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A REVIEW OF THE EFFICIENCY OF THE JSE SECURITIES EXCHANGE

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A research report submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, in partial fulfillment of the requirements for the degree of Masters of Business Administration

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Abstract

The ability of stock markets to function and operate efficiently has long been a question posed by academics and investors alike. In an efficient market, all information is reflected within share prices and therefore leaves no chance for economically viable arbitrage opportunities. Although this notion has been supported by the Efficient Market Hypothesis, it has come under scrutiny over the last three decades.

This report has attempted to establish the extent to which the JSE Securities Exchange is an efficient market, based on the outcomes of previous empirical studies done from 1974 and 2006. Using the Historical Research Methodology, it has been found that overall the JSE Securities Exchange operates as an efficient market, in all forms of the Efficient Market Hypothesis. Along with this conclusion however, is an indication that the market also show signs of inefficiencies for certain stock types, which may have been exploited by shrewd investors.

Declaration

I, Adrian Michael Wood, declare that this research report is my own, unaided work. It is submitted in partial fulfillment of the requirements for the degree of Master of Business Administration in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

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Adrian Michael Wood

18 December 2006

Dedication

I would like to dedicate this work to Irma, my beloved wife, for all the support that she has given me, for all the time that she has sacrificed for me and for all the stress and pressure that she has endured along with me.

For all the times that I questioned myself, she was undoubtedly the source of rationality and inspiration, and without this the journey would have been lonely and far more testing.

Once again, thank you for everything.

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1. Introduction

1.1 Context of the Study

With the inception of the Efficient Market Hypothesis (EMH) and its refinement by Fama (1965, 1970) and Malkiel (1973), it was widely accepted that the price and return movements of the markets approximate that of a random walk. The markets also depict rationality and tend towards equilibrium and therefore expected returns vary according to their systematic risk. Further to this, the market price is fully reflective of all information at any point in time and therefore only through inside information can excessive profit be generated (Thompson & Ward, 1995).

In support of this hypothesis and Malkiel's investment strategy from 1973, Buffet (1996:4) remarks "*Most investors, both institutional and individual, will find that the best way to own common stocks (shares) is through an index fund that charges minimal fees. Those following this path are sure to beat the net results (after fees and expenses) of the great majority of investment professionals.*"

However the validity of the EMH has come under intensive scrutiny by both academics and practitioners alike. *Ex Post*, some events seem to suggest irrationality within the markets and failure of available information to be fully reflected within the prices – that is, signs of market overreaction. Some have

even suggested that prices are predictable based on past returns or through the use of various valuation matrices.

De Bondt & Thaler (1982, 1987) were the first to suggest that market efficiency is questionable, stating that many investors are "*poor Bayesian decision makers*" (De Bondt & Thaler, 1987:557) and as a result they overreact to new information causing prices to deviate from their fundamental value.

Since then there has been an onslaught of subsequent empirical studies done [Fama (1998), Black (1986), Kahnmann & Tversky (1979), Odean (1998), Aberbanell & Bernard (1992), Hand (1990), Porta (1997) *et al*] on this overreaction hypothesis and inefficiencies within the markets. These tend to prove serial correlation within the markets and hence market predictability. Included topics within these studies are investor irrationality, market overreaction or return reversal, (long-term negative serial correlation), market predictability, contrarian strategies, price momentum (short-term positive serial correlation), market timing and various others, leading to a new field of research called behavioural finance.

Even with the questioning of EMH as indicated above, the importance of an efficient market still remains, especially for developing countries, as Magnussun & Wydick (2002:142) state *"… considerable evidence points to beneficial effects of well functioning equity markets on the economic growth process in developing*

countries" suggesting the importance of an efficient market for the economic development of South Africa.

The efficiency of the JSE Securities Exchange (JSE) has also experienced its fair share of empirical studies around market efficiency, starting with Jammine & Hawkins (1974) followed by Affleck-Graves & Money (1975). Subsequent studies continue in support of both fields of market efficiency and financial behaviour within the South African market environment. The reason for this, perhaps, is due to the lack of consensus surrounding the level of efficiency of the JSE.

Thompson & Ward (1995) attempted to consolidate the South African studies done prior to 1993 on the JSE efficiency by reviewing and consolidating studies relating to weak, semi-strong or strong-form efficiency and came to the conclusion that the "evidence is at best mixed, particularly regarding weak and semi-strong form efficiency." (1995:33) and that the market depicted, if anything, strong form inefficiency.

1.2 Purpose of the Study

Following the consolidated review published by Thompson & Ward (1995), further international and local studies have been done to establish the efficiency-form of the JSE.

These studies have used further developed techniques and methodologies in order to understand whether the market shows efficiency in support of the EMH or whether behavioural finance provides a better understanding of how financial markets work.

The purpose of this research is to consolidate the work done by Thompson & Ward along with further studies in the 12 years following their review. This is to establish whether since then, there has been any conclusion to the uncertainty expressed about the JSE efficiency in their 1995 review.

1.3 Problem Statement

The Main Problem Statement:

The research based on empirical studies done prior to 1993 demonstrates mixed evidence on the efficiency of the JSE. Thus the aim of this research is to review all published South African empirical studies done on the market efficiency of the JSE in order to establish, through the consolidated evidence, a definitive level of the EMH.

The Sub Problem Statement 1: Determine the extent to which study periods, objectives, methodologies, sampling, data and results can be categorised according to commonalities and differences.

The Sub Problem Statement 2: Identify and evaluate the assumptions in both the methodology and models used to determine whether the inclusion of such assumptions could have caused misinterpretation within the results.

The Sub Problem Statement 3: Evaluate and analyse the reliability and validity of the study periods, objectives, methodologies, sampling, data and results of the studies according to the categorised results and assumptions.

1.4 Delimitations

- Only full reviews of published studies in South Africa will be considered as part of the critique.
- The focus of this research is on studies done on EMH rather than studies done on aspects of Behavioural Finance, however these will be considered if they speculate an efficient form.
- The objective of this research is not to provide empirical evidence that accepts or rejects the EMH for the JSE, but rather to identify whether previous research has obtained a consensus.
- The research will not attempt to understand (in)efficiencies within the JSE or provide any new methodology or techniques for identifying such (in)efficiencies.

1.5 Significance of the Study

The JSE plays a prominent role within world stock markets as it is one of the largest in the developing countries and is the largest in Africa. Its efficiency to operate within a global economy is important for success of the countries economy as a whole. Thus the significance of this research is to:

- Provide a consolidated source of EMH research conducted on the JSE which will further contribute to body of research already undertaking within this area of study.
- Provide clarity on the level of EMH of JSE. As South Africa is considered to still be a developing country, international funding and investment is of primary importance to the economic growth and stability. Major market inefficiency therefore plays an important role on international and local investor confidence within the country.
- Contribute to the ongoing debate between EMH versus Behavioural Finance. By providing a consolidated view of the South African studies done, it will contribute to markets efficiency debates as a whole, but more specifically to those of developing countries.

1.6 Assumptions

- All studies done on EMH are published within South African journals and no studies are published outside of South Africa.

- All published studies in reputable South African Journals are from credible authors.
- Methodologies and data used within the studies are reliable and come from credible sources.
- No manipulation of statistics, data or methodologies has been undertaking in order for the author(s) to come to bias conclusions.
- EMH holds for the JSE and that it is only the form of efficiency which is questionable.

1.7 Definition of Terms

1. *Efficient Market Hypothesis (EMH) or Efficient Markets*: Defines a market where investors will only be able to achieve an above-average return if they are willing to take above-average risk and price changes are associated with the random walk model.
2. *Weak Form Efficient:* Past stock market information is irrelevant for predicting future movements in stock prices. Fama (1970).
3. *Semi-Strong Form Efficient:* The market processes all publicly available information, rendering techniques of fundamental analysis, exploiting differences between discounted expected earnings and current prices useless for predicting future returns. Fama (1970).

4. *Strong Form Efficient*: The market efficiently converts all information into accurate security prices such that no information of any kind, public or private, will help investors achieve superior results. Fama (1970).
5. *Random Walk*: “a price series where all subsequent price changes represents random departures from previous prices” (Malkiel, 2003:59). In terms of stock prices, this implies that information is unimpeded and reflects immediately in the current price, while tomorrow’s price is only impacted by tomorrow’s information and not by today or previous day’s changes.
6. *Contrarian Strategy*: An investment strategy whereby the “loser” stocks of the previous period are bought while the winner stocks of the previous period are sold. This is the preferred strategy used in overreaction hypothesis.
7. *Buy-and-hold Strategy*: An investment strategy whereby stocks (or more often indices) are bought and held for the duration of a long term investment horizon. This is generally the preferred approach used in EMH theory.
8. *Active Portfolio Strategy*: An investment strategy used to rebalance stock portfolio’s based on professional investor’s superior ability to select profitable stocks and/or timing of the market.
9. *Overreaction Hypothesis (ORH):* This hypothesis is based on Kahnmann & Tversky (1979) prospect theory which states that investors react irrationally to new information compared to that of historical information.

This results in prices rising above their fundamental value in the short term and then reverting back to the fundamental value in the long term.

10. *Cumulative Abnormal Returns (CAR):* A method used in event studies to calculate the differential between expected returns and abnormal returns during an event. Cumulative Abnormal Returns
11. *Buy-and-hold Abnormal Returns (BHAR):* Provides the same functionality as cumulative abnormal returns (CAR).
12. *Beta-coefficient (beta):* Measure of systematic risk of an asset relative to an average asset. In shares this measure is the systematic risk of the individual share (or portfolio) relative to the market as a whole.

2. Literature Review

The literature review covers some of the many empirical studies done from the inception of EMH. As the United States (US) market has the highest capitalization and is arguably the most frequently traded, it should be considered to be the most efficient market in the world. The literature will however highlight the lack of consensus around the efficiency of this market, as the results of one study are consistently criticised and rejected by those that follow.

There seems to be considerable support for the US market efficiency and inefficiency. This dialectic seems to stem from the varying (and somewhat questionable) methodologies used in each study to provide support for the conflicting views. To test a market's efficiency requires the use of a model and any inherent assumptions or bias within the model will affect the outcome of the results.

Thompson and Ward (1995) alluded to problematic modelling within studies, specifically around the validity of the Capital Allocation Pricing Model's (CAPM) ability to identify the risk-return relationship. Others have also indicated, amongst other factors, that result bias can be driven by incorrect assumptions and proxies for the "market returns", survivorship bias, look-ahead bias, methods for calculating returns as well as neglect to incorporate economic or industry based variables when analysing results.

What does become evident in subsequent studies is the inability of any model, be it one of based on efficiency or physiology, to fully describe the functioning of the market as a whole and over time.

The argument for efficient markets suggests that if past studies confirmed that inefficiencies existed within the markets, were those inefficiencies economically exploitable by traders at that time and more importantly was there evidence that supports this exploitation.

The rest of the literature review highlights studies done in the different forms of efficiency and some of the market anomalies that have been discovered that question the EMH.

2.1 Efficient Market Hypothesis

The 1970's article by Eugene Fama, "Efficient Capital Markets", provided support for what became the widely accepted hypothesis that the markets were efficient at reflecting information about stocks. Malkiel's later book (1973) "A Random Walk Down Wall Street" prescribes to the efficient market hypothesis by advising investors to follow a buy-and-hold strategy using a broad-based index fund rather than expending time, effort and transaction costs in trying to achieve abnormal returns or "beat the market".

By the 21 century the validity of this hypothesis was being challenged by numerous economists and intellectuals, stating that there was sufficiently large number of studies done showing evidence of non-random price movements within the market prices. They even suggest that to some extent these inefficiencies could be recognised and therefore provide potential opportunity to predict and realise profits that would exceed that of the market – even after adjustment for risk.

Some of the evidence against market efficiency is the existence of short-run (days and weeks) positive serial correlation (momentum) and long term (months and years) negative serial correlation (return reversal or overreaction).

2.1.1 Weak Form Efficient

Empirical test for weak-form efficient markets are primarily concerned with testing whether price/return movement in shares exhibits the random walk theory and whether trading rules can be constructed to outperform the market on a consistent bases in relation to the CAPM. Weak-form efficiency states that historical data provides no patterns or information that allows investors to predict future share price movement. This implies that if share prices do not follow random movements and therefore create movement patterns, trading rules can be used to achieve above average returns.

Cootner's (1964) early work done on stock price randomness using short run serial correlation of successive price movement showed that the prices show "no

memory" of previous movements and therefore historical information is useless in determining future prices. Harrison & Kreps (1978) questioned the intrinsic value of stocks and believed that this is implied by different beliefs of the investors and as a result there were possibilities for speculation within the market due to inefficiency. Recent work by Lo & MacKinlay (1999) and Lo, Mamaysky & Wang (2000) rejected the randomness of share price movement on the basis of observed patterns of success price movement and signalling.

Lewellen & Shanken (2002) introduce a third source of predictability, 'parameter uncertainty', which they modelled through Bayesian analysis. Their study focused on empirical properties of returns in equilibrium which differ substantially from those perceived by investors. They stated that even though empirical tests find patterns in returns that violate EMH, rational investors can neither "perceive or exploit this predictability"(2002:1114). They showed that parameter uncertainty may explain observed asset pricing anomalies, and empirical studies which test market efficiency should also include rational investor learning to understand whether the pattern could have been exploited at the time patterns was observed.

Interpretation of these empirical results should be understood in the context of what is meant by efficiency. Although there may be statistically significant results that show non-random behaviour of stock prices, a trading strategy must be

interpreted in terms of the economic significance against that of a buy-and-hold strategy during the same period (Malkiel, 2003).

The possible effect of long term negative serial correlations (return reversals) has received a significant amount of attention by researchers and practitioners. Empirical evidence by Fama & French (1988) and Poterba & Summers (1988) suggested definite signs of mean reversion in the markets which they attributed to the markets overreaction to new information.

The first major study to recognise that prices deviated from their fundamental value over the short term only to later recover (thus exhibiting mean reversion) was that of De Bondt & Thaler (1985,1987). They found that this overreaction was consistent with the study of “Prospect Theory” done by Kahneman and Tversky (1979). This theory suggested that investors are over-confident when forecasting future stock prices or corporate earnings which resulted in price deviations from their fundamental value.

As a result, many trading strategies developed from the Overreaction Hypothesis (ORH), of which the most common is that of the Contrarian Strategy. This strategy suggests that investors should buy past “loser” stocks and sell past “winner” stocks, as over times these stocks will revert back to their fundamental value. Past loser stocks will recover towards their higher intrinsic value, while past winner stocks will lose their exaggerated gains and reduce in value.

This phenomena of stock price mean reversion was studied by Howe (1986) using 1963-81 US data and the results confirmed that stocks that had a spurt of good news generally declined in value, while stock that had experienced bad news generally increased in value.

Chan (1988) followed the same study as De Bondt & Thaler (1985, 1987) using the CAPM methodology. However the study deviated from De Bondt & Thaler by adjusting for risk by using test period betas rather than rank period betas. Their findings contradict De Bondt & Thaler, and found that contrarian strategies earn very small, economically insignificant, returns.

Along with Chan, other authors (Brown & Harlow (1988) and Lauterbach & Vu (1992)) have criticized Thaler & De Bondts results on the basis of incorrect adjustment for risk and firm size in their initial studies.

In an attempt to resolve the criticism of size and value stocks within the CAPM, Fama & French (1993) develop a 3-factor asset pricing model, where they introduce two other factors into the basic CAPM. The additional two factors take into account the difference in returns of portfolios of small stocks and large stocks and the difference in returns of portfolios of low book-to-market and high book-to-market.

Dissanaike (1997) cited the three possible reasons for overreaction in the markets as the “size effect”, bid-ask bias due to infrequent trading and time-varying risk. His study eliminated the first two possibilities and focused on time-varying risk using the methodology described by Chan (1988) and Ball & Kothari (1989) on UK data. His findings were once again in contrast to both Chan and Ball & Kothari, firstly by showing that the losers beta’s are lower than the winners (and therefore less risky) and that the returns were economically significant.

Fluck, Malkiel & Quandt (1997) found strong statistical evidence of mean reversion, however using the contrarian strategy they found that although the loser’s yielded higher returns in the first period, the winner and loser portfolio’s yielded the same returns in the next period. This led them to conclude that this strategy would not provide excess returns over an extended period of time.

In their paper on the testing the persistence of overreaction, Chen & Sauer (1997) came to four findings. Firstly they find that utilising a contrarian strategy resulted in returns that are non-stationary. Secondly when they segment the time series into four specific periods, they find that overreaction occurs in only two of the four periods. Thirdly, the standard deviations of the ranked portfolios exhibited a U-shape, which implied that extreme portfolio’s are less likely to remain in the winner or loser category over successive time periods. Lastly they indicated that there seemed to be a strong relationship between returns and

market risk premium. In concluding they stated that the contrarian strategy would on occasion provide excessive returns, but was unsustainable over time.

Dreman & Lufkin (2000) studied return movement based on investor overreaction using firm's fundamentals of growth-earnings, growth-cash flow, growth-sales, ROE and profit margin. They followed the same contrarian methodology as the previous studies but measure the firm's fundamentals 10 years prior to and 5 years post portfolio formation. Their results indicated that major changes in returns were inconsistent with changes in the fundamentals – in fact firms with strong fundamentals i.e. "winners" continue to show strong fundamentals above that of the loser firms five years after portfolio formation. Thus they posit that this change in returns was due to perception rather than changes in the firm's fundamentals and was therefore consistent with investor overreaction.

