing avoids all the market upturns thus reducing the overall volatility. In between these two boundaries the traditional timing strategy becomes exposed to both the market rises and the market falls for correct and incorrect decisions respectively. Being exposed in this manner will clearly increase the volatility as indicated in the graph.

5.3.2 Risk Analysis of the Bullish Trend.

Running the simulations for the three timing strategies during the identified bull trend produced the results shown in Table 19. What is most noticeable are the high returns available for the proficient timers. However it must be noted that the index did achieve a return of 39.3% over the same period of time. The standard deviation of the range of returns from top to bottom of the football at each level of predictive accuracy is also greater than when compared to the total time series. Even though there are fewer statistically non-normal distributions, the skewness does indicate the same trend as observed for the total time period, in that proficient timers were more likely to achieve a return closer to the upper boundary whereas poor timers suffer the opposite result.
Traditional timing again exhibited the highest range of returns at each level of predictive accuracy but contrary to the previous results bear timing resulted in a lower range than bull timing. A possible explanation is that, being in a bullish trend, bear timers are unlikely to purchase many put options, and if they do they are likely to expire out of the money thus having a minimal effect on the range of returns. Bull timers however, are more likely to purchase call options that end up in-the-money thus providing a high return and therefore adding to the potential range of the overall returns.

Under this bullish trend the returns generated by bear timing are noticeably high regardless of the level of predictive ability. This stems from the underlying index, constantly held by this strategy, performing extremely well, thus boosting returns.

Table 19 Simulation Results, Identified Bull Periods.

