A Study of the Relative Performance of South African Unit Trust Fund Managers utilizing the Portfolio Change Measure Technique

by

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Declaration

The research described in this dissertation was carried out by the author between July 1993 and January 1995. Except as indicated in the text, the contents are entirely original and are not the result of work done in collaboration. No part of this dissertation has been submitted to any other university.

Signed,

Trevor Garvin

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This thesis is dedicated to my family for all the love, care and support that they have always given me, and for generally enriching my life.

ABSTRACT

Unit trust funds are one of the fastest growing areas of the financial sector in South Africa today. There are currently over 1 million unit trust fund investors, with their associated management companies controlling over R20 billion in funds. The growing importance of the unit trust fund industry means that, increasingly, both investors in these funds, and those who judge the performance of fund managers, have heightened incentives to ensure portfolio performance is accurately measured. More specifically, there is a growing need to measure the performance of the *individual* fund managers themselves, thus enabling the directors of the fund management companies to suitably reward successful portfolio managers, whilst penalizing those who are less successful. A great deal of research has been done on this topic both in South Africa and worldwide; however most of the studies have made use of Betas and 'benchmark' portfolios, both of which have many inherent flaws. This thesis examines the performance of unit trust fund managers using a *'benchmark' free* measurement technique, thus enabling one to avoid the measurement problems previously encountered.

Chapter 1 gives a brief outline on the South African unit trust fund industry. In Chapter 2 the author looks specifically at the controversies which underlie the measurement of risk, and those surrounding risk-adjusted performance measurement. The flaws in previous studies are noted. Chapter 3 traces the development of the Performance Change methodology which is the method used in this dissertation. Chapter 4 describes the Performance Change methodology as applied to South African data; with the results from the tests presented in Chapter 5. Final conclusions and proposals for future research are put forward in the concluding Chapter 6.

The author has shown conclusively that when utilizing the Portfolio Change Measure, unit trust managers in general are *not able* to *consistently* outperform the market. The author's findings suggest that trust fund managers do not achieve any significant level of *additional* return for the particular funds under their control. The Portfolio Change Measure has two further particularly important uses:

(1) it can act as an additional management tool to aid the directors of unit trust fund management companies in measuring how efficiently portfolio managers are managing their funds; and,

(2) it enables investors to make a more 'informed' investment decision because the comparative performance of unit trust funds is better analysed.

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Glossary

The following abbreviations are used in the main text:

CAPM	-	Capital Asset Pricing Model
SML	-	Securities Market Line
EMH	-	Efficient Market Hypothesis
PCM	-	Portfolio Change Measure
JSE	-	Johannesburg Stock Exchange

CHAPTER ONE

Background to the South African Unit Trust Fund Industry

1.1: Introduction

Following international trends, the unit trust fund industry in South Africa has become one of the fastest growing sectors of the financial market. Nedbank, with its Sage Fund, was the first to launch a South African unit trust fund in mid-1965, and today the industry has grown with over 60 funds existing in the market place. In addition there are over twenty trust fund management companies, each of which endeavors to differentiate its investment from others and so exploit a special niche in the market.

Growth of the unit trust fund industry in South Africa has been particularly rapid in the last eight years, with over 45 of the currently existing funds having been launched in this period. Today the vast assets managed by the country's unit trust funds exceed R20 billion, and in aggregate there are over 1 371 611[1] registed unit trust fund account holders. It is significant to note that the Katz Commission (1994), a committee investigating the structure of the Johannesburg Stock Exchange (J.S.E.), recently praised the growing popularity of unit trust funds. The Commission said that it attracted investors who only had small levels of discretionary savings, and thereby allowed them to obtain appreciable returns on their investments which they might not otherwise have attained. This was of special importance as the percentage of shares held by individual investors on the J.S.E. has been dwindling to the concern of the Stock Exchange authorities. The investment of

[1] Maggie Rowley, Cape Times, April, 1994, p. 8.

individuals on the J.S.E. fell from 37.5% of aggregate volume traded in July 1991 to a meagre 15% at the end of 1993[2].

A unit trust fund may be described as a 'pool' of a number of differing assets. These assets may be made up of shares quoted on the stock exchange, fixed interest bonds, debentures and cash. Some unit trust funds in the United States of America also make use of futures and option contracts in their portfolios as a way of diversifying the risk of the portfolio[3]. A unit trust fund can be considered a form of a collective investment which allows investors to pool their usually small resources of investment capital. In that way a large amount of money is invested in financial securities which would not have been otherwise.

A unit trust fund is divided into equal 'units' or 'shares' which are equivalent to the total value of the fund on any one day, or at any one time, divided by the number of units that have been purchased. Thus the value of these units fluctuates as the value of the underlying assets held by the fund varies on a day to day basis. The differential between the quoted buying and selling prices of each unit is due to the addition of an initial charge equivalent to 5% of the selling price by the management company, as well as compulsory charges which include brokerage fees and a 1% marketable securities tax[4].

Unit trusts in South Africa are 'open-ended' trusts. This means that the unit trust fund either increases or decreases in size depending on the number of 'units' in the trust at any one time, which in turn is dependent on public demand. The number of units will increase as investors invest more money into the fund, and conversely the number of units will decline should investors sell their respective units back to the management company.

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[2] Martin Spring, "Personal Business," *Business Times*, supplement to the *Sunday Times*, 1994, p. 2.
[3] The use of financial derivative products has recently been approved for South African Unit Trusts, but they cannot exceed certain specified maximum percentages of the total value of the fund.
[4] Hugo Lambrechts, "Unit Trusts Survey," *Annual Survey*, No. 5 (March, 1992), pp. 6-24.

The benefits of a unit trust fund to the investor are threefold: firstly, the investor is able to achieve a high degree of diversification in the equity market and in that way minimise the level of risk one holds; secondly, the investor maintains a high level of liquidity as the management company is obliged to repurchase the units at any time convenient to the investor; and finally, investors can expect to earn a return at least equal to the one that they might have achieved if they had invested in their personal capacity.

Every potential unit trust fund investor has differing investment objectives. Some investors are looking for capital growth whilst others prefer regular amounts of income in the form of dividends. Investors also differ with regard to the time frame for which they are looking to make their particular investment. One person may wish to invest either medium or long term, whilst another may anticipate a need for access to their capital in the short term. Furthermore, investors must consider the level of risk that they wish to bear. Investors have differing risk profiles, and this in turn will affect the type of fund in which they will choose to invest. These differing investment requirements have led to numerous unit trust funds being established to cater for the varying needs of the investors.