Donne, O'Conner, Shapiro & Reid (2004) studied a trading rule of market timing, switching from equities to bonds based on the 10-year forward equity risk premium. Their conclusion from the study was that it was difficult to devise reliable methods that would outperform a buy-and-hold strategy without the associated increased risk.

In reaction to studies supporting overreaction, Malkiel (2003) noted that mean reversion within the stock market may be consistent with interests rates during

the time period considered. As interest rates are mean-reverting in themselves, an efficient market would be expected to exhibit the same reversal effects.

As with the South African Studies done, the international studies on weak-form efficiency showed contradiction in the results and a lack of conclusion on whether the international markets exhibited this form of EMH efficiency. The studies implied some definite *ex post* patterns of non-randomness; however evidence of successful use of trading strategies that take advantage of them seemed to be lacking.

2.1.2 Semi-Strong Form Efficient

One of the founding statements on market efficiency it that of the markets ability to absorb new public information into share prices in an efficient manner, implying that the current share price reflects all available public information and represents the fundamental value of the share. This means that there are no disparities between discounted expected earnings and current prices, implying that techniques of fundamental analysis are useless in predicting future returns. Empirical tests for semi-strong form efficient are usually done through the event study method, whereby the impact (or the adjustment of share price to new information) of an event is measured by comparing the actual return against the expected return. A time-delayed difference between the two suggests that the share price does not adjust quickly enough (or shows momentum), representing an opportunity to achieve above average returns.

Studies done by Fama (1998) using “event studies”, which indicated the efficiency of stock prices to absorb new information, lead to inconclusive evidence around short-term momentum. He found evidence that showed price movements around these events depended on the model that was used, adjustment for risk and the statistical approaches used to measure them.

Conrad and Kaul (1993) suggested that the long-term overreaction findings of De Bondt & Thaler (1985,1987) were attributable to a combination of bid-ask effects when monthly CARs are used. Loughran & Ritter (1996) disagreed with these findings on the bases of the methodology used and implied that the results and interpretation were due to the introduction of survivorship bias and market long term mean reversion.

Chordia & Shivakumar (2002) studied the cause of momentum theory in relation to business cycles. Previous studies (Jegadeesh & Titman (1993, 2001) et al.) indicate that the momentum displayed in stock returns is as a result of investor under-reaction which could not be explained by efficient markets. Chordia & Shivakumar (2002) results were consistent with previous studies in that “*profitability of momentum strategies represent compensation for bearing time-varying risk and, hence, is not inconsistent with rational pricing theories.*” (Chordia & Shivakumar, 2002:1015)

Malkeil (2003) Suggest that any form of serial correlation patterns found in statistical studies was only useful to investors if it can be used replicated and implemented consistently over time. He cited Schwert's (2001) observation that many of these patterns seemed to disappear once they become public knowledge, due to them being exploited by investors until they were no longer profitable.

Byun & Rozeff (2003) discuss whether stock splits allow investors to gain abnormal returns. They cite contradictions of this phenomenon in earlier studies [Fama (1969), Ikenberry, Rankine & Stice (1996) and Desia & Jain (1997)] and proposed that stock splits were uncomplicated and therefore there implications can be gauged easier by traders. The number of occurrences of share splits in the US Market runs into the thousands and goes back to 1926. They overcome long-run performance misspecification criticism by using nonparametric boot-strapping methods, CAR's, BHAR's and Calendar Time Abnormal Returns (CTAR) and equally & value-weighted benchmarks. Their findings concluded that there were no abnormal returns and investors have not over or under-reacted to share splits. Therefore the market was efficient when dealing with stock splits.

As with weak-form efficiency on international markets there seems to be contradiction in the results and a lack of conclusion on whether the international markets exhibit this form of EMH efficiency. Event Studies imply the lack of the

markets to react to information and therefore show price momentum over the short period. However whether these events were economic significance or could be economically exploited is questionable.

2.1.3 Strong Form Efficient

A strong-form efficient market suggests that all information, both public and private, is reflected in the current share prices. No other information will be beneficial in allowing investors to achieve above average results or predicting future prices. Tests for strong-form efficiency are orientated towards investors (generally professionals) or other groups that may hold non-public information to determine whether they are able to achieve above average returns due to their superior knowledge. Consistent out-performance by such groups over time implies that such investors posses either superior skill or access to special information which is not reflected in the market.

Lewellwn, W, Lease, R & Schlarbaum (1979) study individual investment performance from 1964 to 1970 and found that there were some investors who consistently beat the market, however, they also found that those who beat the market were not all professional investors and had differing background. They also concluded that investors who held their shares for longer, received better returns than those that traded more often.

Barber & Odean (2000) stated that in 1997, 47% of equity investing in the US was done by individual investors rather than by professional investors. Their

findings indicated that individual investors that traded frequently earned lower average returns than those that traded infrequently and overall both types under-perform a value-weighted index by 1,5% (after transaction costs and taxes). They also noted that most of these traders tend towards small, high beta stocks or value stocks and therefore from previous studies, the under-performance is in contradiction to value or size effect trading strategies.

Continuing from the previous study, Barber, Lehavy, McNichols & Trueman (2001) studied the impact of using aggregate advice from analysts on buying or selling stocks. The results indicated that by purchasing “recommended buys” and shorting “recommended sells”, investors could outperform the market by 4.2%. However, once transaction costs are included into the overall return, these excess returns diminished completely and the buy-and-hold strategy returns remain constantly higher.

Malkiel (2003) maintained that the fundamental test of an efficient market is the ability for professional fund managers to consistently outperform the market as whole. If the market was inefficient and showed predictability in prices, these professional managers would be able to exploit inefficiencies and consistently produce above average returns. Based on Jenson (1968) earlier study of mutual fund performance, Malkiel (1995) confirmed his finding that active funds underperformed the market by approximately the amount of the expenses

incurred. Along with this finding he also noted that the data showed a high level of survivorship bias, thus overstating the funds performance.

Further to this the author showed that the lack of consistency of out-performance of the market by any one manager over any extended period of time, further substantiated his claim made in 1973 about investing in the broad-based market index.

As this form of efficiency is the most difficult to test due to the legalities involved in insider trading, it may be the most difficult form to prove or disprove. As Thompson & Ward (1995:36) state that “tests of portfolio performance … only show the presence of abnormal returns, and not whether these results were caused by exceptional skill or special information.” They further stated that consistent over performance of investors may imply that the market is at least weak or semi-strong form efficient.

2.2 Observed Phenomena

Many of the empirical studies that reject the EMH base their observations on consistent anomalies within the market, which are commonly called “effects”. This section provides literature on some of the most common effects experienced within the US market which the supporters of overreaction theory use as evidence against market rationality. They claim that these effects are common

and occur frequently enough to provide excess returns and arbitrage opportunities for investors.

2.2.1 Monday, January and Seasonal Effect

Some of the patterns discovered through the empirical test of previous share data observed a number of “effects” in the market. These effects include the Monday, January and Seasonal effects. The Monday effect implies that stock prices are generally higher on Mondays than Fridays, while the January effect describes higher returns for stocks in January than other months.

De Bondt & Thaler (1985, 1987) studied the effectiveness of the contrarian strategy and market overreaction. Their findings indicated systematic price reversals and found that excessive returns of portfolios occurred in January. The reversals they concluded were due to tax-loss selling pressure for losers and the capital gains tax “lock-in” effect for winners.

Keppler & Xue (2003) study the seasonal price behaviour of global equity markets and found that the last two months and first four months of the year produced higher positive annual price returns (7.6%), while the other six months produced negative returns (-0.72%).

Malkeil (2003) contested the consistency of the Monday effect which allowed for excess returns as well as the implicit return of this effect in relation to the transaction costs involved in using this as an arbitrage strategy.

2.2.2 Small Firm Effect

The small firm effect has generated a large amount of investigation under the pretence that over time the stocks of small companies generate larger returns than those of large companies. Studies done initially by Keim (1983) and later by Fama & French (1993) using data from 1963 to 1990 showed that small companies generated higher above average returns than their counterparts.

The fundamental argument concerned with these results was that of predictability over time and the correct measure of risk. The basis of most of the studies done implied that systematic risk measure of a stock is the beta estimate according to the CAPM.

Malkiel (2003) alluded to the fact that according to the study by Fama & French, this may not be the correct method of measuring risk due to the inconsistencies of their study and they suggested a better measurement for risk would be size rather than beta. He also suggested that this "size effect" has shown to be ineffective over the last one-and-a-half decades as large company stocks have shown overall better performance in this period.

2.2.3 Predictability using Valuation Techniques

Fama & French (1988), Campbell & Shiller (1988) conducted statistical test on the relationship between dividend yield and future forecast predictability. Their results indicated that up to 40% of variance of future returns of the market can be predicted by the initial dividend yield.

Fama (2003) argued that this didn't imply market inefficient as such, but could be correlated to the markets adjustment to economic conditions under changes in interest rate. He also pointed out that this phenomenon ceased to exist since the mid-1980s in the US, possibility due to changes around corporate dividend policies and further suggested that this "high dividend" strategy was inaccurate when used with individual stocks. Further to this, he suggested that the use of the P/E ratio as another method of predicting future returns should also be considered carefully.

2.2.4 Value versus Growth Stocks

Another style of portfolio creation used to improve returns was that of selecting "value" stocks. These are stocks that have a low price-earnings ratio or low price-to-book value. Studies by Ball (1978), Basu (1983) provided evidence that value stocks provide higher returns. This was supported by Kahneman & Reipe (1998) who suggested that this was due to investor's overconfidence in their abilities to project high earnings growth.

Besides the contention of techniques used in previous studies, Loughran & Ritter (1996) also stated that higher returns from value stocks may have been either due to compensation for risk or market overreaction, however prescribing which one contributed the most was a difficult task.

Once again Malkeil (2003:70) suggested that this effect did not imply inefficiency but rather may "*indicate failure of the capital asset pricing model to capture all dimensions of risk*." Studies done using Fama & French 3-factor asset pricing model (1993) over different time series (1993 – 1998) suggested that this effect may be time-series specific when they show negative returns for the value portfolios.

2.3 CAPM and Beta Estimates

Probably the most contentious issue in all studies has been around the valuation of risk and the use of the CAPM and the Arbitrage Pricing Model (APM). The beta-estimate values are consistently used to determine the abnormal returns versus risk component of studies. Not only has the choice of which beta risk measurements to use been criticised in many studies, but also whether beta fully reflects a portfolio or share risk. CAPM criticism follows similar lines specifically around whether the assumptions of the CAPM model hold true for market shares.

Chan (1988) argued against using ranking period data to estimate beta values for winner and loser stocks in contrarian strategies, and suggested the use of the test period data beta's as being more appropriate. Ball & Kothari (1989) also criticised the results from Thaler & De Bondt (1985, 1987) based on their risk measure and opted for a risk measurement based on event time data.

Fama & French (1993) suggest that there may be other risk factors within the market which is not captured by the CAPM or beta and suggest the use of a 3-factor asset pricing model as the appropriate measure against which market anomalies should be measured. This model includes a book-to-market and size risk measures.

Dissaniake (1997) used both Chan (1988) and Ball & Kothari's (1989) methods to evaluate the risk of the winner and loser portfolios. However even after adjusting for both risk methodologies, the results still indicate overreaction within the marketsd.

Daniel, HirschLeifer & Subrahmanyam (2001) in their mispricing model stated that the CAPM beta could still be a useful predictor of future returns. However within their model they separated the beta and mispricing measure, and from that were able to predict future returns. They further stated that when investors exhibited overconfidence and there were flaws in the fundamental measures, fundamental-price ratios completely dominate beta.

2.4 Survivor Bias

In many of the contrarian studies done, the loser portfolio generally is made up of a large number of small firms. After formation of the loser portfolio, many of the small firm stocks are liquidated or taken over which leads to the researchers having to deal with survivorship in their analysis.

Many of the studies incorporated these stocks back into the portfolio at the value of last trade, thereby exaggerating the loser returns over the winners (which are generally larger firm stocks). Other studies imposed filters on stocks for the loser or winner portfolio, which disqualified them from being incorporated into the formation portfolio. This process generally biases the results upwards for the loser portfolio returns.

Although not directly related to survivorship bias, the choice of the “market” portfolio for the buy-and-hold strategy, in which the comparison of returns is done, can also bias results depending on which “index” is used.

Loughran & Ritter (1996) questioned the results of some previous studies due to the implications of survivorship bias. In studies by Thaler & De Bondt (1983) and Conrad & Kaul (1993) the loser portfolio stocks needed to have lasted the full 3 year test period otherwise they are excluded from the tests. The authors imply that this process will almost guarantee that the loser stocks will achieve higher returns. They deduced that the problem with CAR methodology was that when delisting occurs, the proceeds (which is the last list price – and in takeovers this would be higher than normal) were re-invested into the remaining firms thus biasing the overall returns of the Loser portfolio.

Gray & Whittaker (2003) studied the effects of assumptions often used in long-horizon abnormal performance tests. The study focused on three decision criteria used when doing such studies and test the statistical nature of selection. They tested the performance measure used either through CAR or BHAR, sample selection filters (primarily survivorship bias) and benchmark choice for which abnormal returns would be measured and lastly the method of calculating returns (either simple or continuous compounding). Their results indicated that survival bias filtering used with traditional index benchmarks show extreme bias, high Mean Square Error (MSE) and misspecified t-tests. They suggested that the use of CAR tests with continuously compounded returns produced severe negative bias in reported performance and misspecified t-tests.

3. Research Questions

The literature review describes international empirical studies done on the major world markets (specifically the US) and results indicate a lack of consensus with regards their market efficiency. Common themes inherent in the studies are the differing (or inconsistent) use of models, data (sampling periods and bias), assumptions (risk valuation and representative models) and time-varying macro-economic changes. Thus the research questions which become evident are:

Research Question 1: Are the inconsistent results of empirical studies done on the JSE due to inconsistencies in the underlying methodologies of the studies developed over time?

Research Question 2: Are the assumptions in empirical studies done on the JSE the cause of inconsistency in results and do these assumptions change over time?

Research Question 3: Does the efficiency of the JSE remain constant over time or can the different results be due to major changes within the economic/political climate of the country?

4. Research Methodology

This chapter discusses the research methodology to be used in order to answer the research questions posed in the previous chapter. The first part of the chapter gives a description the methodology and its implications. The choice of two methods is being used in this research i.e. historical research and comparative case study.

The reasoning for the use of the two methods is due to the nature of the research problem which is concerned with the results of previous empirical studies done on the same topic. The common topic in the studies is the "*efficiency of the JSE*", which has been studied for over 35 years – hence the historical research method. The studies have also used common and differing methods resulting in conflicting results. The reasons for the lack of consistency in the studies can only be understood through comparing the intricacies of the studies themselves and hence the comparative case study method.

The second part of the chapter deals with the process of data collection, representation, analysis and interpretation. The chapter is concluded with comments on research validity and reliability within the qualitative research using historical research and comparative case study methods.

4.1 Research Method and Underlying Characteristics

4.1.1 Qualitative Research

The nature of the research problem requires an inquiry into past empirical studies done on the efficiency of the JSE. The nature of these empirical studies should lead to consensus; however as per Thomas & Ward (1995:33) "the *evidence … is at best mixed*." and further quantitative research will only provide support for the continuing uncertainty that exists. Therefore a different approach is required to identify the reasons for the inconsistency of the results and therefore the qualitative methodology is being used.

Leedy & Ormrod (2005) specify that qualitative research begins with a general research question followed by the collection of extensive data from a limited area. The organised data is then interpreted in such a way so that it can be used to state tentative answers to the implied research questions. Qualitative research tends to focus on phenomena that occur in the "real world" and study those phenomena in all their complexity in order to portray such phenomena in its "multifaceted form" (Leedy & Omrod 2005:133). As per their recommendations qualitative approach, this research will adhere to the following purposes:

- Description: This research will reveal the nature of studies done on the efficiency of the JSE.

- Interpretation: This research will enable the researcher to gain new insight, develop new concepts or theoretical perspectives and discover the problems that exist within the studies done on the efficiency of the JSE.
- Verification: The research will allow test the validity of certain assumptions, theories and generalisations within real-world context.
- Evaluation: The research will provide a means through which judgement the effectiveness of the previous studies can be done.

To further qualify using this methodology, they further state that a qualitative study is appropriate "... when variables are unknown, [and/or] when a relevant theory base is inadequate or missing … "as well as the fact that "… analysis of historical data is almost always completely qualitative." (Leedy & Omrod 2005:134)

4.1.2 Historical Research Method

Jankowitz (2000) notes that business and management research uses many different methods, however the primary ones being historical research (archival), case-study, survey and field experiment. Historical research is the process of describing what happened in the past in order to illuminate the present. "*Historical review [research] is particularly important … in accounting and financial subjects, in tracing the current health of … a market from the financial … records available…*" (Jankowitz, 2000:215)

Cohen, Manion & Morrison (2000:158) site Borg's (1963) define historical research as "… the systematic and objective location, evaluation and synthesis of evidence in order to establish facts and draw conclusions about the past." This definition is apt to this research as the focus is attempting to establish from the existing studies the nature of efficiency of the JSE.

Leedy & Omrod (2005) indicate that historic research tries to make sense of present and past events through document analysis, the purpose of which is not the accumulation of facts but rather the interpretation of such facts.

The aim of this research is to identify why previous empirical studies on market efficiency of the JSE have yielded conflicting results - even though the underlying raw data (stock prices) is consistent. The best method of identifying why these discrepancies exist is through historical research. By analysing the collection of historical studies, the research will identify differences within these studies which may be the causes of the inconsistent results.