<table>
<thead>
<tr>
<th>Predictive Accuracy Level</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Obtained</td>
<td>2.6</td>
<td>8.2</td>
<td>14.4</td>
<td>19.9</td>
<td>25.8</td>
<td>31.6</td>
<td>37.2</td>
<td>43.6</td>
<td>48.9</td>
</tr>
<tr>
<td>Min Obtained</td>
<td>-0.9</td>
<td>3.3</td>
<td>7.4</td>
<td>11.8</td>
<td>18.0</td>
<td>23.4</td>
<td>29.5</td>
<td>35.5</td>
<td>43.2</td>
</tr>
<tr>
<td>Median</td>
<td>0.6</td>
<td>5.6</td>
<td>10.5</td>
<td>16.0</td>
<td>21.3</td>
<td>27.1</td>
<td>33.3</td>
<td>39.5</td>
<td>46.4</td>
</tr>
<tr>
<td>Mean</td>
<td>0.7</td>
<td>5.6</td>
<td>10.5</td>
<td>15.9</td>
<td>21.3</td>
<td>27.1</td>
<td>33.3</td>
<td>39.5</td>
<td>46.3</td>
</tr>
<tr>
<td>Std Dev (%)</td>
<td>0.65</td>
<td>0.92</td>
<td>1.27</td>
<td>1.41</td>
<td>1.30</td>
<td>1.29</td>
<td>0.97</td>
<td>-0.12</td>
<td>-0.15</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.19</td>
<td>0.13</td>
<td>0.37</td>
<td>0.27</td>
<td>0.03</td>
<td>0.01</td>
<td>0.00</td>
<td>0.07</td>
<td>0.12</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>-0.23</td>
<td>-0.06</td>
<td>0.07</td>
<td>0.06</td>
<td>-0.06</td>
<td>0.02</td>
<td>-0.12</td>
<td>-0.18</td>
<td>-0.18</td>
</tr>
<tr>
<td>Normal*</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Max Obtained</td>
<td>3.1</td>
<td>7.3</td>
<td>9.9</td>
<td>14.3</td>
<td>17.8</td>
<td>21.5</td>
<td>23.9</td>
<td>27.3</td>
<td>31.1</td>
</tr>
<tr>
<td>Min Obtained</td>
<td>0.3</td>
<td>2.8</td>
<td>5.8</td>
<td>7.9</td>
<td>12.0</td>
<td>15.3</td>
<td>19.3</td>
<td>23.2</td>
<td>27.8</td>
</tr>
<tr>
<td>Median</td>
<td>1.4</td>
<td>4.7</td>
<td>7.8</td>
<td>11.1</td>
<td>14.6</td>
<td>18.1</td>
<td>21.7</td>
<td>25.5</td>
<td>29.4</td>
</tr>
<tr>
<td>Mean</td>
<td>1.5</td>
<td>4.7</td>
<td>7.8</td>
<td>11.2</td>
<td>14.6</td>
<td>18.1</td>
<td>21.7</td>
<td>25.4</td>
<td>29.4</td>
</tr>
<tr>
<td>Std Dev (%)</td>
<td>0.47</td>
<td>0.62</td>
<td>0.89</td>
<td>0.90</td>
<td>0.90</td>
<td>0.86</td>
<td>0.77</td>
<td>0.67</td>
<td>0.59</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.44</td>
<td>0.19</td>
<td>0.04</td>
<td>0.13</td>
<td>0.27</td>
<td>0.04</td>
<td>-0.05</td>
<td>-0.11</td>
<td>-0.18</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>0.09</td>
<td>0.77</td>
<td>-0.28</td>
<td>0.25</td>
<td>0.15</td>
<td>0.31</td>
<td>-0.10</td>
<td>-0.39</td>
<td>-0.18</td>
</tr>
<tr>
<td>Normal*</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Max Obtained</td>
<td>19.9</td>
<td>23.0</td>
<td>26.3</td>
<td>29.1</td>
<td>32.1</td>
<td>34.9</td>
<td>38.2</td>
<td>43.2</td>
<td>45.5</td>
</tr>
<tr>
<td>Min Obtained</td>
<td>17.9</td>