Among the diverse unit trust funds which will be discussed in more detail in the following chapter are:

(1) general equity funds which invest across a broad spectrum of the market and are aimed especially at the risk-averse investor;

(2) 'specialist' funds which allow investors to invest in selected areas of the market, and which are aimed at those investors who accept a higher level of risk, and,

(3) 'income' funds which give the investor a high level of annual income at the expense of large amounts of capital growth.

With the choice of so many differing unit trust funds available to investors, and with misleading headlines such as 'marvelous results for the year, outperforming the market by x percent' seen in the newspapers on a regular basis, a strong need has developed to measure the relative performance of trust funds on a risk adjusted basis. The aforesaid measurement has proved to be a very real problem for both investors and portfolio managers alike, resulting in voluminous academic research and debate over the past three decades.

1.2: Fundamental objective of this research

Portfolio analysis theory basically describes efficient techniques devised for selecting portfolios based on one's predictions on the performance of certain individual assets. Much emphasis is placed on expected return and risk. To find the *'efficient portfolio'*, three distinct phases[5] occur in the investment process.

'Portfolio analysts' attempt to find efficient portfolios, i.e. those portfolios that promise the greatest return for a certain level of risk. They therefore translate predictions on security performance into predictions on *portfolio* performance, and then they choose the most efficient portfolio. 'Security analysts' provide the portfolio analysts with the required predictions on individual share performances, as well as the interrelationships amongst the performances of assets. Finally, the 'investor' chooses which 'efficient' portfolio, as selected by the portfolio analyst, best suits his particular risk profile giving suitable expected returns.

[5] William Sharpe, "Mutual Fund Performance," Journal of Business, (vol. 39, no. 1, 1966), p. 120.

Unit trust fund managers thus adopt an attitude towards risk and expected return, and then invite the investor with similar preferences to invest in the fund. Each fund will have a portfolio analyst aided by a number of securities analysts, who then try and find the 'efficient' portfolio for that degree of risk.

This thesis deals specifically with measuring the extent to which portfolio managers, along with their individual security analysts, can *consistently* predict movements in the market allowing them to select the correct composition of shares within their portfolio; and whether by doing so they can achieve for the portfolio under their management a significant level of *additional return* over and above that which could have been achieved by an 'uninformed' investor. This not only aids potential investors to make more 'informed' investment decisions, but also provides an invaluable management assessment tool. Fund management will be able to both compare and measure exactly how much 'value' may have been added to the fund by the respective portfolio managers and their helpers over specified time periods.

1.3: Outline of forthcoming chapters

This thesis proceeds as follows:

1.3.1: Chapter 2

The measurement of the riskiness of a single share, as well as a portfolio of shares has been a controversial matter for a long time. This chapter will consider these problems in more detail, putting forward the more conventional approaches to risk measurement as well as standard portfolio management models. The Capital Asset Pricing Model which is a model on the 'pricing' of risk is also analysed in detail, with it's assumptions laid out and discussed. This leads on to the development of the Securities Market Line, which looks more specifically at 'market-risk premium' and how it is measured.

Conventionally, a share's market risk is measured by its Beta. Beta is the measure of a share's riskiness when compared to the 'market', and this is discussed in detail along with the shortcomings that occur when using a share's Beta. These shortcomings were the main reasons which led Grinblatt and Titman[6] to develop their own portfolio management technique. Finally this chapter sets out standard measures of portfolio risk, including the Sharpe, Treynor and Jensen measures. Underlying all of these risk measures is their use of Beta, which implies that they have a number of the same inherent problems.

1.3.2: Chapter 3

A discussion of the various types of unit trust funds available to investors is reviewed, with suggestions given as to why certain funds appeal to different types of investors. Because the unit trust fund industry is one of the fastest growing financial sectors[7], there has arisen a very real need to measure the performance of these funds on a *risk-adjusted* basis. This chapter deals with the development of performance measures over the last thirty years, with the research by Mayers and Rice, Cornell, Copeland and Mayers and, finally, Grinblatt and Titman[8] considered in some detail.

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[6] Mark Grinblatt and SheridanTitman, "Performance Measurement without Benchmarks: An Examination of Mutual Fund Returns," *The Journal of Business*, (vol. 66, no. 1, 1993), pp. 47-68. In this article they developed this new method as a result of the many shortcomings involved with using Betas, amongst other reasons. It is this new method that is heavily used in this paper as a means of measuring the performance of the unit trust fund managers.

[7] Martin Spring, "Personal Business," *Sunday Times*, 1994, p. 2; There was a net inflow of over R400 million into unit trust funds by *new* investors in the first three months of 1994.

[8] Mayers, Rice, Cornell, Copeland, Grinblatt and Titman are all American academics who have been heavily involved in research on performance measurement. A full citation on their relevant works is given in the relevant chapters.

The Grinblatt and Titman method reviewed in this paper is based on 'Event Study' methodology. Event Study methodology contrasts *two* distinct time periods, and then analyses any changes that occurred between those two time periods as a result of the occurrence of a specified 'event'. This leads to a discussion as to whether an 'active' or 'passive' portfolio management policy is more beneficial to a portfolio under observation. This is an important and vital debate as related thereto is the question of whether portfolio managers are 'informed' and can predict market movements, or whether they are 'uninformed' and unable to beat the market on a consistent basis. Depending on the outcome of this debate one will either support an active or a passive management policy of unit trust funds.

1.3.3: Chapter 4

Chapter 4 analyses the Grinblatt and Titman methodology when applied to South African unit trust fund data. It also discusses alternative assumptions that have been used by the author of this thesis, as well as adaptations that have been made to the methodology used by Grinblatt and Titman.

1.3.4: Chapter 5

This chapter reviews the results achieved from the author's research making use of both 1-quarter *and* 4-quarter lagged data. The results obtained with the Grinblatt and Titman Portfolio Change Measure methodology are initially presented in tabular form, along with relevant statistical information. This is followed by a discussion of their particular significance. An analysis, with the use of a t-test was then undertaken to observe whether portfolio managers are able to *consistently* provide a significant level of excess returns to the funds under their control, via their manipulation of the shares within the portfolio.

The results of tests measuring persistence in performance are then presented. These results reveal whether portfolio managers who performed well over one period of time are able to consistently perform well over the following period; and, alternatively, whether the performance of each manager differs considerably from one period to the next. Finally a number of regressions are calculated to test whether movements in the entire share market can explain changes in the performance of individual fund managers over time. The Johannesburg Stock Exchange Index was used as a base for the purpose of this test.

1.3.5: Chapter 6

A summary of the conclusions reached by the author in the previous chapter are presented in detail. Thereafter the author discusses the results which have been obtained and the South African unit trust fund industry, in general. Finally the author considers possible areas of further research into the measurement of portfolio performance and related topics.