Bailey (1994) states that historical research has advantages when there is good data as it can complement generalised scientific research. The historical research method is appropriate in this case as it may compliment current scientific research as well as highlight discrepancies in their use. By consolidating all the previous studies the research may uncover a number of

previous unknown variables which have influenced the previous individual results and may provide a more consistent consolidated view.

4.1.3 Comparative Case Study Method

Leedy & Ormod (2005:135) define a case study as being a "*particular individual, program, or event [is] studied in depth for a period of time.*" Generally the research will focus on a particular case, however more than one case may be studied, which are different (or in this research provide different results) in order to "make comparisons, build theory, or propose generalisations."

Unlike a case study method, Yin (1994) identifies that design logic as being similar to experimental methods and different from survey methods. Jankowitz (2000:219) explains that the purpose of the comparative case study method in this research would be to compare the empirical studies in a systematic way by exploring different aspects of these studies – it is not to *sample* the different studies in order to generalise their findings as would be done in a survey. In this instance the empirical studies "*… are chosen for a comparative case study to be representative of different possible positions or stances, regardless of the relative frequency of these stances in the population*."

As cited by Cohen, Manion & Morrison (2000), Stake (1994) identifies three main types of case studies: Intrinsic, Instrumental and Collective, of which the last is

concerned with a number of individual studies that are undertaking to gain a fuller picture.

In this research one could argue that each empirical study done on the efficiency of the JSE is a single case study within itself, and the purpose of the comparative case study is to organise, categories, interpret, identify and synthesis these studies in order to understand the contentious results.

4.1.4 Interpretive Paradigm

The problem statement for this research attempts to find consensus from previous empirical studies (which all follow the functional paradigm) on the efficiency of the JSE. This research attempts to subjectively study the outcome of historical evidence and implicitly will follow the Interpretive Paradigm.

4.2 Data Collection

One of the principle differences between historical research and other methods is that it focuses on data (either primary or secondary) that already exists. Primary data is crucial to this method and are defined as items that are original to the research question being studied. The function of literature review in this method provides the data for the research and the ability to answer the research questions will depend on the selection and interpretation. Cohen, Manion & Morrison (2000).

The historical research method requires that the “data” needs to be considered to be valid and reliable and in context of the research question which has specific constraints. The question whether the empirical studies are primary or secondary sources of information is debateable as the original data used in these studies is that of the raw share data, and their studies are in fact interpretations of that data. The purpose and focus of this research is to not to interrogate the underlying share data but rather to interrogate the studies which have differing results and for this reason the studies will be regarded as primary data.

4.2.1 Published Journal Articles

The source of data to be used for the research project will be limited to journal articles that are published in-between 1975 – 2005. Since the research is concerned only with the efficiency of the JSE, the data will be further limited to South African Academic Journals and include the following:

- South African Journal of Business Management
- Investment Analyst Journal
- South African Journal of Economics

In accordance with the focus of the research on EMH, only journal articles that have a direct association with the efficiency of the JSE will be considered, excluding studies done on derivative trading.

4.2.2 Other Data Sources

Jankowitz (2000) advises that more than one source of data be used for the argument and suggests that cross referencing. Therefore other sources of data will be used in order to substantiate arguments made (both in the studies as well as within this research) and will consist primarily of international studies done on the same theory, published books and raw share and economic data.

International studies and published books will also be used for referencing and will be obtained either from online journals (e-journal portal) or the libraries provided by the University of the Witwatersrand.

4.3 Data Analysis and Interpretation

4.3.1 Analysis of Comparative Case Study Data

Data analysis in this research method does not follow the typically linear phases where analysis only starts once data collection has been completed: because of the nature of the research data analysis and interpretation will start to take place during data collection.

The research questions imply that the analysis focus on different aspects of the empirical studies and will therefore determine the type and level of analysis required to answer each. Analysis will take place between the studies (or aspects thereof), against international studies or theories and in respect of aspects local to South Africa (e.g. socio-economic aspects).

The empirical studies will be analysed using the some of the steps outlined by leedy & Ormod (2005):

- Organisation of details about the cases: This will involve organising the studies according to chronological order, methodology, data sample, outcome, efficiency-form test etc.
- Categorisation of data: This will involve identifying categories for the studies by which clustering and comparison of data can occur.
- Identification of patterns or themes that emerge from the data during ordering and/or categorisation.
- Content analysis specifically around the author's interpretation of the results of each of the studies. This will provide a consistency matrix between methodology, results and conclusions for all of the studies.
- Relevant extraction, simplification and condensed in order to provide manageability of data analysis, presentation and interpretation.

The objective of the data analysis is to provide information that describes the components of each of the studies in a logical and methodical manner in order to make formalise the comparative analysis required as part of the comparative case study method.

4.3.2 Analysis of Historical Research Data

Leedy & Ormrod (2005) distinguish between chronology and historiography when doing studies on history. Genuine historical research is concerned with the later

of the two which focuses on the interpretation of historical events (or records). The further suggest that history is dimensional in terms of historical time and historical space which will be dealt with in more detail below.

Historical time (*the when*) highlights the "significance that the temporal context gives to the data (Leedy & Ormrod, 2005:169) and therefore the presentation of data through a historiographical method provides potential understanding of events. The flexibility of this method allows for multiple events to be plotted on the same historiograph for comparative and indicative analysis.

For this research, the data used in studies, the time that the empirical study was published, and international trends on EMH will all form part of the historiography and analysis process.

Historical Space in historical research implies the space dimension of historical events or "*the where".* As part of the historical time, the historical space gives a geographical relationship to the data. As this research is not concerned with physical space, the space dimension will focus on those factors which influence may have influenced the market efficiency through time. These factors are not primary to the studies but play an important role in the data which was used. They would incorporate the socio-economic factors that were present in South Africa while the studies where done. This will help in gaining a better

understanding of the macro effects which would have impacted the JSE through the process of time.

Leedy & Omrod (2005) advises that the two methods discussed above as well as chronology be used in historical research as each method will provide a different insight into the meaning of the data in order to answer the question “what does the data mean?”

4.4 Validity and Reliability

4.4.1 External Validity

Leedy & Omrod (2005) state that external validity refers to the generalisation of conclusions within other contexts or the extent to which the research results apply to situations beyond the study.

As this research is concerned with the efficiency of markets, specifically to that of the JSE, the results will be compared with international studies to enhance external validity. The comparative international studies that are selected will focus on both developing and first-world markets with differing tests on efficiency in order to provide a better indication of what other research has found when testing the same hypothesis.

4.4.2 Internal Validity

To ensure internal validity, Leedy & Omrod (2005:98) suggest that precautions need to be taken in order to "eliminate other possible explanations for the results" observed. Enhanced internal validity utilises strategies of controlled laboratory studies, double-blind experiments, unobtrusive measures and triangulation.

As this methods (comparative case study and historical research) used in this research are qualitative, the strategy employed to enhance internal validity is that

of triangulation. Triangulation is the process of collecting multiple sources of data which will (hopefully) converge to support the research questions. Triangulation will be accomplished by:

- Utilising a number of South African Studies from different times and utilising different methodologies on testing the efficiency of the JSE.
- Utilising international studies done on efficient market testing for both first and developing countries including those done on South Africa.
- If possible, met-analysis of the published South African studies in order to provide statistical insight into the results obtained from these studies.

4.4.3 Reliability

For historical research and case study, Bailey (1994) indicates that reliability can be checked through either instrument or analyst reliability. This is done by comparing similar documents (instrument) or research results (analyst) at multiple points in time. However the author states that both of these methods are bias towards subjectivity and therefore reliability is questionable. In an attempt to achieve reliability within the results of this research, every effort will be made to provide theoretical support when conclusions are drawn.

5. Historical Review

5.1 Beta Estimates

The validity of the beta estimates (beta) to define the relationship between risk and return has been widely debated and researched. As beta is used extensively within all measures of market efficiency using the Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT) Model, the validity and reliability of the beta estimate is essential.

Beta is defined as the movement of a stock price relative to the overall market, which implies that stocks which move more, relative to the market, are considered more risky than those that move less. This relationship is normally calculated using the ordinary least squares regression (OLS) method which assumes linearity.

Research done in South Africa on beta estimates has focused primarily on two areas: beta within thinly traded environments and the equity beta relationship to the accounting beta.

Retief & Hamman (1983) where the first to investigate the relationship between accounting and market beta by comparing operating, income, equity and risk composed equity beta's against the market beta. Their results indicated that the equity beta was the only accounting beta that was significantly related to the

market beta. Wessels, Smith & Gevers (1993) investigated the relationship between different cash flow beta's and market beta, using the methodology of Ismail & Kim (1989). After Bayesian adjustment of the cash flow beta results, they indicated that the cash-flow based beta was significant and could explain 15.4% of market risk variability. Hamman, Loxton & Smit (1994), in an attempt to better understand this relationship, tested the effects of the research design elements on the results. They concluded that there was a significant positive relationship between the accounting and market beta's and that cash-flow beta's where not superior to earnings beta's as previously thought. They did however indicate that results in such research are sensitive to the design elements used in the methodology.

International research has found that beta is significantly affected by environments that are thinly trading. The JSE Securities Exchange (JSE) is an example of such an environment and therefore thin trading needs to be corrected for when estimating beta. The two approaches available to correct for thin trading are the Cohen and trade-to-trade Estimators. Bradfield & Barr (1988) investigated the thin trading effect on beta values for the JSE and found that thin trading had a substantial effect on stock beta's which was minimised through the use of the Cohen Estimator. Their findings also indicated that an equally weighted index provided a better market proxy than the JSE All Share Index (ALSI). In a comparative study of beta estimation which used the OLS, Cohen and trade-to-trade approaches, Bowie & Bradfield (1993) simulated the efficiency

and consistency of each of the methods and found that the trade-to-trade estimator provided a better overall result. For the Cohen estimator they found that it corrected for thin trading but at the expense of efficiency.

Bradfield (2003) consolidated the beta estimation process for South African stocks and remarked on the choice of market index, the estimation period, the return interval, Bayesian and thin trading adjustments and beta stability, robustness and dynamic estimation. This research also indicated that the ALSI was the best estimator for the market proxy, even though this had been questioned earlier by Bradfield & Barr (1988) amongst others who believed that there was segmentation between the Resources and Financial & Industrial sectors. Further to this Bradfield (2003) indicated that beta estimation should use five year monthly data, adjusted for thin trading using the Bayesian Adjustment and trade-to-trade estimators.

5.2 Model Critique

Gilbertson & Goldberg (1974) were the first to investigate problems associated with using the Market Model in the South African context. Their study was based on the influence of the mining sector, due to the size of its capitalisation, on the JSE. The rationale for this was due to the price of gold being the primary factor which influenced the mining sectors and this price was determined by international political and economical events rather than local economic developments. The authors believed that there was a requirement to incorporate

a mining and industrial factor into the market model. They argued that this would account for some of the anomalies associated with risk estimation when using a single market factor. From this they formulated a two-factor regression market model:

$$R_j = \alpha + \beta_{MI,j} \bullet R_{MI} + \beta_{IN,j} \bullet R_{IN} + \varepsilon \qquad [1]$$

Where:

R_{MI}, R_{IN} Are the returns generated by the JSE Mining and Industrial Indexes

And

$\beta_{MI,j}, \beta_{IN,j}$ are constant beta relating to share j

Page (1986) investigated the relationship between the CAPM and APT model to determine which of the two models gave a higher explanatory power with regard to share price returns. The results of the investigation revealed that a two-factor APT model provided a better estimation than the CAPM. These two factors were related to macro economic variables that determined the return generating process and were split between those that influenced the mining sector and those that influenced the industrial sector.

Affleck-Graves, Bradfield & Barr (1988) examined the validity of the CAPM on the JSE using the one-factor CAPM and by the addition of several additional variables which included dividend yield, market capitalisation and share liquidity. The tests were done on the JSE as a whole as well as the gold shares. The

results concurred that the traditional CAPM was well specified for the JSE. None of the additional variables were found to be significant in the tests and therefore they concluded that the CAPM was a good predictor of expected returns. In contradiction to these findings, Page (1989) used a bootstrapping routine to compare the efficiency of the CAPM with a two-factor APM and once again found that the APT approach provided better overall results.

Van Rensburg (1996) tested the ability of the APT model to determine the macroeconomic variables as priced factors. The study used unexpected movements in gold returns, returns on the Dow-Jones Industrial Index, the term structure of interest rates and inflation expectations as the macroeconomic variables. These were regressed using the iterated non-linear seemingly unrelated regression (ITNLSUR) technique. The results indicated that all of the variables, with the exception of gold returns "*are associated with statistically significant risk premia*." (Van Rensburg, 1996:104) The following year Van Rensburg & Slaney (1997) developed the two-factor APT model using the All-Gold and Industrial Index and found that it significantly explained the cross-sectional returns on the JSE.

Following on from this research Van Rensburg (2001) and Robertson & Van Rensburg (2003a) investigated the identity of style factors that may explain the expected returns of industrial shares on the JSE. The results of the investigation and cluster analysis (Van Rensburg, 2001) indicated that an additional three

style-factors needed to be augmented with the two-factor APT model of Slaney & Van Rensburg (1997). These style factors included earnings-to-price (value), market capitalisation (size) and past year positive returns (momentum). The results from Robertson & Van Rensburg (2003b) later showed that only the first two factors were indeed explanatory.

5.3 Studies on Weak-Form Efficiency

5.3.1 Dependency of Share Price Movements

All empirical Studies done prior to review of Thompson & Ward (1995) used serial correlation and runs tests as the primary methodology for testing the Random Walk Hypothesis (RWH) for the JSE, with the exception of Du Toit (1986) who used the Markovian approach.

Five of these previous studies (Jammine & Hawkins (1974), Hadassin (1976), Strebel (1977, 1978) and Du Toit (1986)) rejected the RWH and EMH outright, while four (Affleck-Graves & Money (1975), Gilbertson & Roux (1977,1978) and Brümmer & Roux (1981)) found evidence of dependencies between share prices, but deduced that these were too small to be used to achieve above average returns and therefore accepted the weak form efficiency of the JSE.

When testing for weak form efficiency, independent of the approach being used, rejection of random walk within share price movements does not automatically reject weak form efficiency. Non-randomness only implies statistical dependency within share price movements and only through the ability of traders to identify and use these dependencies to achieve abnormal returns, can the EMH also be rejected.

(Strebel, 1977:15) summarises this notion when he states that *"… the existence of statistically determined non-random behaviour is sufficient for rejection of the RWH … It must be shown that this non-randomness can be practically utilised to 'beat the market'."* In previous support of this view, Hadassin (1976) had concluded that although a superior analyst may be able to use such dependencies to their advantage, predicting future share prices through knowledge of past earnings is highly optimistic.

In summary of the early studies done, Strebel (1977, 1978) had criticised the studies of Gilbertson & Roux (1977, 1978) which supported the weak form EMH. His argument was that the EMH only applied to half of the market on the basis that thin trading questioned the validity of the CAPM. Although the validity of the CAPM may be compromised by thin trading, as later studies would indicate, the authors rejection of EMH based on this argument was not substantiated through statistical means. In fact, Strebel (1978:30) stated that "*the lack of a documented, successful trading rule on the JSE is the best available evidence consistent with the EMH*" and in so doing inadvertently accepted the weak form efficiency of the EMH.

Tests for random walk for the JSE following Thompson & Ward (1995) have been limited, with the focus of such studies related more towards trading strategies.

Hamman, Jordaan & Smit (1995) examined the hypothesis of higgledy piggledy growth (earnings changes that appear to be random over time) versus the price/earnings ratios (P/E) of listed stocks. The first part of the study implied that, due to the random nature of stock price movements, forecasting models based on historical data had limited accuracy. The second part of the study implied that as stocks traded at different P/E ratios, this reflected divergent earnings expectations or future earnings predictions. The study used industrial stocks listed from 1973 to 1992 with varying sample sizes of 125 to 371 stocks and suffered from survivorship bias for delisted stocks (due to computational problems encountered when companies earnings growth were calculated with negative denominations) that reported losses during the period. However the study did account for look-ahead bias and share splits, consolidation and capitalisation issues. The data was subjected to serial correlation tests (5% significance levels) and was divided into five quintiles based on P/E ratios. The observed versus expected frequencies were compared using binomial tests. Finally the earnings-per-share were compared over time and between quintiles in order to examine the impact of P/E ratio. The results of the serial correlation indicated that there was no significant number of correlations within the data and therefore supported random walk for earnings growth. However the authors did qualify these results by stating that the study suffered from high sampling errors due to the small sample size used. The binomial tests consisted of segmenting the stocks into five quintiles based on the P/E ratios. The 1st and 2nd quintile contained the low P/E stocks while the 4th and 5th quintile contained the high P/E

stocks. In accordance with the Value Effect, stocks in the last two quintiles should have shown more counts of favourable years, while the inverse should have applied to the first two quintiles. However, this was not observed in the results and therefore the Value Effect was rejected.

The last of the tests pooled the earnings-per-share values per quintile over one, two, four and eight year periods and the results indicated that the 5th (high P/E) quintile showed the highest earnings over three of those periods while in four periods the 1st (low P/E) quintile ranked second twice and third and last once.

Once again these results were inconsistent with the hypothesis that low P/E stocks exhibited the lowest earnings growth. The author cited the Negative Earnings Effect of Ettridge & Fuller (1991), which stated that stocks with initial losses potentially recovered more than is anticipated by the market, as the reason for this inconsistency.