<td>20.2</td>
<td>22.4</td>
<td>25.5</td>
<td>28.2</td>
<td>31.0</td>
<td>33.5</td>
<td>37.4</td>
<td>40.7</td>
</tr>
<tr>
<td>Median</td>
<td>18.7</td>
<td>21.5</td>
<td>24.3</td>
<td>27.1</td>
<td>30.1</td>
<td>33.0</td>
<td>36.1</td>
<td>39.2</td>
<td>42.5</td>
</tr>
<tr>
<td>Mean</td>
<td>18.7</td>
<td>21.5</td>
<td>24.3</td>
<td>27.2</td>
<td>30.1</td>
<td>33.0</td>
<td>36.1</td>
<td>39.2</td>
<td>42.5</td>
</tr>
<tr>
<td>Std Dev (%)</td>
<td>0.36</td>
<td>0.51</td>
<td>0.60</td>
<td>0.65</td>
<td>0.68</td>
<td>0.67</td>
<td>0.67</td>
<td>0.58</td>
<td>0.45</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.43</td>
<td>0.13</td>
<td>0.10</td>
<td>0.10</td>
<td>0.07</td>
<td>-0.15</td>
<td>-0.06</td>
<td>-0.21</td>
<td>-0.50</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>0.16</td>
<td>-0.38</td>
<td>-0.22</td>
<td>-0.20</td>
<td>-0.07</td>
<td>0.00</td>
<td>0.39</td>
<td>-0.01</td>
<td>0.32</td>
</tr>
<tr>
<td>Normal*</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

*Standard Deviation of the range of possible returns
^Tested at a 5% significance level
Figure 7 Risk Analysis Identified Bull Period

- Diversification Within
- Diversification Across
- Bear Timing
- Bull Timing
- Trad Timing

Return (% p.a.) vs. Standard Deviation (% p.a.)
Figure 7 displays the risk/return relation for the three timing strategies under the bullish market condition. Clearly all the returns are enhanced from the performance of the index. The diversification across time significantly underperforms the diversification within each time period during this bull run. Traditional timing again provides both the highest but also the lowest return at the extremes of the timing ability scale. Totally imperfect timing ability using the bear strategy yields higher returns than those achieved with a 50% timing ability using the bull strategy. Also perfect predictive ability using a bull timing strategy still underperforms the benchmark unadjusted for risk. These factors are attributed to the high performance of the market.

From Figure 7 it can be seen that, with risk taken into account, bull timers need to be correct roughly 75% of the time to have an equal chance of beating the market. Traditional timing requires a lower timing ability (65%) to have an equal chance of matching the risk adjusted index return with bear timing requiring only a 60% timing ability to achieve the same goal. These results indicate that when the market is bullish market timing becomes more challenging. Again the reduction in the required predictive accuracies between the option strategies can be attributed to the underlying asset class held.