CHAPTER TWO

A Discussion on Risk and Risk Measurement

2.1: Introduction

Any rational investor looking to invest in the stock market at some stage looks at the possible risks and returns associated with such an investment. As Jensen[1] stated in his article:

> *"In a world dominated by risk averse investors, a risky portfolio must be expected to yield higher returns than a less risky portfolio, or it would not be held."*

Thus any investor, when investing in a security would look towards receiving the highest potential return on his investment coupled with the lowest possible degree of uncertainty.

Conventially, the risk associated with a particular security is a measure of the uncertainty related to the expected return of the security. Traditionally the standard deviations of returns over a period of time[2] has been used to quantify this notion of risk. The larger the standard deviation of an individual share's return, the more risky it is considered to be. Variability of returns is brought about to some extent by changes in the market, resulting in an even greater change in the return of those individual shares which inherently 'hold' more risk than the market itself. Conversely, the variability in performance of shares that are inherently less risky than that of the market will generally be less than the changes in the market itself.

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[1] Michael Jensen "Risk, the pricing of Capital Assets, and the Evaluation of Investment Portfolios," *Journal of Business,* (vol. 42, no. 2, 1969), pp. 167-247.

[2] Eugene Brigham and Louis Gapenski, *Financial Management - Theory and Practice*, (Chicago: The Dryden Press, 1991),pp. 120-128.

Much work has been written on how to go about measuring risk, most of which has evolved within the mean-variance framework developed by Markowitz[3].

2.2: Markowitz's Portfolio Selection Model

Harry Markowitz, in 1952, developed his portfolio selection model based upon the following assumptions[4];

1) Investors have probability distributions about the future performance of shares.
2) These distribution probabilities have finite means and variances.
3) There are decreasing returns to risk bearing beyond some point.
4) An individuals preferences are a function of portfolio return and variance only.
5) For any given expected return on a portfolio, the portfolio with the smallest variance is preferred to all others , and for any given portfolio variance, the portfolio with the maximum expected return is preferrd to all others.

Assumption 5, which Markowitz called the mean-variance criterion, was a significant insight. The problem was to find a portfolio with the lowest possible portfolio variance subject to a given level of portfolio return. Diagram 2.1 on the following page graphically depicts Markowitz's mean-variance theory.

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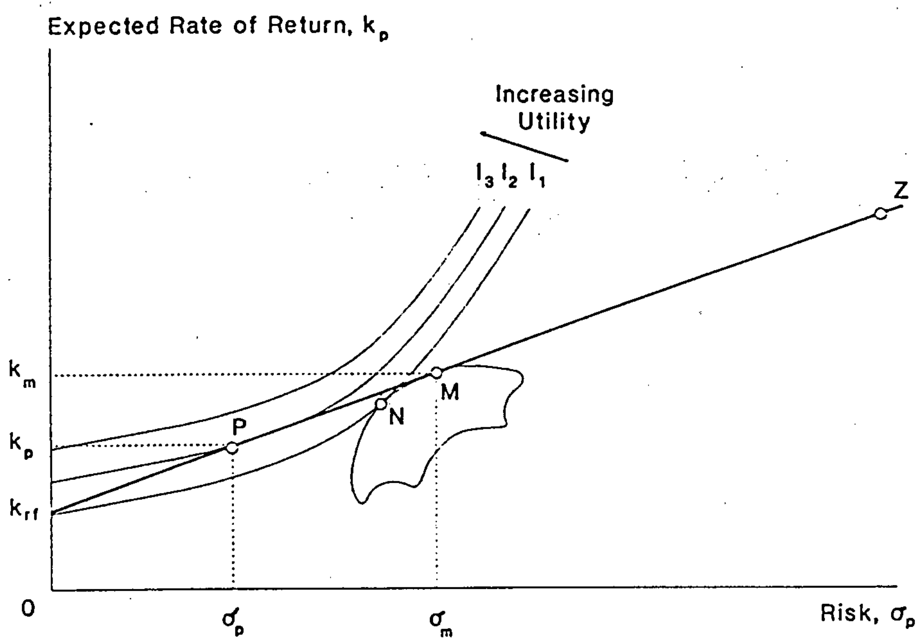
[3] Harry Markowitz, "Portfolio Selection," _Journal of Finance_, (vol. 7, 1952), pp. 77-91.
[4] Harry Markowitz, "Portfolio Selection," _Journal of Finance_, (vol. 7, 1952), pp. 77-91.

Diagram 2.1:

Markowitz's Mean-Variance Theory



The horizontal axis shows the standard deviation of returns, while the vertical axis shows expected portfolio returns. The shaded area shows the feasible region of all the different possible combinations of risk and return that one could attain from investing in risky shares. However, only those portfolios lying on the line ONMQ represent the set of mean variance efficient portfolios. ONMQ is known as the efficient frontier.

A portfolio is efficient if it is impossible to find a portfolio which has a greater expected return without incurring increased risk, while at the same time, one cannot achieve a smaller level of risk without decreasing one's return.

A portfolio is inefficient if it is possible to obtain a higher expected return with no greater uncertainty of return or risk, or to obtain a lower uncertainty of return without a reduction of return without a reduction in expected return. To achieve all investors preferences the entire set of efficient portfolios must be drawn, resulting in the efficient frontier ONMQ.

Individuals indifference curves are shown by I_1, I_2 and I_3 respectively. An investor who is only able to invest in risky shares will maximise his utility by investing in portfolio N with indifference curve I_1.

Tobin[5] extended the model by assuming that investors can borrow or lend at a risk-free rate (k_{rf}) of interest. They can *both* borrow or lend at the *same* risk-free rate. This causes one to get an extended linear line $k_{rf}Z$. All investors who invest their money in a risky asset would invest in portfolio M. If the investor decides to lend a portion of his funds to the market he would invest the remainder of his funds in portfolio M and he would lie on line segment $k_{rf}M$. An investor who borrows and invests all of his money in M will fall on the line segment MZ. Portfolio M, or the 'market' portfolio, should consist of all possible shares in the market in the proportion of its value in the market as a whole. The investor will thus maximise his utility by investing at point P with indifference curve I_2. The investor has increased his utility due to indifference curve I_2 being on a higher utility level than indifference curve I_1[6].