In conclusion, they indicated that even with the presence of survivorship bias and thin trading, the results supported the random walk hypothesis for earnings growth. In addition to this they did however state that the 5th quintile results could have enabled investors to identify the highest earnings growth stocks and from this achieve abnormal returns. However with no risk-adjusted return tests done as part of the study, it must be questioned whether these higher earning growth stocks would have come at a higher risk to the investor.

Through the use of different techniques, Jefferis & Smith (2004) tested seven JSE indices for random walk and evolving efficiency using Multi Variance Ratio (MVR) tests and Tests of Evolving Efficiency (TEE). Due to the date of the index inception, the period tested for the *Datastream* market index, JSE industrial and Gold Index was from 1993 to 2001 while the All Share 40, Industrial 25, Mid Cap and Small Cap indices used data from 1996 to 2001. Weekly data is used from Wednesday closing prices in order to reduce the possible Monday Effect.

MVR tests are nonparametric tests widely used to determine whether a data series follows random walk when the returns are not normally distributed. TEE tests use a time varying parameter GARCH model to detect changing weak form efficiency over time.

Descriptive statistics for the weekly returns indicated that all index returns were leptokurtic and all were skewed to the left - with the exception of Gold Index which was skewed to the right. The MVR tests indicated that the natural logarithm of returns of JSE all Share 40, Gold, *Datastream* and Industrial 25 indices followed random walk, while the Industrial, Mid Cap and Small Cap indices reject the Random Walk Hypothesis due to autocorrelation within these indices. The TEE results indicated that the same indices that followed random walk also exhibited weak form efficiency, while the Mid Cap and Industrial Index were not weak form efficient. The Small Cap index progressively moved away

from weak form efficiency and therefore could be described as being weak form inefficient.

In an attempt to identify the reasons for the results, further tests were done on the constitution, liquidity and capitalisation of the indices. The results indicated that the three indices which followed random walk also showed the highest liquidity (with the exception of gold) while the number of constituents seemed to hold no meaningful influence on the indices tendency towards random walk. The effect of capitalisation was consistent with that of liquidity, once again with gold showing differing results. From this they concluded that indices which were characterised by large capitalisation and high liquidity tended to follow a random walk nature.

Further support for this was found when the MVR tests were extended to the largest and smallest capitalisation stocks, where 32 of the largest 40 stocks followed a random walk while only 18 of the smallest 40 stocks exhibited random walk properties.

An explanation for the difference in gold stocks may have been due to the commodity nature of gold and its method of valuation which tends to be based on the international price of gold, the rand/dollar exchange and mining reserves.

In support of what Strebel (1977) suggested in one of the earliest studies on random walk behaviour of share prices, subsequent studies seemed to indicate that there were “pockets” of efficiencies and inefficiencies. The statistical proof of serial correlation indicated that many shares, specifically those which were thinly traded, did not follow a random walk nature and therefore those shares rejected the weak form EMH.

5.3.2 Trading Strategies – Low Priced Stocks

Affleck-Graves, Gilbertson & Money (1980) introduced the first study which used trading rules based on low-priced shares from all sectors of the JSE (based on shares that cost less than 30c per share) and the results indicated that even after risk adjustment, these shares outperformed the market indices.

Waelkins & Ward (1997) re-ran a similar test some 20 years later for a 100 shares from the industrial sector (1983 to 1993) and compared the results to that of a buy-and-hold strategy using the ALSI as the market proxy. Their results conflicted with that of Affleck-Graves *et al*. (1975) and other international studies but supported the findings of Affleck-Graves, De Villiers, Lowings & Pettit (1986) which found a “high price effect” or “large firm effect”. They suggested that the contradiction to international studies was due to the investment environment within South Africa during the period studied, which was dominated by large institutional investors who could not invest abroad due to the political sanctions.

This resulted in stock overpricing due to the imbalance in the demand and supply of large stocks.

5.3.3 Trading Strategies – Style-based Investing

The anomaly of close-end investments trusts trading at a discount to their net asset value was investigated by the Bhana (1993) using buy-and-sell pointers and filter strategies. Using 13 close-end funds listed on the JSE, the first strategy followed simple rules of buying when a specific discount value was reached and selling when the discount value narrowed. The second strategy involved filtering the percentage change in the share value and buying or selling the share based on per-defined limits. Results indicated that implementing both strategies provided abnormal returns. By buying close-end investment shares when they reach a 20% discount and selling when the discount reduces to 15% would yield the highest return. Based on these finding the author rejected weak-form efficiency for close-end investment funds.

Benjamin Graham (1997), an influential economist and professional investor in the US, promoted value investment strategies through the development of 10 trading rules for value stock selection. Klerck & Maritz (1997) studied the effectiveness of these trading rules on the JSE using three of the 10 investment criteria. The study used industrial share data from 1977 to 1994 and the Industrial Index (INDI) as the market proxy for the buy-and-hold strategy. The

investment criteria used was price to earnings (P/E), Dividend Yield (DY) and total debt versus book value (D/V) and combinations thereof.

In each year of the study, all the stocks were screened for matches according to one of the criteria and placed into the appropriate portfolio. The returns were then calculated and risk-adjusted using the Jensen method. The three portfolios exhibited returns (2.61%, 2.42% and 2.66%) above the market proxy (1.68%) but also exhibited higher volatility than the market, primarily due to lack of portfolio diversification. Transaction costs were excluded from the return calculations which could have reduced the overall excess returns of the constructed portfolios. However the study did indicate that there were undervalued shares which achieved returns above that predicted by the CAPM.

Testing for a number of share price anomalies which could have been used as trading strategies on the JSE, Robins, Sandler & Durand (1999) divided 876 shares from all sectors (excluding mining, financial and non-main board) between 1986 and 1995 into four equally weighted portfolios based on high/low market capitalisation and high/low P/B ratios. Excess returns were then calculated for each portfolio and adjusted for total and systematic risk. The results rejected the market capitalisation effect on the JSE as did Page & Palmer (1991). However they did accept that the non-existence of this effect in their findings may have been due to the granularity of their portfolio breakdown when compared to pervious studies.

In their test for value trading, they used the price-to-book (P/B) ratio for all shares excluding mining and financial sector shares. Results initially indicated that the value portfolios had a higher risk adjusted return than growth portfolios. However, consistent with the CAPM, the results also indicated that a consolidated portfolio of value and growth had the highest risk-adjusted return when compared to either a pure value or growth portfolio. After running ANOVA test for statistical significance, all of the results were rejected but indicated that 71% of value shares are also small firm shares.

Fraser & Page (2000) studied value and momentum strategies using data from 1973 to 1997 of industrial shares and used an equally weighted portfolio of all industrial shares as the market portfolio. They created two value strategies which used dividend yield and book-to-market and ranking the shares accordingly and dividing them into five quintiles. Once ordered, the stocks were assigned to five equally weighted portfolios and the process was repeated for the remaining 257 months. Quintile one represented growth (glamour) stocks while Quintile five represented value stocks with Quintile two, three and four representing intermediate stocks.

The tabulated results indicated that returns increased monotonically from quintile one (Glamour) through to quintile five (Value), which supported the hypothesis that value investing produced higher returns. In almost all cases the quintiles had

a beta larger than one with quintile five (Value) having the lowest beta. The beta distribution across the quintiles exhibited the common U-Shape distribution found in other local and international studies.

From running univariate tests they concluded that each "*of the three variables of D/P, B/M and [past 12 month performance] are positively related to returns of the subsequent month … and both value and momentum strategies work in the short term … and are not related to each other*." (Fraser & Page 2000:29). They further implied that their results could be explained by the misspecification of risk for value and small companies.

Further to this Graham & Uliana (2001) studied the value-growth phenomena for 58 JSE Industrial stocks listed from 1987 to 1996. The stocks were divided equally, based on price/book (P/B) ratio, with the top 50% forming the growth portfolio and the bottom 50% forming the value portfolio. To compare whether market capitalisation and value-growth were related, the portfolios were also divided up to have approximately equal market capitalisation. This procedure was done at the end of June each year and excess monthly returns were calculated on both an equal weighted and capitalisation weighted basis by subtracting the actual return from the risk free rate (The Treasury bill was used as the risk free rate proxy).

The results indicated that on a returns basis, there was no significant evidence that a value-growth phenomenon existed on the JSE for the period under review, as value and growth stocks each yielded the highest returns in five of the ten periods. This was further supported using Sharpe ratio analysis for the same periods, which resulted in values that were nominally different.

Cumulative mean excess monthly returns on the annually reformed value-growth portfolios indicated that on equal weighted basis the value portfolio outperformed the growth portfolio by seven percent over the 10 years. If however the portfolios were capitalisation weighted, the value portfolio would have outperformed the growth portfolio by 37%. If the portfolios were not reformed annually, the growth portfolio would have outperform the value by 17.3%, if reformed after five years the value portfolio would have outperform the growth 28% in the first five years and 37% in the second. Splitting the tests into three periods the growth portfolio outperformed the value portfolio in the first two years by 25% and five percent respectively with value portfolio recovering in the last period with a 64% out-performance.

The fluctuations in the value-growth results could have been explained by political-economic factors and interest rates. These factors seemed to correspond to growth stocks performing better in high inflation periods while value stocks performing better in low inflation periods. The authors concluded that the overall results of the study "*raised some doubts about the validity of …*

the CAPM and the EMH" (Graham & Uliana, 2001:17). Included in the results it was found, consistent with Robins, Sandler & Durand (1999) that value stocks also tended to be small stocks.

Robertson & Van Rensburg (2003b) studied the size and value effect of the ALSI and FINDI stocks between 1990 and 2000 by using one-way and two-way sorting procedures. The stocks were sorted into five quintiles ranked according to size and then placed into equally weighted portfolios, which were rolled over each month. Pre- and post-ranking beta were calculated for each portfolio in order to compare beta stability. The results indicated that in both the ALSI and FINDI stocks there was significant differences in returns as small-size stocks produced returns twice that of the large-size stocks. In addition to the return differences, the pre- and post-beta values remained relatively consistent and were inversely proportionate to the returns (i.e. high return stocks had low beta, while low return stocks had high beta). These results supported Graham & Uliana (2001) in that the small-size effect did indeed exist on the JSE, as with international markets, and contradicted the CAPM and beta estimates.

5.3.4 Trading Strategies – Overreaction Hypothesis

Early studies done on trading strategies generally tended to support the weak-form efficiency of the JSE. However with the international publication of De Bondt & Thaler (1985, 1987) on overreaction hypotheses and other observed phenomena in the markets, further studies in support of market inefficiencies

based on contrarian, market-timing and style-based strategies, as discussed previously, emerged.

Bhana (1992) introduced the first study on over reaction on the JSE and although the study supported the earlier international results of De Bondt & Thaler (1985, 1987), the author suggested that the unexpected under-performance of growth stocks was attributable to the normal economic activity of new entrants and competition which reduced the growth prospects of firms in the future. When investors priced these stocks however, they would under-estimate these economic factors as part of their expected returns valuations.

Following from this, the exact international study of De Bondt & Thaler (1987) was replicated by Page & Way (1992) for the JSE. Consistent with the results of US studies, the JSE exhibited prior loser portfolios outperforming the prior winner portfolios by 10% - 20%, however the study did suffer from the same criticism (bid-ask spread, time-varying risk, thin trading and beta estimation etc.) as the De Bondt & Thaler (1985,1987) studies.

In contrast to the many overreaction studies previously done, the international study by Brown, Harlow & Tinic (1988) developed a hypothesis that relaxed the unrealistic EMH assumption that all investors have immediate access to all information. The Uncertain Information Hypothesis (UIH) was based on

conditional probability distributions for when investors received new information which caused information uncertainty.

Briefly, the UIH implied that when investors were faced with unexpected information, there would be an *"… increased uncertainty and thus greater risk and therefore they immediately discount the value of the company below the expected value of this probability distribution …(which) disappears gradually, along with the uncertainty*." (Bhana, 1995c:42)

Bhana (1995a) applied the UIH to the JSE over an 18 year period from 1975 to 1992 which used the ALSI and 200 shares present on the JSE as of 1975. The UIH predicted that major surprises would increase investor uncertainty which would be represented in increased price volatility on and after the event date. This was measured from the event date (day zero) and 60 days thereafter (+60 days). Pre-event measurement of the market sample volatility was measured as the variance of the share price returns and was compared to the post-event variance. Individual share risk was measured as the beta for the 200 pre-event days compared to the 60 post event day beta. Due to the thin trading effect, beta was calculated using both the OLS and Bradfield & Barr (1988) method. In defining an unexpected information event, the author chose a value of two percent movement in the market and five percent move in the individual share price. For individual companies, good or bad news events were defined by the

change in residual values occurred on a day using the single index-return generating process defined by Bowman (1983).

The results of the study supported the UIH by demonstrating that regardless of the information news type (good or bad) the price adjustments after the initial reaction were significantly positive. Also observed during the post event date period was an increase of volatility, which could be interpreted as investor compensation for bearing the additional risk associated with unexpected information. These results contradicted the previous overreaction hypothesis studies of De Bondt & Thaler (1985, 1987) as well as the South African studies of Page & Way (1992) and Bhana (1989b). The overall conclusion was that the JSE reacts to uncertain information in an efficient manner and that trading strategies based on daily price changes would not earn abnormal returns after adjustment for the increased price volatility (or risk).

Following from this, Muller (1999) used computing techniques to run 78,150 simulations that tested contrarian strategies. This was done using a similar, but optimised sample and market measure as that used by Page & Way (1992). The time series (1985 – 1998) has a four year overlap on that (1974 – 1989) studied by Page & Way (1992) and produced the same overall results. Besides loser strategies outperforming winner strategies, both strategies were found to outperform the market. Also observed was that winner strategies showed signs

of momentum (short run positive serial correlation) while loser strategies showed long-term mean reversion (negative serial correlation).

5.3.5 Trading Strategies – Market Timing

Market timing strategies were based on Jeffery's (1984) studies done on the NYSE and were first conducted locally by Firer, Ward & Teeuwisse (1987). This was followed up five years later by Firer, Sandler & Ward (1992) in a study which used a similar approach but, included testing for the impact of the 1987 market crash and market timing using a high beta asset of the gold index. Results of both studies indicated that high levels of accuracy were required to consistently outperform the market. In the second part of the Firer, Sandler & Ward (1992) study, the timing of the gold index required 87% accuracy to beat the market and 89% accuracy using the ALSI. Accuracies less than 49% (Gold) and 32% (ALSI) would result in certain loss compared to a buy-and-hold strategy. What this research also found was that the crash of 1987 had no significant effect on the market timing results and would only have impacted a buy-and-hold strategy if the investment horizon ended within 2 years after the crash.

Following on from these studies, Smit & Du Plessis (1995) used data from 1960 to 1989 to test whether markets could predict business cycle peaks (growth) and troughs (recession) and whether a switching strategy based on these timings could be used effectively to outperform the market. Three strategies where tested by switching between equities in growth periods and either cash, treasury bills or

bonds in recessions. Included in the tests were lead and lag times of six months (using one month increments) for non-perfect timing. The results indicated that switching between equities and cash results in negative returns independent of timing ability, while switching between equities and either bills or bonds would result in a positive excess return of up to 5.7%. However it is important to note that the results excluded switching costs.

Firer, Grey, Sandler & Ward (1996) furthered their studies on market timing using three types of unit trusts offered by two investment houses, over a five year period starting from 1989. The three types of unit trust funds were chosen due to their risk profiles and the investments could be switched between each. These timing strategies were benchmarked against a buy-and-hold strategy of each unit trust fund which produced annual returns of 17.7% and 18.9% (Standard Bank Mutual Fund and GuardBank Growth Fund respectively). If 100% timing was possible, the excess returns for the above funds would have been 31.7% and 26.4% respectively, however 65% accuracy was needed to give investors an equal chance of beating the buy-and-hold strategy without missing 20% of the best months (12/60) or quarters (4/20). As the study assumed that switching costs would be minimal and therefore where excluded from the calculations, the results of high levels of switching of between 50% to 75% of the periods (either 37/60 months or 14/20 quarters) may have impacted the excess returns generated by perfect timing. The study concluded that the level of predictive

accuracy required to beat the buy-and-hold strategy was extremely high and was dependant on correctly predicting a small number of good periods.

Previous studies indicated that high levels of predictive accuracy were required to beat the market based on market indices, business cycle and unit trust investments. Extending these studies, Dumont Du Chassart & Firer (2001a) investigated market timing from 1924 to 2000 based on bull and bear markets. The study used traditional timing, bull timing (purchase of call options when market rises) and bear timing (purchase of put options when market falls). The results indicated that perfect prediction of traditional timing would have achieved the highest results, however once adjusted for transaction costs, traditional timing may have resulted in the same return as perfect bear timing (27.4%). Bull timing resulted in the lowest returns due to the cost of purchasing large numbers of options. To beat the RDM 100 and ALSI would require predictive accuracy of 86.1% (traditional), 86.2% (bear) and 91.7% (bull) with no adjustment for risk included in the results. Once again the conclusion of this timing strategy study indicated that market timing required high levels of predictive accuracy to consistently beat the market.

5.4 Studies on Semi-Strong Form Efficiency

5.4.1 Effects of Legislation

Affleck-Graves & Knight (1983) and later Affleck-Graves & Hamman (1985) tested the effect of accounting policy changes on South African Firms. The accounting policy change required firms to adopt a LIFO method to accounting for inventory rather than FIFO method. The first studies sample included 21 non-LIFO industrial firms between the periods of 1969 to 1980 and used the market model to calculate abnormal returns, which were aggregated over 70 weeks using the CAR technique. The second study used 19 “flip-flop” firms from the original sample and used the same methodology to test whether the results concurred with the first study. Using visual interpretation of the results for both studies (Type I error) they found a negative impact on share returns for LIFO adopters, which was unrelated to systematic risk or potential non-stationarity of beta. From this they concluded that the market was inefficient as it reacted to the accounting impact rather than the economic effect of the change. They did however note that the market was learning how to better interpret the LIFO changes as there was less impact on share prices of firms that had later adopted this method.