5.3.3 Risk Analysis of the Bearish Trend.

Table 20 displays the results of the simulations run for the three timing strategies during the identified bear trend. Clearly, given the poor performance of the market, the returns across the different timing strategies are far lower than the previous two sets of results. Under these market conditions bull timing appears to be the best strategy to employ mainly due to the reduced downside risk, as can be seen by the relatively high returns generated at the low levels of predictive ability. This attribute is derived from the money market instruments outperforming the index.

Comparing the standard deviation of the range of returns at each level of predictive accuracy, traditional timing again provides the widest spread and, as with the analysis of the total time series, bear timing results in a wider spread than bull timing. Again
there is prevalence of non normality at the extreme ends of the timing ability spectrum and the skewness once more indicates that the proficient timers are likely to fare well at market timing.

Table 20 Simulation Results. Identified Bear Periods.

<table>
<thead>
<tr>
<th>Predictive Accuracy Level</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
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</thead>
<tbody>
<tr>
<td>10%</td>
<td>-12.3</td>
<td>-7.5</td>
<td>-3.7</td>
<td>0.7</td>
<td>5.2</td>
<td>9.3</td>
<td>14.3</td>
<td>18.6</td>
<td>22.8</td>
</tr>
<tr>
<td>20%</td>
<td>-15.9</td>
<td>-13.8</td>
<td>-9.5</td>
<td>-6.7</td>
<td>-1.7</td>
<td>1.3</td>
<td>6.5</td>
<td>12.4</td>
<td>17.5</td>
</tr>
<tr>
<td>30%</td>
<td>-14.5</td>
<td>-10.8</td>
<td>-6.8</td>
<td>-2.9</td>
<td>1.7</td>
<td>6.0</td>
<td>10.9</td>
<td>15.6</td>
<td>20.7</td>
</tr>
<tr>
<td>40%</td>
<td>-14.5</td>
<td>-10.8</td>
<td>-6.8</td>
<td>-2.8</td>
<td>1.6</td>
<td>6.0</td>
<td>10.9</td>
<td>15.6</td>
<td>20.7</td>
</tr>
<tr>
<td>50%</td>
<td>0.60</td>
<td>0.87</td>
<td>1.07</td>
<td>1.22</td>
<td>1.24</td>
<td>1.21</td>
<td>1.11</td>
<td>0.92</td>
<td></td>
</tr>
<tr>
<td>60%</td>
<td>0.26</td>
<td>0.27</td>
<td>0.12</td>
<td>0.02</td>
<td>-0.08</td>
<td>-0.20</td>
<td>-0.16</td>
<td>-0.31</td>
<td></td>
</tr>
<tr>
<td>70%</td>
<td>-0.13</td>
<td>0.42</td>
<td>-0.27</td>
<td>-0.02</td>
<td>-0.16</td>
<td>0.15</td>
<td>-0.07</td>
<td>-0.16</td>
<td></td>
</tr>
<tr>
<td>80%</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>90%</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>50%</td>
<td>-5.1</td>
<td>-2.9</td>
<td>-0.1</td>
<td>2.2</td>
<td>4.9</td>
<td>7.6</td>
<td>9.9</td>
<td>12.6</td>
<td>14.7</td>
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<tr>
<td>60%</td>
<td>-7.7</td>
<td>-5.7</td>
<td>-3.4</td>
<td>-1.3</td>
<td>0.7</td>
<td>3.5</td>
<td>5.7</td>
<td>8.9</td>
<td>12.0</td>
</tr>
<tr>
<td>70%</td>
<td>-6.8</td>
<td>-4.5</td>
<td>-2.1</td>
<td>0.3</td>
<td>2.9</td>
<td>5.4</td>
<td>8.1</td>
<td>10.7</td>
<td>13.5</td>
</tr>
<tr>
<td>80%</td>
<td>-6.8</td>
<td>-4.5</td>
<td>-2.0</td>
<td>0.4</td>
<td>2.8</td>
<td>5.4</td>
<td>8.1</td>
<td>10.7</td>
<td>13.5</td>
</tr>
<tr>
<td>90%</td>
<td>0.37</td>
<td>0.51</td>
<td>0.62</td>
<td>0.64</td>
<td>0.68</td>
<td>0.69</td>
<td>0.67</td>
<td>0.59</td>
<td>0.44</td>
</tr>
<tr>
<td>10%</td>
<td>0.25</td>
<td>0.32</td>
<td>0.21</td>
<td>0.06</td>
<td>0.14</td>
<td>0.11</td>
<td>0.17</td>
<td>-0.08</td>
<td>-0.20</td>
</tr>
<tr>
<td>20%</td>
<td>0.24</td>
<td>0.16</td>
<td>-0.19</td>
<td>-0.09</td>
<td>0.17</td>
<td>0.15</td>
<td>-0.05</td>
<td>0.09</td>
<td>0.02</td>
</tr>
<tr>
<td>30%</td>
<td>No</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>40%</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>50%</td>
<td>Max Obtained</td>
<td>-9.4</td>
<td>-5.7</td>
<td>-3.2</td>
<td>-0.3</td>
<td>2.8</td>
<td>5.7</td>
<td>8.6</td>
<td>11.1</td>
</tr>
<tr>
<td>60%</td>
<td>Min Obtained</td>
<td>-12.2</td>
<td>-10.3</td>
<td>-8.2</td>
<td>-5.4</td>
<td>-2.8</td>
<td>-0.6</td>
<td>2.7</td>
<td>6.2</td>
</tr>
<tr>
<td>70%</td>
<td>Median</td>
<td>-11.3</td>
<td>-8.5</td>
<td>-5.8</td>
<td>-2.9</td>
<td>-0.1</td>
<td>2.9</td>
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<td>Mean</td>
<td>-11.2</td>
<td>-8.5</td>
<td>-5.8</td>
<td>-3.0</td>
<td>0.0</td>
<td>2.9</td>
<td>6.1</td>
<td>9.1</td>
</tr>
<tr>
<td>90%</td>
<td>Std Dev (%)*</td>
<td>0.57</td>
<td>0.74</td>
<td>0.92</td>
<td>0.97</td>
<td>1.07</td>
<td>1.04</td>
<td>1.02</td>
<td>0.88</td>
</tr>
<tr>
<td>10%</td>
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<td>0.35</td>
<td>0.18</td>
<td>-0.02</td>
<td>-0.04</td>
<td>-0.12</td>
<td>-0.23</td>
<td>-0.29</td>
</tr>
<tr>
<td>20%</td>
<td>Kurtosis</td>
<td>0.15</td>
<td>-0.01</td>
<td>-0.32</td>
<td>-0.29</td>
<td>-0.40</td>
<td>-0.20</td>
<td>-0.18</td>
<td>-0.15</td>
</tr>
<tr>
<td>30%</td>
<td>Normal#</td>
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<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>40%</td>
<td>Normal#</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