2.3: The Market Model

The 'market model' was originally considered by Markowitz[7] whereafter numerous other researchers extended and modified it to its current framework. Simply put, the market model states that returns on a security 'i', are linearly related to returns on the market

[5] Tobin, "Liquidity preferences as behaviour towards risk," Review of Economic Studies, (vol. 25), pp. 65-86.
[6] A risk-averse investor will have a steep indifference curve giving him a point such as P, while a more risk-prefering investor will choose to hold more risk and his indifference curve will be much flatter giving him a point beyond M towards Z as he borrows money to buy more risky assets. Should individual's borrowing rates be higher than k_{rf}, then the line $k_{rf}MZ$ would tilt downwards beyond point M, thus invalidating the CAPM. It is for this reason that the assumption of equal lending and borrowing rates for investors is so crucial to the workings of the CAPM.
[7] Harry Markowitz "Portfolio Selection: Efficient Diversification of Investments," Wiley and Sons, 1959, New York.

index. This relationship between the returns on the i'th security and that of the market can be written as:

EQ.2.1:

$$R_{it} = \alpha_i + B_i R_{mt} + e_{it}$$

where: R_{it} = return on the i'th security in time period 't'

R_{mt} = return on the market in time period 't'

α and B = parameters specifically unique to the i'th security, and;

e_{it} = disturbance or error term for secuirty 'i'.

It is further assumed that e_{it} is independent of R_{mt}.

The Beta (B) parameter has been commonly used as a way of measuring an individual shares risk in relation to the overall market.

2.3.1: Betas

Using an ordinary least-square regression technique, Betas can be calculated as follows:

EQ.2.2:

$$B_i = \sigma_{im}/\sigma_m^2$$

where B_i = Beta co-efficient on share 'i'

σ_{im} = the covariance between the returns on share 'i' and the market return

σ_m^2 = the variance of returns on the market index

The Beta of a share measures that particular share's volatility compared with movements in the market[8]. When a share's Beta is greater than 1, then the share is said to be more volatile than the market. When the market rises (falls), the return on the security will rise (fall) at a faster rate than the return on the market. In contrast, should a share have a Beta less than 1, then in a rising (falling) market the share will rise (fall) more slowly than the market. In summary, one can therefore say that shares having a Beta greater than 1 are recognised as being more volatile and hence more risky than the market (they are more risky due to the increased volatility causing increased levels of uncertainty), whereas shares with Betas less than 1 are recognised as being less risky than that of the market.

2.3.2: Systematic versus Unsystematic risk

From our Market Model equation, one notices that the variance of a share's returns is affected by two sources, namely the variance of the return on the market (R_m), and secondly, the variance of the random error term (e_i). The above two componenets of risk are commonly referred to in financial literature as Systematic or market risk and Unsystematic or unique risk respectively.

Mathematically one can express these two componenets of risk as follows:

$$var(R_i) = var(\alpha_i + B_iR_m + e_i) = var(\alpha_i) + var(B_iR_m) + var(e_i) ;$$

since one assumes α_i to be constant, the $var(\alpha_i) = 0$, therefore one can write the following:

$$var(R_i) = var(B_iR_m) + var(e_i) = B_i^2 var(R_m) + var(e_i);$$

[8] Eugene Brigham and Louis Gapenski, *Financial Management*, (Chicago: The Dryden Press, 1991), pp. 145-148.

writing this in a more compact manner, one gets:

$\sigma_i^2 = B_i^2\sigma_m^2+\sigma_{ei}^2$ where:

σ_i^2 = variance of returns on share 'i'

σ_m^2 = variance of returns on the market

σ_{ei}^2 = residual variance

Verbally this can be restated as:

Total Risk = Systematic or Market Risk + Unsystematic or Unique Risk

Unsystematic risk occurs due to the fact that there are particular 'perils' that are peculiar to a specific company and its immediate competitors[9]. Examples of this company specific-risk would be events such as company strikes, marketing campaigns which could fail or be successful, and also the winning or losing of major job contracts. As these events are 'unique' to a particlar firm and are random in nature, their effects on a portfolio can be eliminated through diversification.

In contrast to unsystematic risk which is diversifiable, systematic or market risk cannot be avoided no matter what an investor does. Market risk is that risk that affects *all*[10] businesses and is beyond the control of any one investor. Examples of such events would be wars, inflation,interest rates and general economic cyles. It is because firms are simultaneously affected by these perils that this 'market risk' cannot be eliminated through diversification. It is these 'perils' that are prevalent throughout the world and beyond the

[9] Richard Brealey and Stewart Myers, Principles of Corporate Finance, (New York: McGraw-Hill Inc., 19910, p. 137.

[10] Stephen Ross, Randolp Westerfield and Jeffrey Jaffe, Corporate Finance, (New York: Mosby College Publishing, 1990), pp. 298-300.

control of any individual which make up the basic 'uncertainty' under which everyone lives and invests in the market.

It has been argued that when one is measuring portfolio risk, one need only take the market risk of a portfolio into consideration. This is due to the fact that as one combines individual shares into a portfolio, the contribution of unique risk that each individual share contributes to the total diminishes, and eventually tends towards zero. Hence it is only the market risk that is important when measuring portfolio risk.

Brealey and Myers[11] state:

"If we want to know the contribution of an individual security to the risk of a well diversified portfolio, it is no good thinking about how risky that security is in isolation - we need to measure its market risk and that boils down to measuring how sensitive it is to market movements. The sensitivity of an investments return to market movements is usually called its Beta."

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[11] Richard Brealey and Stewart Myers, Principles of Corporate Finance, (New York: McGraw-Hill Inc., 19910, p. 137.

Diagram 2.2:

Effect of Portfolio Size on Portfolio Risk

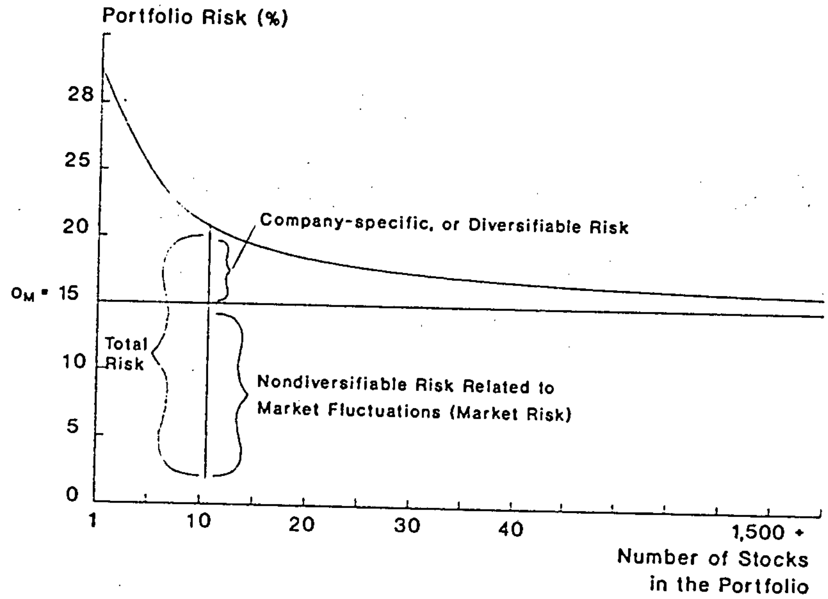

Diagram 2.2 clearly shows how diversification reduces the risk of the portfolio. Diversification occurs rapidly at first, and the slows down quite dramamtically once one reaches a 'critical' point - it is popularly beleived that holding approximately 15-20[12] well selected shares within a portfolio is the most efficient. When one has a fully diversified portfolio, one is left holding only systematic or market risk.