With the abolishment of the tax concessions for the LIFO method and the resultant impact of higher taxes and reduced cash flow, Gevers (1990) tested the markets reaction to this announcement on 71 LIFO, 23 flip-flop and 99 control-

sample firms using the CAR technique and INDI as the market measure. Initial results indicated a possible “January Effect” and unexpected positive residuals for the flip-flop firms, which the author postulated was due to the inclusion of both holding and flip-flop firms within the same, relatively small sample. In the final conclusion it was stated that the information content had already been discounted by the market at the time of the announcement. This resulted in a lack of market reaction to the announcement and therefore no conclusion could be drawn on the markets efficiency.

Investigating regulatory requirements imposed on certain industries, Bhana (1995b) studied the impact of the regulatory announcement of increased capital requirements for the banking sector. Using the event study methodology, the event window covers the announcement date of 30 November 1990. The market model was used for the -90 to -6 day estimation period with the ALSI as the market proxy. These estimated parameters were applied with the actual returns to derive expected returns over the event window (-five, zero and 10 days, where day zero is the announcement date) from which abnormal returns were calculated and consolidated into an equal-weighted portfolio. CAR values were also calculated for the post announcement date of day one, two, three, four and five and tested for significance using the t-test.

Results identified the possibility of insider trading, as abnormal returns started to become negative five days before the announcement day. Significant negative

abnormal returns were found for previous day, the announcement date and day three and four post the announcement. As the press report was published the day before the official announcement, the significance of that days return implied that the market accepted the announcement without waiting for it to become official. Further tests, using cross-section analysis, were done to identify whether the market penalised banks that had low capital ratios. The results indicated that banks that had lower capital ratios where indeed penalised on the basis that they would have to raise more capital through share issues.

As indicated by studies of Bhana (1998) and later by MacKenzie, Pascoe & Ward (2005), share prices of companies who issue new capital requirements tended to drop, as the market penalised these firms for the reduced expected future price of their shares. Further to this it was suggests that the market views regulation of this event unfavourably and reacts speedily to the announcement. This is reflected in the share price movement which implied semi-strong efficiency when dealing with such information.

5.4.2 Changes in Dividend Policy

Two studies on the effects of dividend announcements was done in 1987 by Archer, Ooms & Smit (1987) and Affleck-Graves & Knight (1987) and both studies suffered from the criticism that neither could isolate the effect of dividend announcements from that of earnings announcements. Archer *et al.* (1987) used 1122 dividend samples of industrial shares between 1973 and 1984 and the

Actuaries Industrial Index and Actuaries Dividend Index for the market returns. The CAR technique was used to aggregate residuals from both the risk-adjusted market model and actual versus market returns. Affleck-Graves & Knight (1987) used 230 dividend announcements from 41 companies between 1973 and 1980 and used the market model with both the CAR and APT aggregation methods. The results of Archer *et al*. (1987) showed a positive reaction around the announcement date but with abnormal returns not significantly different from zero. This led both studies to conclude that dividend traders were unable to earn superior results, while Affleck-Graves *et al.* (1987) found no support for the signalling role of dividend announcements. However, due to the criticism of these studies, the results should be interpreted with caution.

Bhana (1991a) tested the market reaction to major shifts in dividend policy for four groups of shares which had large increases (decreases) and omissions (resumptions) of dividends between 1970 and 1988. Each group consisted of 40 random samples and abnormal returns where calculated for the 41 days surrounding the announcement date. This was done using the market model, the ALSI as the market measure and aggregated residuals using the CAR technique. As the study required dividend and earnings information to be separated by at least 10 trading days, the results indicated that large dividend changes provided information over and above that of earnings (see criticism of Archer *et al*. (1987) and Affleck-Graves *et al*. (1987)) studies. Further to this, the study found that market reaction continued for up to 19 days post-announcement date. This would

have allowed investors to realise large excess returns by buying or shorting stocks that announced large dividend increase or decrease respectively. The conclusion of the study was the rejection of the market as semi-strong efficient as the findings were consistent with the over-reaction hypothesis.

To determine whether share dividends are used by managers as financial signals, Bhana (1997) selected 250 random samples of companies that had announced share dividends from 1986 to 1995. To avoid possible interference from other announcements, the sample was filtered to exclude events that included cash dividends and other significant announcements within 2 days of the event. In contrast to most studies of this type, the author employed the use of the Comparison Period Return Approach (CPRA) rather than the CAR technique to measure the significance of daily share price movements. This alleviated the stationarity and stability problems associated with beta and the market model. Additionally a naive expectation model was used to measure expected versus unexpected dividend share announcements. The tests were run for a 60 day period before and after the announcement date for the comparison period, and included the entire sample (250 shares) as well as four sub-samples based on dividend share size. The results indicated that dividend share announcements were interpreted by the market as financial signals from managers and the size of the dividend impacted the share returns positively on the announcement day independent of whether the announcement was expected or unexpected.

Concerning the efficiency of the market to absorb the information, the results indicated that information was only completely absorbed in the share prices 20 days after the announcement. The average cumulative abnormal returns for the three day period after the announcement was 1.93% and increased to 4.13% after 10 days and 4.57% after 20 days, after which the returns stabilised. This evidence implied that the JSE was semi strong inefficient.

5.4.3 Information Content of Earnings Figures

Affleck-Graves & Knight (1985, 1986, 1987) conducted three studies in consecutive years on the impact of interim, preliminary and annual report announcements on the market. The first two studies, concerned with the preliminary and interim results, used the same methodology and sample. The sample consisted of 41 Industrial companies listed between 1973 and 1980 of which weekly abnormal returns were calculated using the market model and the RDM 100 Industrial Index as the market portfolio. An earnings expectation model was used to divide stocks into good and bad news portfolios, whose residuals were aggregated over a 73 week and 50 week period respectively using the APT model. In the first study the results were graphically analysed (Type I Error) from which they found that the market prices adjusted fairly rapidly to information, but tend to over-anticipate bad results causing a post announcement correction. The results of the second study found that interim results provided significant increment information and this was more evident in the second half of the year announcements than in the first.

The third study looked at the effect of both the previous event studies and the annual report information on 180 well traded industrial companies between 1973 and 1980. Once again they found that all three reports had information content which resulted in abnormal share behaviour over the event time. All three studies concluded that the market prices impound the information contained in the reports fairly rapidly and therefore the market was semi-strong efficient.

Concerns raised with these studies included the fact that it took between 2 and 10 weeks for the adjustments to take place, which in other studies would be considered unacceptable to imply efficiency.

Bhana (1995c) tested the “overreaction to earnings hypothesis” for a fifteen year period from 1975 to 1989 using random samples of 400 companies which were split between positive or negative earnings. Monthly sample share data were used and excluded companies that where involved in acquisition, mergers, bankruptcy, delisting or thin traded. The study made use of the CAPM to obtain abnormal risk-adjusted returns which were aggregated using the CAR technique.

To test the effect of negative and positive earnings, data for each sample was collected for price per share, earnings per share (EPS) and market capitalisation. EPS data was collected for two years prior to the test year, the test year itself and two years after the test year. The sample companies were aggregated

across all test years and classified into negative earnings (losers) and positive earnings (winners) with the five year EPS values. The results showed that for the first year after earnings announcements the losers reported large and positive CAR's while the winners reported negative CAR's. Further testing using linear regression supported this and implied that the CAR in the next year was related to the magnitude and direction of the EPS change in the current year.

Testing whether the "negative earnings effect" and the "small firm effect" are one in the same, the same test was redone by firstly sorting the companies into five market value quintiles and then further splitting the quintiles between winners and losers, which resulted in a distinction between the two effects. The results where observed in conjunction with the risk of the share. What was apparent was that negative earnings were associated with increased risk and decreased share price which was reversed the following year.

This negative correlation *"… suggests that investors are compensated for the perceived higher risk associated with companies reporting negative earnings*" (Bhana, 1995c:53).

Implicit in the results was that investors overreacted to negative earnings announcements and excessively discount the share, underestimating the company's ability to recover. If this was so, the overreaction hypothesis predicted that this effect would be more apparent in first time losers than in repeat

offenders (companies that have announced negative earnings in preceding years). Testing this statement, the study found that repeat offenders tended to have higher CAR values than first timers.

In concluding the study highlighted this market inefficiency and suggested that astute investors could outperform the market using a strategy based on the findings. However, the author raised the question of risk-based reward for companies that produce negative earnings announcement and identified the need for further investigation, specifically related to the operational and financial characteristics of the firms reporting the results.

Jefferis and Okeahalam (1999) used the event study method to determine the possibility of integrating the Botswana, Zimbabwe and JSE exchanges. The earnings results were used as the event and were categorised into good, bad and no news announcements. The study looked at the 60 week period between 1996 and 1997 and used 13 banks and 17 retail firms for the JSE test. The CAPM was used to generate the returns and the results aggregated using the CAR technique.

Their conclusion supported the semi-strong efficiency for the JSE, although this conclusion is somewhat unsupported by the evidence from the study, which indicated a two week post-announcement period for the returns to normalise. An extended correction period of two weeks would in other studies indicate

inefficiency within the markets and therefore the results of this study should be interpreted with caution.

Conducting the same international study of Sloan (1996) which evaluated whether share prices reflect the current cash and accrual components of future earnings, Hamman, Heyns & Smit (1999) used JSE data from 1974 to 1996. The study involved two tests of which the first tested whether the cash component of earnings or the accrual component of earnings attributed more to earnings performance. The second tested the efficiency of share prices to reflect the greater persistence of earnings attributable to the cash flow component of earnings. The second test used the method developed by Mishkin (1983) to test the *rational expectations hypothesis* in macro-econometrics using non-linear least squares regression and abnormal returns. This was done by finding the difference between realised returns and size-matched portfolio returns.

The findings of the first test were consistent with international studies in that the *"… persistence of earnings attributable to the cash flow component of earnings is greater than the persistence of earnings attributable to the accrual component of earnings."*(Hamman *et al*., 1999:130)

The second test rejected market efficiency on the basis that even though investors realised that there was a greater persistence of earnings as attributed

to the cash flow component of earnings, they had underestimated the influence of this component in the earnings.

5.4.4 Corporate Decisions

Using the event study methodology to examine the effects of merger announcements on share prices, Von Der Honert, Barr, Affleck-Graves & Smale (1988) examined 45 acquisitions over the period of 1975 to 1985. Both the acquiring firms and target firms were examined and the results indicated that share price reaction was observed for the target company some weeks prior to the official announcement. However the requirements of the JSE for cautionary announcements be made before any merger or acquisition may have influenced these results.

A study of abnormal returns of post-listing performance was done by Bradfield & Hampton (1989) using 77 new listings between 1975 and 1986. The CAPM was used to estimate the expected risk-adjusted returns and the results indicated significant positive abnormal returns of new listings within the first year, specifically when new listings had occurred in “hot” periods i.e. periods that have a high number of new listings. Although the study suffered from thin trading effects and *ex-ante* period identification, it did provide evidence of inefficiency in the performance of new listings.

Extending the study by Bradfield & Hampton (1989) and focusing specifically on the new listings boom period of 1985 to 1987, Bhana (1989a) tested 40 new equities listings for risk adjusted and non-risk adjusted excess returns after a week, a month and a year. Two approaches were used in the study to evaluate the price behaviour. The first used the issue price and the second used the closing price on the first trading day. Surprisingly the two approaches yielded different results, with the first approach showing large positive excess returns in the first trading day followed by significantly positive excess returns for both the first month and first year. The second approach showed insignificant returns for the first week and month and negative returns for the yearly holding period.

The results indicated that the market is efficient in that the rate of return at the initial offering did not affect the subsequent share price behaviour. However the negative serial correlation observed in the share price over time also supported the overreaction hypothesis.

Investigating the impact to shareholders wealth when local firms list overseas Bhana (2000) found that listings done on the London Stock Exchange (LSE) were associated with positive significant abnormal returns. The CAPM and CAR technique was used to measure the effect of the listings 25 days before and after the listing date. This was benchmarked against the mean returns 125 days before and 125 days after the measurement period and resulted in a 301 day overall measurement period. The sample consisted of 35 South African

companies that listed on the LSE between 1986 and 1997. Contrary to international studies which found significant losses over the pre and post listing period, this study found significant positive returns 3 days before the listing (0.43%, 0.52%, 0.61%), on the listing date (0.45%) and one day after listing (0.33%). Positive returns, although not significant, were visible for the entire 51 day event period which resulted in a CAR of 2.14%.

The study further tested the effects of the overseas listing on the volatility of the shares and revealed an increase in volatility which could not be attributed to noise trading or change in the return-generating hypothesis. The conclusion was that the overseas listings added value to shareholders as it allowed local firms to access cheaper sources of capital but this resulted in increased volatility due to informed traders taking advantage of information differentials between the two markets.

The subject of Initial Price Offerings (IPO) and the effect of under-pricing were extensively studied by M'kombe & Ward (2002). They used 541 IPO's over the period from 1980 to 1998 to test whether IPO's yielded risk-adjusted abnormal returns for one, three, five and 10 year periods after listing. The test was further concerned with whether certain IPO characteristics had an effect on post-listing performance. Using the BHAR technique rather than CAR technique, the study compared the IPO performance against four different BHAR methods. The first method involved ranking all shares against book-to-market values and assigning

them to three portfolios. In December each year the book-to-market value of the IPO was matched against one of the three portfolios and the monthly returns of the portfolio was used as the expected returns of the IPO, which was then used to calculate the BHAR of the share. The second method used was similar to that of the first, however it used market capitalisation instead of book-to-market and five portfolios instead of three. The third method used the CAPM incorporating the ALSI and R150 as the market proxy and risk free rate respectively. Beta values were calculated as the regressed difference between the share return and risk-free rate versus the market return and the risk-free rate. The last method was further expanded by testing the CAPM without the effect of beta where beta was equal to one.

The results showed that IPO's significantly under-performed the three buy-and-hold benchmarks and the underperformance increased over the one, three, five and 10 year buy-and-hold periods. This suggested that the cost of raising equity for these firms was low. In terms of the characteristics which influenced the aftermarket performance of IPO's, the listing price, capital raised on listing and issue period (hot or cold) had an effect, while size of initial *premia* and volume of shares listed had no effect. They concluded that according to the EMH, the aftermarket performance and initial *premia* should be independent of each other, as was found in the study, and therefore the study suggested that the market was efficiency.

In a similar study done by Von Der Honert, Barr, Affleck-Graves & Smale (1988), Negash & Wimberly (2004) studied the value creation effects of merger and acquisitions (M&A) on the JSE. Using data from 1986 to 2001 the study measured the abnormal returns generated by firms three years after the M&A announcement. The study used the control portfolio method to calculate the "normal" or expected returns by comparing the sample firm returns to the benchmark portfolio returns, based firstly on size and then book-to-market. Abnormal returns were calculated as the difference between the sample firm returns and the matched benchmark portfolio returns, which were aggregated using the CTAR and CAR techniques. T-tests and Wilcoxon sign-ranked tests were also done on the results to test for significance.

The CAR tests indicated that positive abnormal returns were generated between the first 3 and 14 months after M&A announcements, after which negative abnormal returns occurred. T-tests indicated that abnormal results were only significant in the second year following the announcement. The results of the Wilcoxon test indicated that independent of period (one, two or three years) the abnormal returns of M&A firms was significant and negative. These results indicated that investing in M&A firms was only beneficial for the three to 14 month period after the announcement.

To understand the impact of Management Buyouts (MBO) on the shareholders wealth of the divesting firm, Bhana (2005) investigated 38 MBO's on the JSE

from 1983 to 2002. Besides the requirement for data availability and share suspension, sample selection filters also required that the acquiring management team had at least one manager of the divesting firm and that only a single instance of MBO had occurred in a 310 day period surrounding the event.

The event study methodology was employed and used the market model to calculate excess returns where beta was calculated through the use of OLS and the Bradfield and Barr (1988) procedure. Daily excess returns were averaged for the 38 MBO's and average cumulative excess returns (ACER) calculated over a -40 to 40 day period over the announcement date. Significance testing was done using the *t ratio*. A second set of tests was performed which used the average standardised cumulative excess returns (SCER) followed by the portfolio standardised cumulative excess return (PSCER) which tested whether the results were significantly different from zero.

To account for size differences in the 38 MBO's, the measurement used was the announced selling price of the unit divided by the equity market value of the parent company, one month prior to the announcement. The MBO's were then categorised according to those divesting less than 10%, those divesting more than 10% and all the MBO's. These were then examined by regression of the excess returns against size, followed by calculating the ACER for small and large MBO's.

Results showed a significant positive ACER values 40 days prior to and five days before the announcement date, with the announcement date excess return accounting for 14% of the overall 81 day ACER. The ACER for the 10 days prior and 10 days post the announcement date accounted for 83% of the overall gain of which the majority of these gains occurred before the announcement day.

This lead to the conclusion that MBO's had a positive effect on the wealth of the divesting firms shareholders, which was highlighted by a period of abnormal positive returns over the announcement date. When they tested the effect of the MBO size the results indicated that there was a positive relationship between excess returns and size and the higher the proportion of assets sold, the higher the positive excess return received by the divesting firm. Although the study was not a direct test of EMH, the author stated that the speed at which the information of the MBO was divested into the market would suggest semi-strong form efficiency.