*Standard Deviation of the range of possible returns
#Tested at a 5% significance level

The risk/return profile, shown in Figure 8 indicates that the index under performed the money market instruments and that this return was achieved at a higher level of risk.

One of the most striking features is that diversification across time outperformed diversification within each time period but the former returns were still obtained at higher levels of risk. This is a departure from Samuelson’s (1989) supposition and is caused by the market having a lower return at a higher level of risk.
Figure 8 Risk Analysis Identified Bear Periods
What is contrary to the results of previous research is that on a risk adjusted basis all three timing strategies require a less than 50% timing ability to beat the market i.e. a random guess will outperform the benchmark. However it must be noted that the returns achieved are very low.

Comparing Figure 8 with Figures 6 and 7 it is evident that despite the low returns there does not appear to be a reduction in the variance of the returns. Therefore the market condition appears to have a negligible affect on the overall variability of returns.

5.3.4 Analysis of the Risk Adjusted Returns Using the Sharpe Ratio.

The Sharpe ratio, a conventional performance measure that estimates the reward per unit of risk, is commonly calculated as excess return per unit of standard deviation. Table 21 displays the Sharpe ratios for each strategy under the three market conditions. The figures in red indicate the highest return/risk for the particular market phase whereas the blue figures indicate the lowest.

### Table 21 Return Per Unit of Risk for the Three Timing Strategies

<table>
<thead>
<tr>
<th>Mkt. Phase</th>
<th>Total (0.43)*</th>
<th>Bullish (1.74)*</th>
<th>Bearish (-0.39)*</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Bull</td>
<td>Bear</td>
<td>Traditional</td>
</tr>
<tr>
<td>0%</td>
<td>-2.52</td>
<td>-0.38</td>
<td>-1.65</td>
</tr>
<tr>
<td>10%</td>
<td>-1.60</td>
<td>-0.30</td>
<td>-1.23</td>
</tr>
<tr>
<td>20%</td>
<td>-1.01</td>
<td>-0.13</td>
<td>-0.82</td>
</tr>
<tr>
<td>30%</td>
<td>-0.53</td>
<td>0.04</td>
<td>-0.44</td>
</tr>
<tr>
<td>40%</td>
<td>-0.14</td>
<td>0.21</td>
<td>-0.07</td>
</tr>
<tr>
<td>50%</td>
<td>0.22</td>
<td>0.40</td>
<td>0.29</td>
</tr>
<tr>
<td>60%</td>
<td>0.56</td>
<td>0.59</td>
<td>0.68</td>
</tr>
<tr>
<td>70%</td>
<td>0.89</td>
<td>0.79</td>
<td>1.08</td>
</tr>
<tr>
<td>80%</td>
<td>1.22</td>
<td>1.00</td>
<td>1.53</td>
</tr>
<tr>
<td>90%</td>
<td>1.57</td>
<td>1.23</td>
<td>2.03</td>
</tr>
<tr>
<td>100%</td>
<td>1.98</td>
<td>1.55</td>
<td>2.68</td>
</tr>
</tbody>
</table>

Red (blue) figures indicate the best (worst) Return/Risk for the particular market condition

* indicates Return/Risk for the index of the corresponding market phase

These results clearly display a definite pattern. At high levels of predictive accuracy traditional timing outperformed the option strategies on a risk adjusted basis. This is consistent with the previous results when unadjusted for risk. However, unlike the
prior results, bull timing fared the worst at low levels of predictive ability, as opposed to traditional timing when risk is taken into account. Bear timing proves to be the best strategy to employ at low levels of predictive accuracy, regardless of the market's performance.

Comparing the two option strategies at high levels of predictive accuracy, bull timing outperforms bear timing on a risk adjusted basis except when the market turns bullish. This again is similar to the previous results except for the total time series whereby bull timing outperforms bear timing when adjusted for risk.

These results also give an indication of the required predictive accuracy needed to beat the buy-and-hold the market return, on a risk adjusted basis. This occurs when the Sharpe ratio for the strategy equals that of the index for the particular time series. For the total time series the three strategies required roughly a 55% forecasting accuracy to achieve a superior risk adjusted return. During the bullish market phase this forecasting accuracy rose to about 65% for bear and traditional timing whereas bull timing required a higher 75% accuracy. For the bearish market phase these required risk adjusted forecasting accuracies fall to below that of a random guess with each strategy only requiring a 45% accuracy.

5.4 Summary of the Results

The three independent studies highlight certain attributes of the various market timing strategies, as well as how the different market conditions affect each strategy. Below, in point form, are the more pertinent results of the studies.

- Perfect traditional timing, not including transactions costs, outperformed perfect bull and perfect bear timing regardless of the markets performance. If transactions costs were in the order of 1.85% per switch this advantage would be eroded.
- During a bullish market phase perfect bear timing outperformed perfect bull timing and vice versa for a bearish market condition.
- Totally inaccurate traditional timing under performed totally inaccurate bull and totally inaccurate bear timing, regardless of the markets performance.
Some level of forecasting ability above that of a random guess was required to outperform the buy-and-hold return, except when the market turns bearish.

For the total time series, traditional and bear timing required roughly a 57% forecasting accuracy to have an equal chance of beating the index and a 87% forecasting accuracy to be guaranteed a return above that of the market. However, for the same criteria, bull timing required a 76% and 92% forecasting accuracy.

For the bullish phase traditional and bear timing required a 79% forecasting accuracy just to have an equal chance of outperforming the benchmark. To be guaranteed a return greater than the market under these market conditions the strategies required at least a 92% forecasting accuracy.