A portfolio with a number of low risk or low Beta stocks will itself have a low Beta, as the Beta of a portfolio is simply the weighted avearge of the Betas of the individual securities.

EQ. 2.3: Beta of a portfolio = $B_p = \Sigma x_i B_i$

where: x_i = weighting of share within portfolio; and

B_i = beta of individual share within portfolio

[12] Eugene Brigham and Louis Gapenski, Financial Management - Theory and Practice, (Chicago: The Dryden Press, 1991), p. 124.

If a high Beta stock is added to a portfolio with a relatively low Beta, the riskiness or Beta of the entire portfolio will only rise marginally as a result.

2.4: The Capital Asset Pricing Model

Although Markowitz developed his portfolio selection model which explained how people go about selecting particlar portfolios, it did not directly explain how individual assets are actually *priced* in the market place. However, subsequent to the Markowitz portfolio selection model being completed, much work was written on the pricing of assets, culminating in the Sharpe-Linter-Treynor[13] Capital Asset Pricing Model.

As in all financial theories, a number of assumptions were made in the development of the CAPM. These assumptions are summarised in the below list:

1) All investors try to maximise their expected wealth utility from their investments by choosing among the alternative portfolios the one that offers the best return for the risk (standard deviation) offered;

2) Investors can lend or borrow as much money as they wish at a specified risk-free rate of interest, with there being no limit on the level of short sales of any assets;

3) All investors have homogeneous expectations regarding future asset performance;

4) The quantities of all assets are assumed fixed;

5) There are no taxes;

6) There are no transaction costs with all assets being perfectly liquid and divisible; and

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[13] See William Sharpe, "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk," _Journal of Finance_, (vol. 19, September, 1964), pp.425-442; J. Lintner, "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets," _Review of Economics and Statistics_, (vol.47, February, 1965), pp. 13-37; Treynor's article on this subject has not been published to date.

7) Finally, all investors are price takers.

The Capital Asset Pricing Model can be written as:

EQ.2.4: $$E(R_i) = R_f + B_i[E(R_m) - R_f]$$

where $E(R_i)$ = the expected return on the i'th security

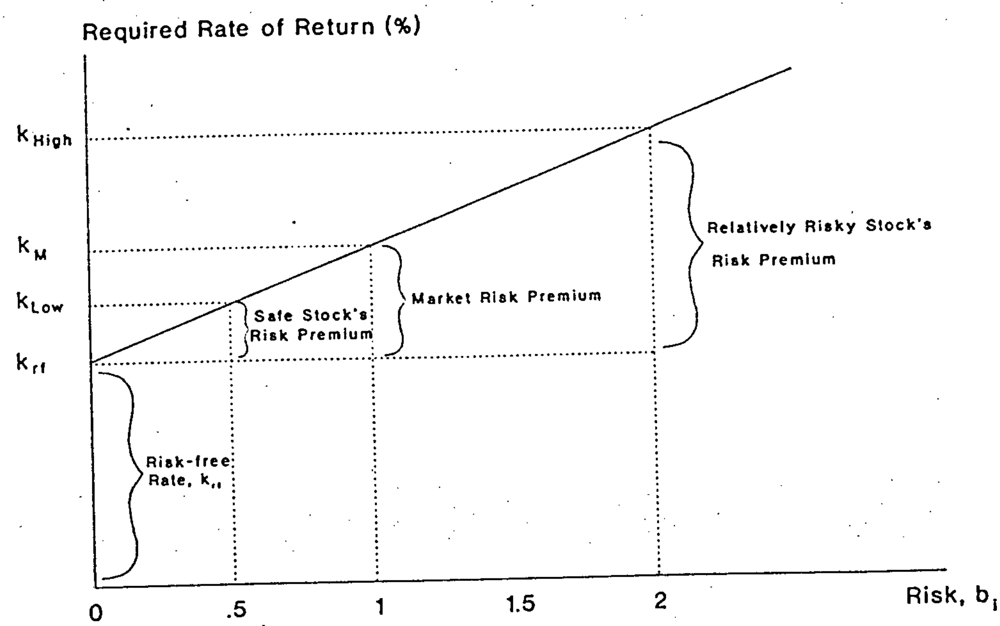
$E(R_m)$ = the expected return on the market of all assets

R_f = risk free rate

B_i = covariance(R_i,R_m)/variance(R_m)

The CAPM therefore implies that in a competitive market, the expected risk premium on a share varies in direct proportion to beta. Thus all investments should plot along a straight line, commonly called the *security market line* (SML). The SML is depicted in the diagram below.

Diagram 2.3:
The SML under the CAPM



One can calculate the market-risk premium by subtracting the risk-free rate of return from the market's return. The 'market-risk premium' is the return that investors require over and above the risk-free rate for assuming an additional amount of risk. One can then multiply this by the individual share's Beta in order to obtain the market-risk premium for that particular asset. Thus the size of an individual share's risk premium, when compared to that of an average stock's market risk premium, will vary according to the size of that particular share's Beta. The market has a Beta equal to that of 1, while a share's Beta increases or decreases according as to whether it is relatively more, or less, risky than the market.

As can be seen from Diagram 2.3, riskless securities have a Beta of 0 and, as mentioned previously, the 'market's' risk is defined as having a Beta equal to 1. The more risk averse the investor, the steeper the SML, as the investor requires a relatively *greater* increase in return for every additional unit of risk held.

The slope of the SML therefore shows the relative risk premium that an investor holds[14]. Should the investor have a high degree of risk aversion, this will cause:

(1) a greater risk-premium for any risky asset that is held;

(2) a higher required rate of return for all risky assets in general, and

(3) the slope of the SML to steepen[15].

As can be seen from the SML, the required rate of return on specified assets, depends not only on the particular asset's Beta or measure of market-risk, but also on the level of the market-risk premium and the risk-free rate. Because all of the above measures can vary, the SML may be variable and *not* necessarily stable over time.

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[14] Eugene Brigham and Louis Gapenski, Financial Management - Theory and Practice, (Chicago: The Dryden Press, 1991), pp. 124-140.