5.4.5 Changes in Share and Capital Structure

In an investigation on whether the markets showed excess returns during share splits, Cross & Firer (1986) investigated 34 stocks that had ordinary share splits between 1972 and 1984. These shares were split between high and low traded stocks to account for thin-trading and used monthly returns and the JSE Actuaries All Share Index as the market portfolio. Expected returns were calculated from the CAPM and residuals aggregated over 59 months using the

CAR technique. Results were analysed graphically and indicated that positive abnormal returns were apparent 15 months prior to the share split, with the maximum abnormal returns observed in the month of the event which then gradually decreased over the 11 months that followed. The conclusion reached by the authors was that the share splits occurred as a result of periods of previously sustained abnormal returns rather than the observed abnormal returns being a reaction to the forthcoming share split.

Using the CAPM, two-factor and naive model to estimate abnormal returns, Biger & Page (1992) investigated the effects of share splits and capitalisation events on 92 and 34 firms respectively between 1980 and 1990. The results showed significant positive abnormal returns before and during the week of the announcement date, which implied that the market had information regarding the announcement. Also observed was an increase in the systematic risk of the shares following the announcement. This supported the CAPM in that the positive abnormal returns were as a result of increased risk associated with the firm and hence investors required a higher return from those firms.

Firer, Youds & Ward (1993) investigated rights issue announcements for 63 firms listed on the Industrial or Financial sectors of the JSE. Using daily share prices between 1986 and 1992, the returns were calculated using the market model, the specific sector index and beta with residuals aggregated using the CAR technique. The results support the semi-strong form efficiency due to the speed

at which the information is impounded into the share prices. However the authors noted that share price movement observed before the announcement would seem to indicate possible insider trading, confirming the results observed by Biger & Page (1992).

Firer & Philpott (1994) studied the share price anomalies associated with different types of shares within the same company and the related shares of companies in pyramid structures. The research hypothesis tested stated that the JSE, as a semi-strong efficient market, would have very few share price anomalies and if these occurred they would only persist for a single day.

The sample was selected from 1986 to 1991 and resulted in a final sample with 16 companies with convertibles, six with preferred ordinaries, eight with convertible preference shares and two with two types of convertible debentures. Five companies which had two types of ordinary shares with differing voting rights were also included while 42 pyramid pairs made up the rest of the sample.

Share value ratios were calculated and defined the exact value of “S” shares, the lower limit of preferred or convertible preferred shares value were relative to the ordinary shares. The upper limits for deferred share or shares with no or restricted voting rights were also relative to the ordinary shares. Share value ratio’s for the pyramid companies were computed as the ratio of “*… number of*

shares in the bottom company held by the pyramid to the number of issued shares by the pyramid" (Firer & Philpott 1994:41).

Using daily data for the analysis, the study followed a lengthy and complex process of identifying anomalies in which the share price of the one share traded at a premium or discount to the other by more than four percent (which was determined to be the switching cost during the study period) and for two or more days in succession. Thereafter an anomaly index was constructed which used three measures of market efficiency as was indicated by extent and magnitude of the anomaly: percentage of anomaly days, the percentage of non-isolated anomaly days and the maximum premium or discount. This index was regressed, using stepwise multiple regressions, against various influencing factors which were considered to be descriptive of the extent of the anomalies.

The results of the stepwise regression indicated that liquidity ratio (days traded of one share versus days traded of the other), Value ratio code (inability of investors to interpret of remember information) and minimum between the shares of the shareholder activity (passive versus active shareholders) constituted the extent of the anomalies. Overall the results of the study provided conclusive evidence of reoccurring share price anomalies on the JSE.

In concluding the authors stated that based on the amount, magnitude and persistence of anomalies, the JSE was not an efficient market and anomalies existed for both high volume and low volume traded shares.

From previous investigations it had become apparent that new equity capital issues were seen unfavourably by the market and resulted in a decreased share price of between three to four percent over the two day announcement period. In light of this Bhana (1998) attempted to identify this market reaction against the managerial ownership and slack abundance hypothesis. Using data from companies listed over a 16 year period (1980 – 1985) a random sample of 100 companies announcing additional equity shares were analysed using the market model for abnormal return estimation, which were averaged to obtain the returns for an equally weighted portfolio. The CAR technique was used to aggregate the results. The event window of 40 days preceding the announcement and 40 after the announcement was used in conjunction with 160 day pre and post estimation period. To test the hypothesis, linear multiple regression models were used where the independent variables consisted of the two day announcement period, level of insider ownership, slack, size of the issue, change in debt, market value of the company, share price run-up and the variance of the residuals.

Overall the results indicated an average decline in share prices of 3.51% over the two-day announcement period. Testing the first hypothesis, the coefficient of the insider ownership variable was positive but insignificant. Further tests on the size

of the firm and relative ownership produced significant results and therefore supported the hypothesis that inside ownership of less than 30% reduced the decline in the share price. Inside ownership greater than 30% also showed a reduced decline in share prices, but was not significant (these shares were usually small firms and only accounted for 10% of the sample). Testing the second hypothesis, the results rejected the slack abundance hypothesis on the basis that the coefficient variable was negative and as a result did not provide a cushion for the pending share price decline.

In terms of efficiency (although not directly specified in the study) the results indicated a share price reduction that persisted for a month after the announcement date and resulted in a -2.54% CAR which implied a semi-strong form inefficient market when faced with new equity capital issue.

MacKenzie, Pascoe & Ward (2005) further investigated rights issue announcements. As with new equity issues, previous studies had shown that the market responded negatively to rights issue announcements and that economic factors both collectively and individually impacted these announcements. The study used the event study methodology and used the CAPM to estimate the abnormal returns. The CAR technique was then used to aggregate the residuals over the event window, after which all the rights issue events were averaged. The significance of these results were tested using the z-statistic.

To test whether the economic factors were significant, regression analysis using stepwise regression was used along with the F-test and t-tests for significance testing. The variables tested included interest rate, stock market, economic growth, business cycle and business confidence proxies. The population consisted of all companies that had right issue announcements from 1989 to 2002 and was filtered based on ordinary shares and rand-denominated shares and excluded shares with confounding events, unanticipated announcements and thin trading. A random sample was then taken from the remaining population in order to increase the reliability of the results. A 21 day event windows was used and consisted of the 10 days prior the announcement day, the announcement day and 10 days post the announcement day.

The results indicated that there was a period of persistent negative abnormal returns on the announcement day and four days following the announcement. This resulted in significant cumulative abnormal returns of -3.8% over this window period. The abnormal returns also showed non-normality and leptokurtosis but not abnormal skewness. Plotting the CAR values against time with a quarterly, three year moving average, exhibited an increasing trend of the market to react negatively to rights issues.

The results of the stepwise regression and resulting model explained 18% of the variation in the CAR's. Economic growth and interest rate had positive coefficients, while stock market performance had a negative coefficient and all

were significant at five percent. Time, business cycle and business confidence were all statistically insignificant and all residuals were found to be heteroscedastic and non-normal. Although this study is not a direct test of market efficiency, the five day event window depicting the negative abnormal returns may be short enough to support semi-strong efficiency.

5.4.6 News Impact on Share Price

Extensive international studies have been undertaking to identify the relationship between changes in money supply and share prices. A number of hypotheses cited by Glass & Smit (1995) exist on this relationship and include:

- The *expected inflation hypothesis* (Hafer, 1986),
- the *risk premium effect hypothesis* (Hamburger & Kochin, 1972),
- the *policy anticipations hypothesis,*
- the *real activity hypothesis* (Hafer, 1986),
- and the *monetary portfolio hypothesis* (Bhana, 1993).

In their study on semi-strong efficiency of the JSE, Glass & Smit (1995) focused specifically on information regarding changes in money supply. The study used two time periods, the first was between 1978 and 1993. The second period consisted of a subset of the first and included the money supply regime as described by Philip & Smit (1992) which ran from 1984 to 1991. Four models were specified in order to determine the anticipated change in monetary growth and were defined as the:

a) Classical IS-LM based model,

b) Barr & Kantor model (1990),

c) atheoretical model using a range of macro-economic variables and

d) a model based on Bhana (1993).

Following from this, regression equations were specified with the rate of change in the ALSI as the dependant variable with the anticipated and unanticipated changes in monetary supply as the independent variables. This resulted in five models based on the M1A and M3 money aggregate, which were then tested for heteroscedasticity and significance using the t-test and serial correlation.

The results were divided between the M3 and M1A money aggregates and both indicated that all variables are specified in terms of rate of change. M3 results indicate that 40% of monetary growth was anticipated while the M1A tests suggested 53% market anticipation. With the exception of the M3 model, all other cases indicated a significant relationship between lagged monetary growth variables and share prices. The authors did however suggest that despite the theoretical significance, the explanatory power of the models was very low which implied that a trading rule would, after transaction costs, not allow for an investor to achieve above market returns.

On this basis the authors concluded that theoretically the market showed semi-strong inefficiencies, but economically the semi-strong EMH was supported.

To testing the supply and demand effect of block transactions on the JSE, Atkins & Ward (1996) used block transactions over R1 million, between 1993 and 1994 period, to test for price pressure, information and substitution hypotheses. The transactions were divided between seller and buyer induced trades and tested using the event study methodology with the expected share price modelled using the market model (beta values were obtained from UCT) and returns which were aggregated using the CAR technique. Significance in changes in the share price before and after the event was tested using the Student's t-test.

The event window was defined as the 20 days before the event (-20 days), the event day (ay zero) and 20 days post the event (+20 days). The results of the study indicated that there was an average increase of 3.5% in buyer induced trades and average decline of 1.7% for seller induced trades. For both trade types, the change in share price was permanent and was related to the size of the block volume traded. Price reversals occurred the day after the trade occurred and the buyer induced trades showed increases in residuals for 10 days following the trade.

The study concluded that even though there was implied inefficiency due to the continued increase in residuals, the ability to make profit or excess returns during this period was nullified by the costs of transactions. They therefore supported the JSE as semi-strong form efficient.

Investigating the impact of industrial strikes on the JSE from 1984 to 1993, Bhana (1997b) found that the market was able to anticipate whether a strike or settlement would occur. However, even though the market was able to predict the outcome, it seemed to underestimate the actual cost to the share holders in the event of a strike occurring. The study used daily data from the JSE and news from the Business Day. The event study methodology used the Bowman (1983) model and market model (ALSI as the market proxy and beta calculated using OLS and Bradfield & Barr (1988) technique) to determine the abnormal returns which were aggregated using the CAR technique. The t-test was used to determine whether the CAR values were significantly different to zero.

In an efficient market the investors would on average have been able to anticipate the cost of the strike, however the results of the study indicated that the price fell on average by -3.64% up to 30 days after the strike announcement. As the *"… absolute value of this decline was significantly greater than brokerage and other trading costs …. (it) suggests that investors could have made above normal returns … by taking a short trading position on the first day of the strike."* (Bhana, 1997:47). Therefore the conclusion reached from the study was that the market was not semi-strong form efficient when dealing with strike actions.

The common belief in South Africa was that firms under-invest in Research and Development (R&D) because of the fact that markets, which are fixated on accounting earnings, penalise R&D expenditure by expensing it against earnings.

In investigating the validity of this, Bhana (2001) firstly tested whether markets have traditionally reacted to information on R&D announcements. Secondly the author evaluated market efficiency by testing whether a company announcing R&D expenditures received positive abnormal returns while their counterparts incurred negative abnormal returns over the announcement period. Lastly the study tested the *free-rider hypothesis* which predicted that counterpart companies will benefit from intra-industry spill-overs.

Using 68 uncontaminated and 83 contaminated samples from the JSE between 1980 and 1997 the methodology used daily returns to calculate abnormal returns per stock using the market model (market coefficients where estimated using 330 – 16 day pre-announcement day values). All the samples were then combined to create a portfolio average abnormal return which was aggregated using the CAR technique and tested for significance using the Z-statistic.

The results indicated that firms which announced R&D expenditure realised a statistically significant average abnormal return of 1.19% over the announcement period. Counterpart firms, on the other hand, suffered from these announcements by an average of -0.56% over the same announcement period.

In both cases, the contaminated and non-contaminated sample showed the same sign but with differing magnitudes. These results indicated that the market did react to R&D announcements and that the market reaction was consistent with that predicted by the efficient market hypothesis. Through regression of the Standardised Cumulative Abnormal Returns (SCAR) of counterpart firms against the announcing firm, the study indicated support for the *free-rider hypothesis* in that rival firms gained from intra-industry spill-overs, but these gains were at a reduced level.

The conclusion suggested that the common belief associated with R&D spending was rejected and that the investor's reaction indicated a tendency to capitalise R&D expenditure in the valuation process of market prices.

Bhana (2002) continued with event studies concerned with corporate decisions and their effects on share prices by investigating the impact of layoff announcements and their subsequent long-term financial performance.

The following two reasons for layoffs were cited: *"uncompetitive firms who often see rationalisation of their labour force as a major strategy to reduce operational costs"* while due to other *"… firms becoming 'lean and mean' by eliminating redundant employees, reducing operational costs and increasing productivity."* (Bhana, 2002: 47*)* and were classified as the *decreased demand hypothesis* or the *pure efficiency hypothesis* respectively. It was also noted that layoff

announcements may be used by management as a signalling tool to investors, who may consider layoffs as an effective cost reduction method of increasing company value.

The study sample consisted of 88 companies who announced layoff decisions between 1980 and 1997 which were filtered using four rules. The sample was then divided into two sub-samples representing layoff decisions made for declining demand (35 companies) or efficiency enhancement (53 companies). Daily returns were used for the seven year pre and post announcement data (three years before, the event year and three years after). The methodology used the market model with beta estimated from the OLS and the Bradfield and Barr (1988) procedure based on a 140 pre-announcement daily returns. The CAR technique was used in calculating the three alternative announcement periods which included two days (day -1, 0), 3 days (day -1, 0, 1) and 12 days (day -1 through to 10).

The results indicated that firms citing adverse conditions for layoffs experienced negative abnormal returns, while those that cited reasons of improving efficiency experienced positive abnormal returns. The study then tested whether the reason for the results were due to size differences between the two sub-samples. This was done trough the use of the geometrically compounded return method and the results indicated that size was not a differentiating factor.

The author concluded that the market was semi-strong efficient in processing layoff announcements and used these announcements as signals of future profitability and company value.

5.5 Studies on Strong Form Efficiency

5.5.1 Portfolio Performance Tests

The earliest study on professionally managed portfolio performance was done by Gilbertson (1976). This study analysed the performance of 11 unit trusts between 1970 and 1976. Assuming beta stability for the study, the author found that the funds earned a risk adjusted average of 1.1% less than the market.

Following from Gilbertson (1976), a similar study was performed by Gilbertson & Vermaak (1982) using 11 mutual funds performance measured against JSE Actuaries All Share, JSE Actuaries Industrial Index and the RDM 100 Industrial Index. The time period used was from 1974 to 1981 and was analysed using both risk adjusted (using the Sharpe and Treynor index and the Jensen measure) and unadjusted returns. The results contradicted the study of Gilbertson (1976) in that the findings indicated that risk adjusted returns outperformed all three market indexes over the same period.

Both studies assumed beta stability which in both cases was found to be incorrect. Secondary to this, the assumption of Gilbertson & Vermaak (1982) that beta reflected the true measure of risk could also been questioned.

In an attempt to overcome the problems associated with beta stability and stationarity, Knight & Firer (1989) investigated unit trust performance between 1977 and 1986. They tested for market and unit trust returns and found that both of these returns showed normal distributions, validating the use beta determination through linear regression and the Jensens performance measure. Unit trusts were found to have a lower systematic risk when compared to the market and underperformed the market when unadjusted for risk. After adjusting for risk, five unit trusts outperformed the market, but when further adjustment for trading costs were done, they again under-performed the market. However, one unit trust consistently outperformed the market after it was adjusted for risk and trading costs, which lead to the conclusion that the market was strong form inefficient.

Oldfield & Page (1997) studied the performance of unit trusts and the specialist abilities of unit trust fund managers for eight general equity and nine specialist funds over the period of 1987 and 1994. The benchmark portfolio consisted of six "asset classes" made up of the major JSE indices with the risk free rate based on the 90 day Treasury Bill. Using the Jensen methodology, the results indicated that on a risk adjusted basis, nine of the unit trusts outperformed the market, but the results were not significant at the 5% level. If management fees were incorporated into the risk adjusted returns, none of the unit trust funds provided superior returns above that of the market.

Meyer (1998) used the Jensen's Measure to determine the persistence of unit trust performance for 13 unit trusts over a ten year period (1985 – 1995) and 33 funds over a five year period (1990 – 1995). The 10 year period was divided into seven sub periods. The results indicated that positive Jensen Alphas existed for four of the 13 funds over the entire 10 year period, while 13 funds had positive Jensen Alpha's for the 5 year period tested. In terms of persistence of performance, the repeat winner phenomenon existed for a two year period, while the repeat loser phenomena existed for a one, two and four year period. The study suffered from a number of methodological concerns, namely the small sample size that was used and beta stationarity and stability. Due to these concerns the results of the study should be interpreted with caution.