Bull timing did not outperform the index during the bullish phase, even if perfect predictive ability was achieved.

For the bearish phase, traditional and bear timing required a 35% forecasting accuracy to have an equal chance of outperforming the benchmark. To be guaranteed a return greater than the market under these market conditions the strategies required at least an 80% forecasting accuracy.

Bull timing only required a 20% forecasting accuracy to have an equal chance of beating the market under bearish conditions. A forecasting accuracy of 69% guaranteed bull timers a return superior to that of the bearish market.

For the total time series the loss/gain ratio was above 1 for traditional and bear timing and above 2 for bull timing, indicating that the range of possible returns from under performing the index were greater than for outperforming it.

For the bullish phase, the loss/gain ratio increased for all strategies.

Only when the market turned bearish did the loss/gain ratios fall below 1 indicating that there was a greater range of possible returns above the index than below it.

The risk analysis indicates that, regardless of the market condition, proficient timers were more likely to achieve a return closer to the best case scenario whereas poor timers were more likely to achieve a return closer to the worst case scenario.
• Bear timing always achieved returns at a higher level of risk (variance) than traditional timing. The bull timing returns were obtained with the least amount of risk. These attributes were unaffected by the market condition.

• On a risk adjusted basis, traditional timing remained the superior strategy at high levels of predictive accuracy. At low levels of predictive accuracy bear timing produced the highest risk adjusted returns. These attributes were unaffected by the market condition.

• Comparing across the option strategies, bull timing produced the highest risk adjusted returns at the higher levels of predictive accuracy except when the market turned bullish.

• For the total time series, on a risk adjusted basis, market timers required a 55% forecasting accuracy regardless of the strategy employed.

• For the bullish market phase bear and traditional timing required a 65% forecasting accuracy to outperform the risk adjusted market return. Bull Timing required a 75% forecasting accuracy to be in the same position.

• When the market turned bearish the three strategies only required a 45% forecasting accuracy to beat the market on a risk adjusted basis. This is below a random guess.

The three studies give an indication of how the market timing strategies analysed behave under the various market conditions. They complement and reinforce each other as well as eliminate uncertain areas when consolidated. What follows is a brief discussion on what the three studies together indicate about market timing under different market conditions.

The potential rewards from market timing are high if perfect predictability is achieved. This return will also be achieved at a lower level of risk than the market. However as the forecasting ability falls the advantages of market timing are quickly eroded. The potential returns are not only lower but will generally be achieved at a higher level of risk compared to perfect timing, unless a bull timing strategy is employed. To be guaranteed success at market timing, predictive ability of roughly 80% is required. For timing abilities below this threshold the success and risk profile
of such a strategy will largely be dependent on which review periods are incorrectly predicted.

For predictive ability below roughly 60% investors are more likely to underperform the market than to beat it. On a risk adjusted basis this falls to 55%. This indicates that investors need some level of predictive ability to be successful at market timing. The results also indicate that it is generally more important to predict the bullish review periods than the bearish ones.

On the downside market timers stand to lose more than they can gain. That is to say that there is a greater obtainable range of returns below the return on the index than above it, as indicated by the loss/gain ratio. Investors must also be aware that returns below those of money market instruments are possible.

It is clear that the market condition has a significant effect on all the market timing strategies analysed. When the market is in a bullish phase, extremely high levels of predictive accuracy are required just to have an even chance of beating the index, even to the extent that a bull timing strategy may not outperform the index regardless of the predictive ability. The only saving grace is, that on a risk adjusted basis, returns above the market are possible, albeit at high levels of predictive accuracy. Evidently, when the market is bullish, market timing is not a viable investment strategy.

Nevertheless this study does highlight that there are pockets of time where market timing may be viable. When the market turns bearish, opportunities appear for market timers. The main difficulty for market timers is the high levels of predictive accuracy needed to outperform the market. This obstacle disappears and predictive accuracies below that of a random guess are more than likely to produce a return above that provided by the market. The only catch is that the return on the bearish market is often below that of the money market instruments. Hence, despite the outperforming the benchmark, the overall return may not be acceptable. Again, as with the normal and bullish market conditions, market timing during a bearish period achieves returns at a level of risk below that of the index.
The results also give insight as to how each of the strategies perform under the different market conditions. It is clear that, for very high levels of predictive accuracy, traditional timing performs the best on both a nominal and on a risk adjusted basis. However, on the other end of the scale, poor timing using this strategy performs the worst on a nominal basis. Only when risk is taken into account does poor traditional timing outperform poor bull timing.