[15] Note that the slope of the SML is *not* Beta, but rather a measure of the market-risk premium.

2.5: The Sharpe, Treynor and Jensen Measures

A number of techniques making use of Beta have been devised to measure the performance of portfolios over a period of time. One should measure performance on a risk adjusted basis, so as to be able to compare the various funds on a level playing field. The majority of academic studies, as well as most professional evaluations of managed funds, traditionally have employed measures which take into account both average return and some estimate of portfolio risk. These measures include the well-known Sharpe[16] and Treynor[17] ratios, and Jensen's[18][19] measure of excess portfolio return, or Jensens α. Each of these measures provides a means of measuring portfolio performance on some sort of risk-adjusted basis.

2.5.1: The Sharpe Measure

Sharpe's measure makes use of the *entire or total* risk of the portfolio that is being analysed. As a result, he makes use of the portfolio's standard deviation of returns, which is a combination of systematic *and* non-systematic risk. Sharpe developed an expression which then measures the amount of excess return that the portfolio achieves for each unit of risk held. To reiterate, each unit of risk is made up of total risk as opposed to merely systematic risk. By adjusting for total risk as opposed to only systematic risk, Sharpe's measure thus penalises the manager for not holding what should be a fully diversified portfolio.

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[16] William Sharpe, "Mutual Fund Performance.",*Journal of Business,* (vol. 39, 1966), pp. 119-138.
[17] Jack Treynor "How to Rate Management of Investment Funds.," *Harvard Business Review,* (vol. 43, no. 1, 1965), pp. 63-75.
[18] Michael Jensen "The Performance of Mutual Funds in the period 1945-1964,".*Journal of Finance,* (vol. 23, no. 2, 1968), pp. 389-415.
[19] Michael Jensen, "Risk, the Pricing of Capital Assets, and the Evaluation of Investment Portfolios," *Journal of Business,* (vol. 42, no. 2, 1969), pp. 167-247.

The Sharpe measure, S_i, may be written as follows:

$$S_i = \frac{\text{risk premium}}{\text{total portfolio risk}} = \frac{r_i - R}{\sigma_i}$$

where: r_i = average return on i'th portfolio

σ_i = standard deviation of returns for i'th portfolio

R = riskless rate of interest

The Sharpe ratio is thus simply the portfolio's excess return, i.e. the average portfolio return minus the estimated risk-free return, divided by the standard deviation of returns, or total portfolio risk. The numerator or "risk premium" is the return over and above the riskless rate that is paid to induce the investor to hold a certain level of risk.

By calculating individual ratios for each of the funds to be evaluated, the managed funds can be ranked and compared to other similarly managed portfolios, or to some 'benchmark' portfolio. Importantly, however, each calculated ratio is *independent* of any benchmark against which it may be compared; thus the Sharpe measure avoids many of the criticisms noted by Roll with regard the use of 'benchmark' portfolios. It is able to avoid many of these criticisms due to the fact that no use of Beta's is made resulting in an avoidance of benchmark problems inherent in Beta estimation as well as any Beta estimation problems per se.

2.5.2: The Treynor Measure

The Treynor ratio is also a single parameter measure, but differs from the Sharpe measure with respect to the type and measurement of portfolio risk. The Treynor index is based specifically on systematic or 'priced' risk, and embodies some form of *ex post* asset pricing model in the sense that only risk that is expected to be compensated for is considered. The Treynor ratio uses the portfolio's Beta as its measure of risk. Treynor thus recommends using only the systematic risk and not the portfolio's entire risk, based on the rationale that through diversification a portfolio's unsystematic risk tends towards zero. Treynor's measure therefore does not penalise portfolio managers that are not be holding a fully diversified portfolio.

Treynor's single parameter investment performance index, T_i, can be written as:

$$T_i = \frac{\text{risk premium}}{\text{systematic risk}} = \frac{r_i - R}{B_i}$$

where: r_i = average rate of return on i'th portfolio

B_i = beta coefficient for i'th portfolio

R = riskless rate of interest

The Treynor ratio is thus simply the portfolio's excess return divided by the systematic risk, or Beta, of the portfolio.

2.5.3: The Jensen Performance Measure.

The Jensen Performance Measure, α,by contrast can be interpreted as the average return earned over and above that of a benchmark portfolio with the same systematic risk. It is found by regressing the excess returns of the portfolio against that of the market and interpreting the y-intercept. Given the underlying assumptions of the asset pricing model used to measure portfolios' respective Betas, a positive value for Jensen's α is interpreted as evidence of 'abnormal' performance while a negative value implies the fund failed to adequately compensate the investor for the given level of systematic risk.

Jensen's α can be written as follows:

$$R_i - R_f = \alpha_i + B_i(R - R_f) + u_i$$

where: R_i = return on the i'th portfolio

u_i = error term; and,

α_i = the intercept of the regression

The notion of the level of expected compensation for bearing different levels of systematic risk is embodied in the CAPM and is therefore summarized below.

2.6: Debate over the CAPM and related performance measurements

The background which is worth discussing in the context of this thesis can be summarised into the following four main categories, namely; transaction costs, betas stability, Roll's[20] critique and finally timing and selectivity performance.

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[20] Richard Roll,"A Critique of the Asset Pricing Tests," *Journal of Financial Economics*, (vol. 4, no. 4, 1977), pp. 129-176.

2.6.1: Transaction Costs

The CAPM's assumption that transaction costs are zero is clearly a strong one. High levels of transactions costs, particularly in the form of commissions payable in buying and selling shares are not uncommon in South Africa. Not only are there brokerage charges, but securities taxes must be paid as well. It is also extreme to assume that the lending and borrowing rates of interest are exactly the same. If the borrowing rate is greater than either the lending rate or the risk free rate, which is normally the case, then the capital market line would not extend in exactly a straight line beyond the market portfolio.

2.6.2: Beta Stability

The problem of Beta stationarity is very important. This is the problem of an individual share's riskiness being unstable over time and varying with changes in the economy and marketplace. According to the CAPM, a share's Beta reflects an investor's estimate of a share's *future volatility* in relation to movements in the total market. As no-one knows exactly how a share will react to future changes in the market, all that one can use is data on *past* volatility. This allows one to only calculate *historical* Betas. If these historical betas were stable over time, then investors would be able to use this information as an accurate estimator of a particular share's future volatility. In other words, if a share's Beta were stable in the past, then it's historical Beta would be a good 'proxy' for its *ex post*, or expected future Beta.