Two years later, Von Wielligh & Smit (2000) continued the study on performance persistence of unit trusts. Using a different methodology to previous studies, this study analysed unit trusts over a five and a ten year period using the three models of performance measure (CAPM, two-factor APT model and three-factor APT model). Four samples of data were used in the study which correspond to 10 General Equity Unit Trusts over the 10 year period, the General Equity Unit Trusts over the five year period and the combination of the two samples over the two sub periods. The four data samples were split into three equally weighted portfolios based on the current year's excess returns (a modified version of Hendricks, Patel & Zeckhauser (1993) methodology). The first portfolio had the top performers and the third portfolio had the worst performers. Portfolios were

held for a year from which the excess monthly returns were calculated. Multiple regression analysis was then performed with the three portfolio's returns as the dependant variable. The two-factor APT model consisted of the All Gold Share Index and the All Industrial Share Index, while the three-factor model used the previous factors as well as the standard deviation of monthly returns.

The results indicated that there was long and short term persistence in performance, specifically for the worst performing unit trusts, which tended to remain the worst. However, there was a lack of persistence for the best and average unit trusts which tended to switch, with the best becoming the average and the average becoming the best. The unit trust portfolio's showed excess returns of up to two percent per month above the ALSI.

Beale, Edwards, Hendrie, Scheppening & Firer (2001) continued with performance persistence and used 43 unit trusts and 35 bond and fixed income unit trusts, between 1989 and 1999, with formation and holding periods of three, six, 12 and 24 months. Unit trusts returns where ranked and assigned to quintiles according to performance and persistence. This was based on whether a unit trust significantly repeated its performance in terms of its quintile ranking. In order to enhance the reliability of the results, the returns where also split into two groups of winners and losers. The problems of beta stationarity and stability were overcome by using the Sharpe performance index to risk-adjust the unit trusts returns.

The results showed significant persistence in the unit trusts over all sub periods up to a two year holding period. The strongest persistence was found for half-year formation periods which were used to predict a quarterly holding period. The results differed from pervious studies because of the larger sample size and the methodology and risk adjustment method used. Whether a two year holding period was a suitable period to assume persistence may be questioned in this study.

In an attempt to overcome the problems associated with traditional approaches to portfolio performance measurement, Akinjolire & Smit (2003) introduced the conditional performance evaluation technique in order to measure unit trust performance from 1989 to 2002. This approach introduced market variables into performance measurement and subsequent analysis was conditional on these variables. This model controlled for time-varying beta to overcome problems associated with beta stability and stationarity. The study also attempted to identify whether the conditional approach method used was superior to that of traditional unconditional performance measurement approaches (i.e. CAPM, Treynor, Sharpe and Jensen measures). The study used the Jensen technique as the basis and included the conditional variables for the dividend yield and term structure of interest rates. The data consisted of seven unit trusts available between 1989 and 2002 and used monthly observations. The ALSI acted as both the market proxy and benchmark portfolio.

The results of the conditional performance measure indicated that overall the unit trusts underperformed the market with only two of the funds having results statistically significant at the five percent level. All funds had beta values less than one. Market timing was reversed for the conditional performance measure which indicated that the investment managers did not posses market timing abilities.

The debate on whether the CAPM fully described the market, specifically around its ability to define the risk versus reward relationship, was illustrated by the international study of Fama & French (1992). Their study showed that variations in returns could be attributed to various style factors which, by modifying the base CAPM model to include variables for size and value/growth, better explained the market returns.

Muller & Scher (2005) stated that the inclusion of these variables accepted that style was a source of risk when investing in the markets. Using the Fama & French (1992) model they tested the performance persistence of unit trusts within South Africa from 1990 to 2002. Using monthly data for all domestic unit trust funds, the sample consisted of 14 funds at the start of the evaluation period and ended with 106 funds in the last year of evaluation. The three-month Treasury Bill was used as the monthly risk-free rate while the ALSI was used as the market proxy. As the Fama & French (1992) model required data based on

equity-style returns, the authors obtained four style indices from the Mutooni (2001) database, which included value, growth, small cap and large cap data. These indices were used to create the two style-risk factors SMB and HML required for the three-factor model. Each individual unit trust was then categorised into one of the four style portfolios on a yearly basis and the average returns of the portfolio were regressed against the three-factor model from which analysis and conclusions where made.

The results of the tests indicated similar results to that of overseas studies as most South African unit trusts are unable to outperform the market once adjusted for market size and value. Of more interest were the results from the small cap and value funds which showed negative performance persistence of up to two years. This indicated that unit trusts managers were unable to exploit the perceived inefficiencies within these two style types.

Contrary to common belief, the large cap unit trusts seemed to show the highest out-performance. They stated that managers offering style-based unit trusts needed to out-perform the associated style-benchmark and that based on the results this would imply that they are unable to do so further suggesting that investors could do better by investing in passive style-based indexes. The finding, supported by the international study of Phelps & Detsel (1997), indicated that "*positive persistence found by others is the result of persistence in broad*

equity classes (macro-persistence) rather than sustainable managerial ability (micro-persistence)". (Muller & Scher, 2005: 61)

5.5.2 Insider Trading Tests

Insider trading is prohibited by law and any sign of its existence rejects the strong form efficiency of the EMH. There was little work done on insider trading prior to Thompson & Ward (1995) review and any inference of insider trading was the result from other tests on efficiency. Through test on takeovers, dividend policy and dividend omission and resumptions, Bhana (1987, 1991b) found evidence of insider trading in all cases leading up to the announcement date of the event. From this Bhana (1987, 1991b) concluded that the market was inefficient due to insider trading and therefore rejected the JSE as being strong form efficient.

Further to this, many of the later event studies done by Bhana (1995a, 2005) on semi-strong form efficiency showed further evidence of share price movements before the announcement dates, which indicated some form of insider trading. In a previous study (Bhana, 1995a) the results showed that abnormal returns became negative five days before the actual announcement date. This indicated that the announcement was pre-empted by private knowledge from insiders within the banking industry.

In a direct test of insider trading Bhana (1999) evaluated the impact of take-overs on the share price of the target company. The study was based on evidence that

share prices of the target company increase before the actual announcement of the take-over bid, which would seem to indicate the presence of insider trading. The data used consists of all targeted take-over companies listed on the JSE between 1985 and 1996. Of the 136 targeted companies sampled, 39 companies had pre-announcement publicised articles of possible take-overs in the Business Day while the other 97 companies had no pre-publicised articles before the official announcement date. This resulted in two samples consisting of “NEWS” and “NO-NEWS” companies.

The magnitude of pre-announcement price run-ups was examined through use of the event study methodology. Data consisted of the 30 days prior to the announcement date and 10 days following the announcement date. CAAR where computed for each day using the portfolio average abnormal returns with the ALSI and estimated market model coefficients of alpha and beta (measured from 149 days to 30 days prior to the announcement date). A second test was done on the NEWS sample to identify whether price run-ups occurred before the release of the first press article related to the take-over.

The results suggested that companies in the NO-NEWS sample gained all of their abnormal returns on the official announcement date while companies in the NEWS sample exhibited price run-ups before the official announcement date. Information leakage tests for the NO-NEWS companies indicated minimal impact on the share price movement. The conclusion reached was that insider trading

for NO-NEWS companies had no significant impact on share price returns while the opposite conclusion was reached for the NEWS companies. The study did acknowledge that other sources of public information were not used within the study and therefore these may have attributed to the possible results which indicated insider trading within the NEWS companies.

The author concluded that "*the aggregate pre-announcement share price run-up statistics must be used cautiously as a measure of illegal insider trading activity."* (Bhana, 1999:40)

In an attempt to identify whether outsiders could profit from mimicking directors dealings of shares within their companies, Mordant & Muller (2003) investigated the profitability of director's dealings as a measure of insider trading based on their superior knowledge of a company performance. Using a modification of Fama & French (1993,1996) three-factor model, the investigation included a forth factor based on the findings of Van Rensburg & Slaney (1997) which showed that the JSE exhibited a dual nature based on the resource and non-resource sectors.

As of 2 October 2000 all directors of companies listed on the JSE had to disclose all their trading in companies of which they were on the board. This information was published through Securities Exchange News Services (SENS). Therefore the selection of sample data started from this date and ended on the 31 March

2002, which included 2549 transactions (trades of non-ordinary shares, options or option-related trades and director portfolio restructuring trades were excluded from the original sample). Survivorship bias was minimised by keeping delisted shares within the sample until the day of delisting while new listings were included from the day of listing.

The event study methodology was employed and was based on international studies of abnormal performance which was measured in daily intervals from the day of the transaction (Day_0) to a year after the transaction (Day_{252}). Two models were used to calculate the abnormal returns and consisted of the Market Effects Control Model (Using the Fama & French (1993, 1996) three-factor model plus the "resources effect") and the simple Market Adjusted Returns Model. In contrast to traditional event studies that calculated abnormal return based on equally weighted transactions, this study calculated abnormal returns weighted on the initial transaction value. This was done to avoid bias in favour frequently traded stocks.

The results of this study showed that abnormal returns generated from directors share transactions were mainly due to the market effects of size, value and resources rather than their trades. After accounting for these effects, an investor mimicking director dealing's would on average have gained 11.5% abnormal returns. If they sold short when directors sold shares would have resulted in a maximum of 14.5% over performance (Short selling transaction costs were

excluded from the return calculations). However, only abnormal returns for the first five days after the transaction occurred were statistically significantly different from zero.

They therefore concluded that an outside investor would gain the same or higher returns by investing in a style based investment strategy rather than by following the trading activities of directors.

Bhana (2005) found that 74.7% of the total cumulative excess returns in the parent company shares were realised during the 40 days prior to the announcement. Many critics of management buyouts believed that managers have access to inside information which would allow them to trade in the parent companies shares and impact the share price before a buyout announcement was made.

5.5.3 Specialist Skills of Analysis

As with insider trading, early studies of strong form efficiency within the JSE based on specialist skills where primarily done by Bhana (1990a, 1990b). In the first study, a 100 random buy and sell recommendations from stock brokers and investment advisory firms from 1979 to 1988 was used to determine their ability to predict share price movements. The results indicated that the recommended “sell” shares underperformed the market, while the recommended “buy” shares where significantly positive. The evidence supported semi-strong form efficiency

but also implied that the specialists ability to correctly predict share price movements supported strong form inefficiency.

Further extending on this, Bhana (1990b) studied the effect of secondary share recommendations published in newspapers and financial journals. The results were consistent with the first study, however they showed that secondary share recommendations still impacted share prices, leading Bhana (1990b) to conclude that information from the first recommendations were not fully and immediately reflected in the share prices. Although this showed strong form inefficiency within the JSE it also showed that this process made the market more efficient.

Oldfield & Page (1997) studied two characteristics of unit trust fund manager's specialist abilities. The first characteristic measured their timing ability and the second their stock selection ability. To measure the market timing abilities of the unit trust managers, the returns of a buy-and-hold strategy of the unit trust was compared to the actual returns of the unit trust on a quarterly basis. To test the selection ability of managers, the macro portfolio was compared to the actual returns of the portfolio.

The resulting tests indicated that unit trusts managers showed no significant market timing ability or selection ability. Although they had achieved returns on average of 0.6% per quarter above the market on a market timing basis and 0.2% per quarter on a selection ability basis, none of results were significant.

Investigating the accuracy of analysts' consensus forecasts Prayag & Van Rensburg (2004) determined the extent of systematic error and accuracy as the earnings announcement date approached. In addition to this, the authors also decomposed the forecasts to determine whether the analyst's expectations fully reflect the systematic error of their previous forecasts. Previous international research found that analyst forecasts were more accurate than that estimated by time-series models and this accuracy increased as the forecast horizon decreased.

The sample consists of monthly analyst forecasts for 114 firms which reported interim and final earnings results between 1990 and 2002. Testing the relative accuracy of the analysts' forecasts, the study made use of the semi-annual time-series model used by Liu, Strong & Xu (2001) as the benchmark. The model generated semi-annual earnings estimates by using a first-order auto regressive process in the first difference with drift. Theil's inequality coefficient was computed for each forecast horizon in order to analyse the components of the forecast error as the announcement date approached.

The findings showed that neither the analysts' forecasts nor the auto regressive time series model managed to significantly predict the exact change in earnings results. The analysts' forecasts showed a tendency to over-estimate rather than under-estimate forecasts, but these estimation errors converged as the

announcement date approached. Compared to the time series model, the analysts' forecasts were more accurate overall, with a 12 month forecast horizon having a 23.62% average absolute percentage error which declined to 7.95% a month before the actual earnings announcement. The convergence of the forecast towards the actual earnings per share value indicated that either the information used in the forecast had became more accurate or that the forecasts continually incorporated new information over the forecast horizon.

6. Discussion

6.1 Studies on Weak Form Efficiency

Figure 1 below depicts the various studies done for the JSE on weak form Efficiency. The blue rectangles define those specifically associated with random walk studies while the green rectangles are associated with trading strategies. A yearly timeline runs through the centre of the figure onto which the various studies have been mapped. All studies that support the weak form EMH lie above the timeline while those which reject the weak form of EMH lie below the timeline.

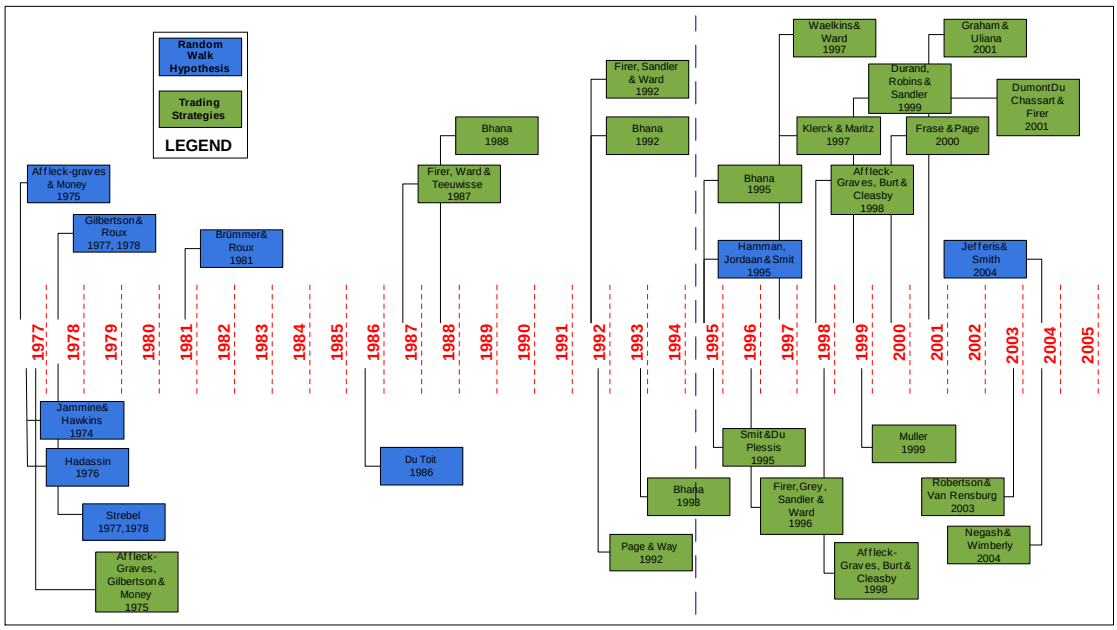


Figure 1: Weak Form Efficient Studies

The first observation evident from the figure is the almost equal number of studies that lie above and below the timeline. This would indicate that there is no

apparent outright distinction between support for, or rejection of, the weak form EMH for the JSE. What is also apparent from the timeline series is the grouping of random walk studies at the beginning of the study period (i.e. 1970 to 1980) and the proliferation of trading strategy studies at the end of the study period. The possible reason for this is due to the international publications of De Bondt & Thaler (1985, 1987) on overreaction hypothesis done in the mid 1980's, which seemed to have re-spawned interest in the EMH.

In an effort to identify whether the JSE is weak form efficient from the studies conducted, it is important to understand that all the studies suffer from various types of criticism. The most common and most influential of these being the ability of the beta to identify risk – especially in a thin traded market like that of the JSE. Bradfield (2003) describes the methodology that should be used when estimating beta in empirical studies, a methodology that is seldom used in most of the studies.

All studies done on the random walk nature of share prices indicated that the JSE seldom supports the statistical random walk hypothesis. As noted before, this may not necessarily indicate weak form inefficiency. The question of whether these non-random walk inefficiencies can be identified *ex ante* and used consistently to outperform the market remains the pertinent question on whether the EMH can be rejected on economic grounds.

Jefferis & Smith (2004) use new techniques to identify random walk behaviour and from this identify that certain shares of the JSE follow random walk behaviour, and therefore are efficient, while other shares do not. Interestingly, these results are similar (and statistically more sound) to the conclusion reached by Strebel (1977, 1978) in the earliest studies done on the JSE.

Trading strategies based on positive or negative serial correlation of share price movement has been shown in international studies (Fluck, Malkiel & Quandt (1997) to be inconsistent over time. This can be observed by the mixed evidence from the South African studies that have occurred over the last decade. Trading strategies like those of Muller (1999) which use a hybrid of overreaction hypothesis and market timing to prove the opportunity to gain excess returns, seems to indicate market inefficiency. However, the high level of accuracy required to identify changes in share price movement (Firer, Sandler & Ward (1992) and Dumont Du Chassart & Firer (2001b)) would seem to indicate the probability of achieving such excess returns consistently is very low.

Identification of *ex post* serial correlation is in itself questionable, as the methods and techniques used to identify these anomalies today are based on massive improvements in technology. As processing power doubles every 18 months, the ability for researchers to utilise deep data mining techniques and highly complex analysis software will undoubtedly continue to find new evidence of share price anomalies that existed in the past. Whether these anomalies were economically

viable after considering trading costs, share liquidity and risk, or whether they still exist after they have been published becomes a topic of continual discussion and uncertainty.