Comparing the two option strategies across the different market conditions does not fully resolve the question of which strategy is superior. However there are some observations which can be made. Firstly a bear timing strategy always generates its returns at a higher level of risk and secondly, except when the market turns bearish, the returns available at a given predictive accuracy are higher using a bear timing strategy. Only when the market turns bearish does bull timing outperform bear timing. This apparent advantage by bear timing over bull timing can largely be explained by the higher risk characteristics experienced by bear timing. This is evident when the risk analysis is applied to the total time series which indicates that bull timing outperformed bear timing on a risk adjusted basis.

These results indicate that there is no clear cut solution as to which is the best strategy to employ, but does describe the characteristics of the strategies and how they perform under different market conditions. By using this information investors can decide which strategy best suits their attitude towards risk and their perceived ability at predicting future market movements.
6 Conclusions

Market timing is a controversial investment strategy and many believe that it is not worth employing as it is unlikely to yield returns above that of the market. The majority of past studies conducted in this area indicate this to be a valid argument. The potential returns are high but the chances of achieving such gains are remote. In fact market timers are more likely to achieve a return below that of the market than above it. Predictive accuracies of roughly 60% to 70% are required just to have an equal chance of outperforming the market. However on the upside, market timing strategies produce returns at a lower level of risk. Simply this means that market timers require a 55% forecasting ability to have an equal chance of outperforming the benchmark on a risk adjusted basis. Nevertheless the odds are still stacked against the market timer.

To compound the problems for market timers, when the market turns bullish the chances of success fall drastically, sometimes to the extent that event perfect timing cannot outperform the market. The market itself provides an above normal return so to better this obviously requires outstanding forecasting ability.

However, there are some critics who believe that the problem is not fully understood. Sy (1990) observed that, even though market timing is unlikely to yield returns above that of the market on the whole, there are time periods when such a strategy could be very effective. This study has shown that this could be true when the market turns bearish. The results indicate that, when the market is bearish, a forecasting accuracy below that of a random guess is likely to have a better than average chance of outperforming the market. This is a radical departure from the results of many previous studies\(^5\), which suggested that investors require some level of forecasting skill to be successful at market timing. Nevertheless the returns generated can be poor despite outperforming the index. More importantly the returns may well be below

those of money market instruments. This is largely caused by the weak performance of the market.

Clearly the advantages of market timing during a bearish phase can only be harvested if investors can firstly identify when the market is in a bearish phase and secondly detect when it begins and ends. This study has not addressed this issue, as the focus was to assess the performance of market timing under different market conditions and not to forecast market movements. However Polakow's (2000) study did highlight a possible way of predicting future bullish and bearish markets. To factor in the risk of incorrectly predicting a bearish market phase may all but erase the benefit of implementing a strategy of only timing the market during bearish conditions otherwise buying-and-holding the market. Addressing this issue would obviously be an entire study on its own.

One further concern of this study is that market timers were restricted in as much they could only switch asset classes at the end of the month. In reality market timers may very well decide to switch whenever their perception of the market changes and not to be constrained by only being allowed to switch on certain days. Unfortunately, due to the nature of the data, monthly review periods were the shortest possible holding periods that could be accommodated. Also it must be noted that as the review period is reduced, transactions costs become a significant factor as the number of possible switches increases.

To conclude, market timing is risky. Merely assessing the risk in terms of volatility of returns does not do justice to the complex nature of such an investment strategy. Other factors such as forecasting ability and range of possible returns relative to the benchmark play a pivotal role in understanding the nature of market timing. The question of whether one could employ market timing successfully will depend on a variety of factors such as forecasting ability, market conditions and type of timing strategy employed.
It is hoped this study will add to the body of knowledge surrounding the contentious issue of market timing and pave the way towards a better understanding of the risks and rewards awaiting investors who seek to enhance their returns through the use of market timing strategies.
References


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