Levy[21] and Blume[22] both studied this question of Beta stability in depth. Levy calculated the Betas for a large number of shares, as well as portfolios, over a wide range of

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21 Robert Levy, "On the Short-Term Stationarity of Beta Coefficients," Financial Analysts Journal, (vol. 5, Nov. 1971), pp. 55-62.

intervals. Levy found that the Betas for individual shares were unstable over time, thus making their past Betas unreliable estimators of future volatility. However, he also found that the Betas of portfolios consisting of ten shares or more were reasonably stable over time, making them more accurate estimators of *portfolio* volatility. Blume's work, amongst others, supported these findings of Levy.

Others to research the problem of beta stability were Fabozzi and Francis[23] and Kon and Jen[24] who all studied a large number of shares on the New York Stock Exchange. Similarily to Levy and Blume, they found evidence that Beta co-efficients tended to be unstable over time. Importantly however, evidence supporting the stability of Betas co-efficients over bull and bear market conditions has been found by Fabozzi and Francis[25] in their research on the New York exchange, as well as by Bradfield, Affleck-Graves and Barr[26] as well as Bowie[27] in their research on the Johannesburg Stock Exchange.

It should be noted that one way portfolio managers can manipulate a portfolio's beta is by changing the ratio of shares to liquid assets within the portfolio. During times of high risk and uncertainty, managers tend to hold more cash than equity, in that way reducing the volatility in performance of the portfolio[28]. By investing more heavily in cash they are 'guaranteeing' themselves a minimum return, as opposed to having a more uncertain return due to large share fluctuations in a highly volatile equity market.

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22 Marshall Blume, "Betas and Their Regression Tendencies," Journal of Finance, (vol. 3, June, 1975), pp. 785-796.
23 Fabozzi and Francis, "Beta as a Random Co-efficient," Journal of Financial and Quantitative Analysis, (vol. 13, 1978), pp. 101-116.
24 Kon and Jen, "Estimation of Time Varying Systematic Risk Statistics," Journal of Business Research, (vol. 8, 1978), pp. 263-275.
25 Fabozzi and Francis, "Stability Tests for Alphas and Betas over Bull and Bear Market Conditions," Journal of Finance, (vol. 32, No. 4, 1977), pp. 1093-1099.
26 Dave Bradfield, Affleck-Graves and Graham Barr, "Stability Tests for Alphas and Betas over Bull and Bear Market Conditions on the JSE, Technical Report, University of Cape Town.
27 D C Bowie, (1994)
28 Richard Ippolito, "On Studies of Mutual Fund Performance 1962-1991," Financial Analysts Journal, (January, 1993), pp. 42-48.

2.6.3: Roll's Critique

Roll[29], in an important paper in 1977, strongly criticized tests of the CAPM. He argued that it was not possible to show that investors behaved exactly in accordance with the pricing theory which underlies the CAPM. He further explained how it was also impossible to choose a 'benchmark' portfolio that accurately portrayed the 'market' portfolio. Roll states *" the demonstration that the proxy index and true market index are perfectly correlated is beyond our economic ingenuity, for the reason that the true market portfolio is unknown"*[30]. He argued that when using benchmark portfolios as a proxy for the market, it is vital that the benchmark portfolio have a similar risk structure or level of risk to the portfolio that it is being used to measure. Roll stated that the mere fact that it was very difficult to choose a valid benchmark portfolio implied that it was virtually impossible to know if the two portfolio's risk structures were similar. Stambaugh[31], however, showed that test results were not too sensitive to choices of market proxy.

2.6.4: Timing and Selectivity Performance

Investment managers are often evaluated according to two main criteria -- timing performance and selectivity performance[32]. 'Timing performance' refers to the ability of managers to foresee changes timeously in the market and make the necessary changes with regard to asset allocation within their respective portfolios. For example, a portfolio manager who correctly reduces the relative weighting of equities for increased holdings of

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[29] Richard Roll, "A Critique of the Asset Pricing Theory's Tests," *Journal of Financial Economics*, (vol. 4, no.4, 1977), pp. 129-176.
[30] Richard Roll, "A Critique of the Asset Pricing Theory's Tests," *Journal of Financial Economics*, (vol.4, no. 4, 1977), pp. 129-176.
[31] Stambaugh, "On the Exclusion of assets from tests of the two-parameter model: A sensitivity analysis," (vol. 10, 1982), pp. 237-268.
[32] Mark Grinblatt,"Performance Evaluation", *The New Palgrave Dictionary on Money and Finance* , ed. by Peter Newman *et al*, (London: MacMillan Press, 1992), pp. 133-135.

cash, prior to a fall or crash in the stock market demonstrates adroit 'timing performance' ability. If the correct investment decisions were made, it would be considered to be a positive and appropriate move with regard to timing performance.

'Selectivity performance' refers specifically to the ability of portfolio managers to correctly predict *ex ante* the performance of shares, aiding them in deciding which shares they should buy or sell in future periods. Portfolio managers will attempt to reduce their holdings in shares that they predict are going to drop in value, while correspondingly increasing their relative holdings of shares that they think are going to rise in value.

It is very difficult to capture the above two performances when using the Treynor and Jensen measures, as these measures do *not* take into account any *changes of Beta*. For example, should the true Beta of a portfolio drop as a result of a manager switching his portfolio from "high-risk" shares to "low-risk" cash , a positive timing performance movement, performance with the Treynor or Jensen measures would be heavily underestimated[33]. This is due to the fact that the Beta achieved when regressing the portfolio's excess returns against the market's excess returns would *exceed* the true value of the portfolio's Beta, due to *no* adjustment having been made for positive timing performance changes. Timing performance is thus mismeasured when using the Treynor and Jensen measures.

[33] Mark Grinblatt and SheridanTitman, "Portfolio Performance Evaluation: Old Issues and New Insights," Review of Financial Studies, (vol. 2, no. 3, 1989b), pp. 393-421.

2.7: Development of the PCM

As mentioned earlier, the Sharpe, Treynor and Jensen measures are all methods currently used by the investment community to measure the performance of portfolios, and more importantly, allowing one to measure the relative performance of funds which all hold differing levels of risk. This thesis develops a new method of measuring this relative performance by looking at the problem from a different perspective.

Grinblatt and Titman[34] devloped a measure that allows one to compare the relative performance of funds by comparing the 'value-added' to the fund's total return through superior fund management. Their Portfolio Change Measure measures the 'value-added' to the overall return of the fund through the portfolio manager making net positive adjustments to the overall composition of the shares making up the fund under his control.

The Portfolio Change Measure thus tackles the problem of performance measurement from a completely different angle when compared to the more frequently used measures discussed earlier in detail. One of the most important differences is that avoids using any of the traditional asset pricing models, resulting in an avoidance of the use of Betas. Rather, with the Portfolio Change Measure, risk is inherently built into the model. The development of the Portfolio Change Measure is discussed in detail in the following chapter.