What is definite from the historical review on weak form efficiency of the JSE is that share price anomalies do exist, and are more apparent in thinly traded shares. These anomalies show both signs of non-randomness and serial correlation and when using trading strategies based on such anomalies care should be taken when using beta as the only risk estimator.

Style-based trading strategies also have come under attack in the last decade, with Fama & French (1993) indicating that both value and size should be considered as risk variables and returns should be adjusted accordingly.

Malkiel (2003) extensively criticises studies that attempt to prove market inefficiency based on share price anomalies and concludes by stating that "*with the passing of time and with the increasing sophistication of our databases and empirical techniques, we will document further apparent departures from efficiency and further patterns in the development of stock returns."* (Malkiel, 2003: 80)

6.2 Studies on Semi-Strong Form Efficiency

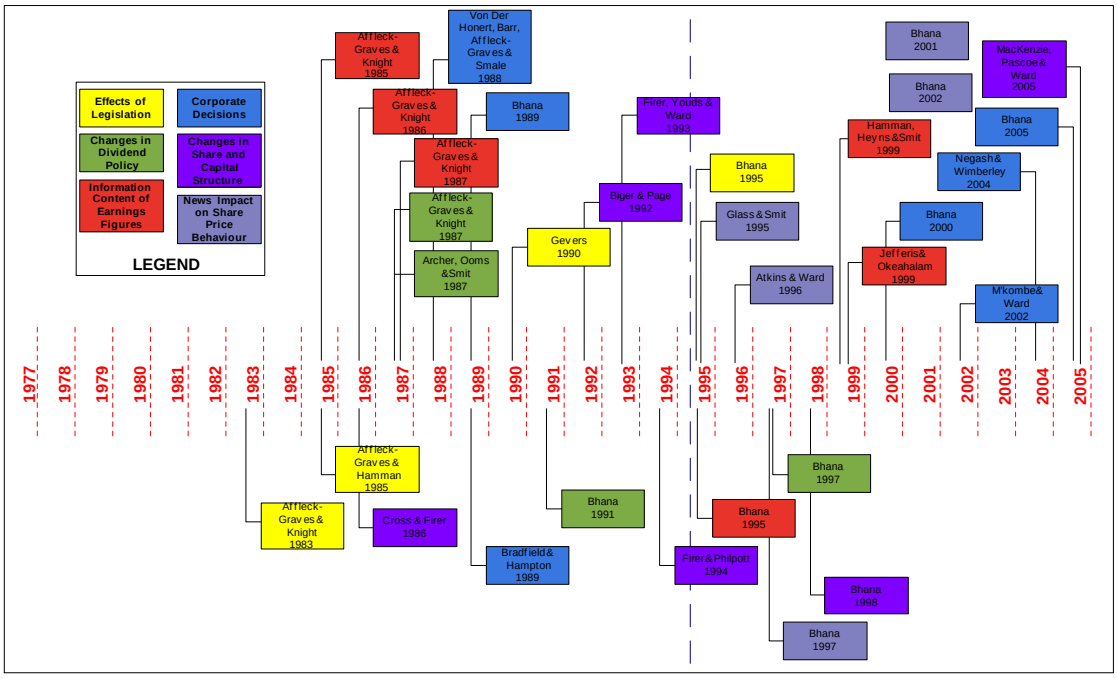


Figure 2: Semi Strong Form Efficient Studies

As with the weak form efficiency studies, the semi-strong form efficiency studies have also been chronologically ordered and categorised according to the type of study discussed in the historical analysis. Compared to the weak form efficient studies, the semi-strong form studies are more evenly distributed over time, but start in the mid 1980's rather than the mid 1970's as with the weak form efficiency studies. The colour-coded studies are categorised according to:

- The effects of legislation (Yellow)
- Changes in Dividend Policy (Green)
- Information Content of Earnings Figures (Red)
- Corporate Decisions (Blue)
- Changes in Share and Capital Structure (Mauve)

- Impact of News on Share Prices (Grey)

Unlike the previous section, the numbers of studies that support the semi-strong form efficiency are almost twice that of those which reject this form of efficiency. Notable amongst these studies is the large number produced by Bhana (1989a, 1991, 1995a, 1997b, 1998, 2000, 2001, 2002, 2005) which covered a variety of subjects based on information and its associated impact to share prices.

The objective of semi-strong form efficiency tests is to identify the speed at which new public information is reflected in share prices and whether delayed reaction to such information will allow for excess returns to be gained by investors. The methodology used in all of these studies is primarily based on the Event Study Method, which in itself relies heavily on the beta and some form of expected returns market model. Besides the criticism around these aspects of event study, a further criticism of this methodology is that of information contamination. This occurs when the change in share price is as a result of multiple new information data becoming available outside of the effect being studied.

Very few of the early studies identify this inherent problem and therefore the results of a study on one set of information may be skewed by other information that becomes known during event window. This bias increases proportionately to the duration of the event window and therefore the results of studies which

measure information impact over months or years must be accepted with caution.

Generally it is observed that the market tends to be efficient at processing information based on corporate decisions such as M&A, IPO's, MBO, overseas listing decisions and publicised news. All the other category studies provide mixed results and the time series shows that the markets efficiency with regards to effects of legislation is improving over time, while reaction towards changes in dividend policies seems to be worsening. Changes in Share and Capital Decisions seem to ebb and flow between efficiency and inefficiency over the time series.

Although many of the studies use the CAR technique to aggregate the results and imply beta stability and stationarity, some of the studies indirectly question this assumption. High volatility of the share prices around major announcements indicated that CAR results may directly related to increased or decreased risk associated with the share and any abnormal returns may be as a direct result of investors requiring higher or lower returns based on the changing risk profile.

Once again the implied abnormal returns that can be gained through studies that reject efficiency, even without the implied criticism expressed above, generally cannot examine the real world problems that exist around share price liquidity, bid-ask spreads, trading costs and time to purchase or sell shares within the

market. The identification of information processing anomalies on a theoretical basis and the ability to exploit such anomalies in the reality may provide two different results. As with any *ex post* theoretical study, if the results where known at the time that the actual event occurred and investors reacted accordingly, by virtue of the interaction with the event, the excess returns as initially indicated by the study would have been traded away and the anomaly would never have existed.

6.3 Studies on Strong Form Efficiency

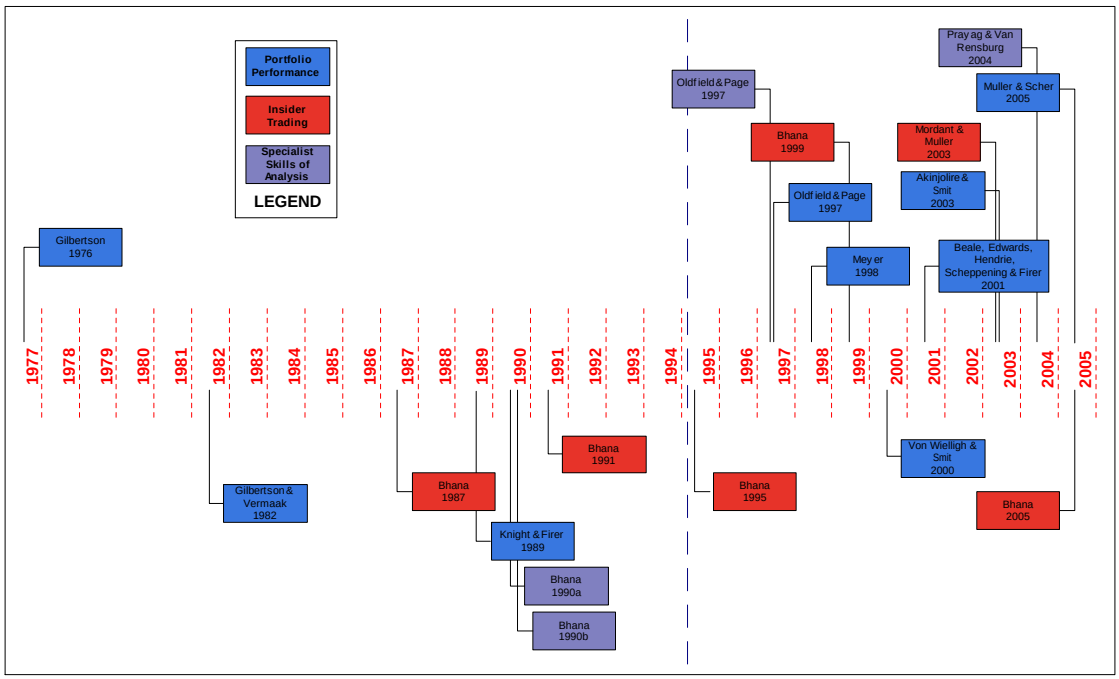


Figure 3: Strong Form Efficient Studies

The timeline series for strong form efficiency tests show a different pattern compared to the previous efficiency tests. What is noticeable is that the majority of studies which support strong form efficiency are grouped around the later part

of the study period, while those which reject strong form efficiency occur primarily before 1995. The studies are categorised according to whether they test portfolio performance (blue), insider trading (red) or specialist skills (grey).

What becomes apparent from the time series categorised studies is the prevalence of supporting studies for strong form efficiency based on portfolio performance tests in the later part of the time series. As more than 60% of the tests are relatively recent for this form of test, it would indicate that professional portfolio management has become of increased importance.

Also evident from the timeline is the rejection of strong form efficiency due to insider trading. Many of the insider trading studies resulted from semi-strong form efficiency tests, where changes in the CAR are observed in the period before any announcement is made. Contradictory to this, the study by Mordant & Muller (2003) on director's dealings shows that a buy-and-hold strategy would provide better results rather than mimicking the trades of directors. Implicit in this argument is that insider trading provides excess returns to investors. However director's, who posses the same or more knowledge than investors, seem unable to exploit this knowledge effectively.

Studies to determine investment manager's specialist skills are limited within the South African context. Bhana (1990a, 1990b) provided the first studies which indicated that investment managers do posses predictive abilities; however the

source of these abilities (either skills, timing or insider information) is unknown. Oldfield & Page (1997) are the first to test whether managers posses either selection or timing abilities or both. Although their study indicated that investment managers do on average provide higher returns than the market, the results are not significant and they concluded that managers posses neither of these skills. This, by default, implies that most investment managers investigated in the study beat the market based on chance.

One problem with the strong form efficient studies done on the JSE is that they all use unit trust investment vehicles as the data for investigations. Implicit within the make-up of unit trusts is the conservative and legislated approach to investing which requires asset allocations to be split between cash and equities. Perhaps a better test would be a study on whether pure equity investments outperform the market, however sufficient data for such an analysis may be difficult to source.

The international studies of Jensen (1968) and Malkiel (1995) indicated that mutual fund managers were unable to outperform the market over 10, 15 and 20 year periods and that there was a large survivorship bias in studies regarding fund performance. Even the South African studies on performance persistence show relatively short persistence of funds, majority of which are less than five years, which supports that of the international studies.

From the historical review it would seem that fund managers seem to have little predictive skill which resulted in regular underperformance of the market. Those that had managed to out-perform the market would seem to have done so with the help of insider information, which they were able to process better than those which supply the information.

In the review done by Thompson & Ward (1995) many of the strong form efficient studies suggested that the market was inefficient. From the time series it can be seen that almost all of the studies done prior to their review rejected the strong form EMH on the basis of performance, insider trading and specialist skills. However if one views the studies that followed 1995, they would strongly suggest support for strong form efficiency.

7. Conclusion

Figure 4 below summarizes all the results of EMH studies done from 1994 to 2006. These are chronologically displayed along the timeline, with those studies supporting EMH above the timeline and those rejecting EMH below the timeline.

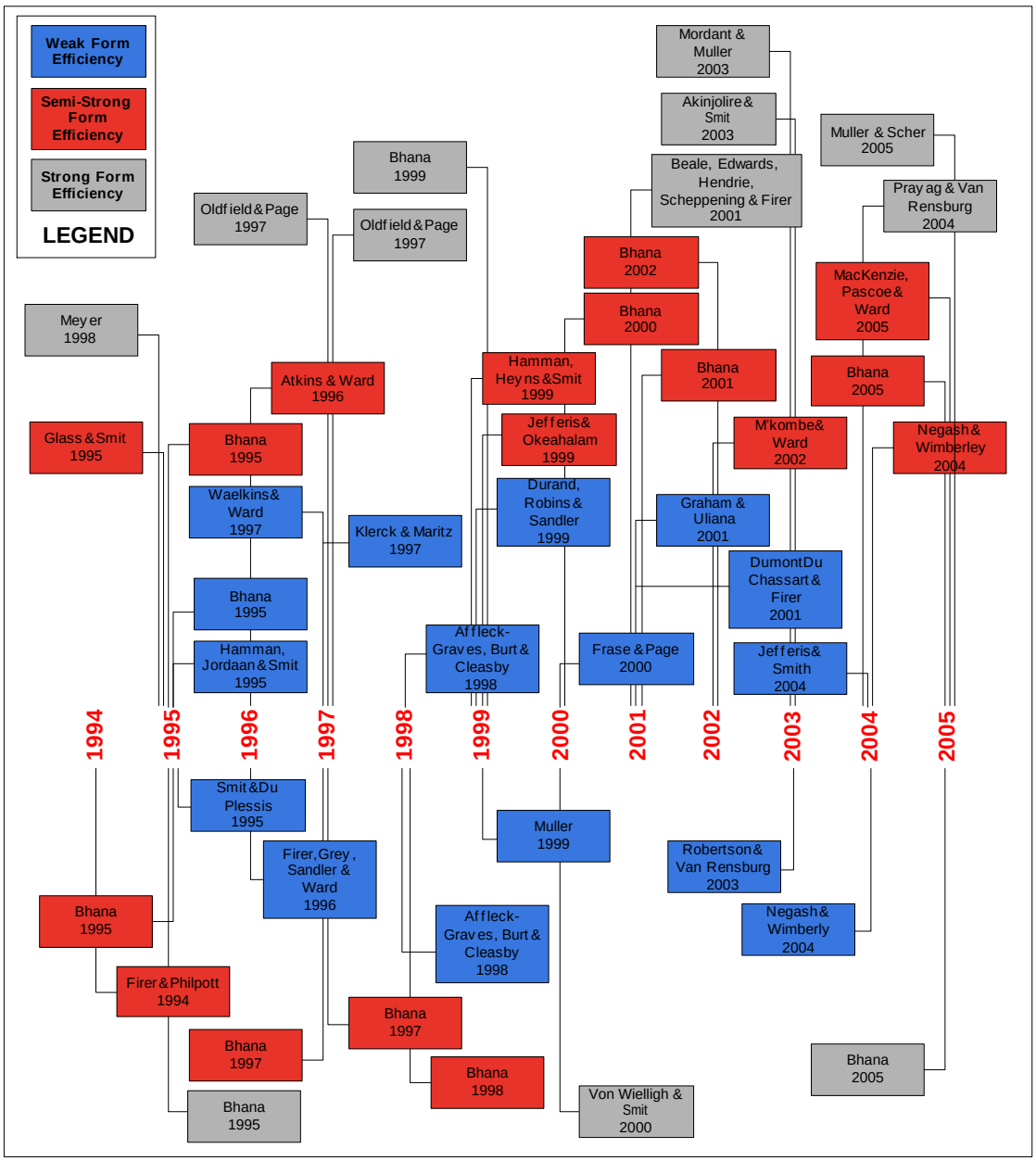


Figure 4: All EMH Studies from 1994

From the diagrammatic layout in figure 4 it can be seen that the majority of studies done from 1994 support the EMH for the JSE. Overall it can therefore be concluded that based on the results of these studies, the JSE can be described as being efficient in all forms of the EMH.

However, such a broad based conclusion would be unqualified and based on the studies reviewed there is no outright conclusion for all shares which make up the market, as it would seem that there are definitely cases where their efficiency is questionable.

Based on these findings, it would be fairer to say that the JSE shows signs of efficiency as well as inefficiency. It would seem that from the studies conducted, shares that exhibit characteristics of high capitalisation, liquidity and trading are as efficient as those found internationally, while those that are small and not well traded exhibit inefficiency. Further to this, extensive analysis of these shares may provide investors with a means to outperform the market as a whole.

What makes concluding the JSE as efficient or inefficient difficult is primarily due to the composition of the methodologies used and the variations that exist in applying these methodologies consistently over the studies. As described in the literature review and the historical review, the choices of data, time series, benchmarks, beta, models, event windows and survivorship and look-ahead bias can significantly change the results for each study. Over time new technology will

enable the academic community to further create and refine those aspects of research, implying that future studies will continue to show inconsistencies in methodology and results.

What is important to remember is that with any empirical study, a base model is required to perform the analysis. Inherently a model is a mathematical formulation of variables which tries to mimic reality. With all the studies reviewed, there is criticism around the models and their assumptions and this criticism will continue to be prevalent in future studies on EMH.

The review does however indicate that the JSE seems to be more efficient than described by Thompson & Ward (1995 and is starting to show more evidence of strong form efficiency. The study by Jefferis & Smith (2004) states that the JSE is becoming more efficient over time and that while this holds true for some of the shares, it does not hold true for the market as a whole. Perhaps technological advances within the market (for example the introduction of STRATE) have allowed this transformation of efficiency to occur or perhaps it has allowed for deeper analysis which has in itself eradicated known inefficiencies.

The role of risk within the market is perhaps the most important element when describing or measuring efficiency. Its relationship to returns the basis of an efficiently functioning market and what is evident in all of the studies is the inability to understanding and measurement of risk completely. As more studies

identify the inability of beta to fully describe risk, so the search for a beta substitute or combinations of risk measures will continue which will perhaps define a better mechanism to prove or disprove the EMH for the JSE.

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