In summary, this chapter first looked at the concept of risk and how individuals go about 'picking' an efficient portfolio of shares. Markowitz's Portfolio Selection Model layed out how investors who can borrow or lend at a risk-free rate are able to always invest in an

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[34] Mark Grinblatt and Sheridan Titman, "Performance Measurement without Benchmarks: An Examination of Mutual Funds Returns," *Journal of Business*, (vol. 66, no. 1, 1993), pp. 47-68.

efficient portfolio lieing on the efficient frontier. The Market Model then introduces the concept of only looking at systematic risk when analysing portfolios due to the concept of diversification in which all 'unique' risk is diversified away. Finally the CAPM developed the security market line which clearly laid out the how shares are actually priced in the market.

A number of performance measurement techniques were then described in detail, in particular the Sharpe, Treynor and Jensen measures. All of these measures are based on traditional pricing models, as opposed to Grinblatt and Titman's Performance Change Measure which looks only at the changes in the composition of the portfolios under review. It is the workings of this PCM which the remainder of this thesis will concentrate on.

CHAPTER THREE

The Background and Development of the Performance Change Measure Methodology

3.1: Introduction

Because of its importance to investors and portfolio managers, the controversy surrounding the measurement of the performance of unit trusts funds continues to interest both academics and financial practitioners. There exists a voluminous amount of literature on the topic. Moreover, throughout the world, investors have shown enhanced interest in unit trust funds. This interest definitely extends to South Africa, where the number of such unit trust funds has grown from 14 in 1986 to 41 by December 1991[49]. By mid-1994 this number had increased to over sixty unit trust funds, with many of the major financial institutions continuing to announce the launch of new and more specialised funds virtually every quarter.

3.2: Discussion on Various Unit Trust Funds available to Investors

General equity funds invest in balanced and diversified portfolios consisting of shares spread across all sectors of the stock market. The aim of these general equity funds is to 'preserve the investor's capital by offering unit holders sustained long-term growth in both income and capital values'[50]. General equity funds should be seen as solid long term investments which offer the investor a high degree of protection by reducing the variability

[49] Hugo Lambrechts, "Unit Trusts: Measurement of Investment Performance," *Finance Department at the Graduate School of Management*, University of Pretoria, (1992).
[50] Association of Unit Trusts for South Africa: *Yearbook*, (1991).

in their returns and by giving consistently good returns with regular cash flows. In contrast the more specialist funds hold inherently more risk and accordingly, the investor faces a higher variability in returns.

There is a decided trend towards specialist funds, designed to meet the differing needs and characteristics of various groups of investors. Specialist funds concentrate their investment attention on one, or a highly limited, sector of the stock market. For example, they may invest in shares of companies involved, for instance, in developing South Africa's natural resources or gold. Specialist equity funds therefore aim to achieve a high degree of capital growth for their investors, with income in the form of dividends being of a secondary goal or consideration. Specialist funds, due to their risky nature, tend to have a greater level of volatility in returns when compared to the less 'risky' general equity and income funds.

For those investors who prefer to receive relatively higher dividend income, as opposed to a high degree of capital growth, there exist high income/gilt funds which invest predominately in debentures, gilts and semi-gilts. This gives investors a substantial flow of current income via the payment of dividends and interest. These funds appeal particularly to the more risk-averse investor, as well as to those who wish to spread their portfolio beyond equities.

3.3: The Importance of Risk-Adjustments in Comparing Unit Trust Performance

It is not unreasonable to suppose that investors have a decided interest in comparing the published results of all unit trust funds as it assists them in deciding into which funds to invest. However, simplistic evaluations of unit trust funds are a fruitless exercise since, typically, the unit trust funds are not comparable as regards, among other things, their levels of risk. Funds have differing levels of risk, reflecting differences in desired levels of expected returns by the various investors. As investors who hold increased levels of risk expect to earn higher returns, there is a need for the returns achieved by the various unit trust funds to be measured on a risk-adjusted basis as this would convey a much more accurate picture to an investor looking to make the best investment possible. A risk-adjusted comparison would enable the investor to compare the relative performances of the different funds and in that way make a more 'informed' investment decision. An investor would be able to choose a preferred level of risk, and corresponding with the differing levels of risk, differing levels of return.

Portfolio evaluation on a risk-adjusted basis is also useful in evaluating or assessing the performance of the portfolio managers themselves. Senior management, directorates of public companies, as well as shareholders who are directly affected by changes in the profitability of the particular company in which they have invested, also need to know whether their particular funds are being optimally managed so as to achieve the best possible returns. Frequently, 'under performance' is 'masked' by a generally rising market and investors should be aware of this situation. Portfolio managers should be rewarded for making a high degree of positive adjustments to a fund's portfolio holdings, and conversely negative adjustments should also be noted. The whole debate over whether 'active' or 'passive' management techniques are optimal must also be considered and analysed in greater detail.

3.4: Active vs. Passive Management

The question of whether an active or passive management policy should be employed by portfolio managers is a highly controversial matter, as the outcome is highly dependent on whether one thinks the Capital Asset Pricing Model (CAPM) and Efficient Market Hypothesis (EMH), along with their respective predictions and implications, holds. If one suspects the CAPM predictions to be correct, then it would be impossible to *consistently* outperform the market. If the market portfolio is efficient, no shares will lie either above or below the Securities Market Line. In this regard, the EMH states that all relevant information is immediately recorded in the price of a share, and it would thus not be possible for one to observe either an over- or under-priced share.

This controversy was looked at in detail by Black et al[51] who argued that unit trust managers are incorrect when they suggest they can supply investment opportunities superior to those that individual investors would attain by use of their own efforts. Black et al acknowledged that when a well diversified portfolio held by a soundly funded financial institution is compared to that of an undiversified portfolio, such as those often held by many households and which often consist of a portfolio of up to only a few shares, the former will achieve a superior risk-to-return ratio. However the important question is, if both parties held fully diversified portfolios, whether specialist fund managers could be expected to achieve 'abnormally high' returns. If these managers *are* expected to earn in excess of equilibrium market returns, then we would have to accept that the EMH does not hold fully.

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[51] A. Black, P. Fraser, and D. Power, "UK Unit Trust Performance 1980-1989: A Passive Time Varying Approach," *Journal of Banking and Finance*, (vol. 16, 1992), pp. 45-65.

Fama[52] and Alexander *et al*[53] suggested two reasons why unit trust managers may be able to outperform the market. The first was that the manager might have the ability to identify shares that are undervalued by the market. The ability to do this is commonly known as having 'micro-forecasting' skills. Related to this is the ability of managers to exploit anticipated movements in the market which is termed 'macro-forecasting'. However both these skills raise the problem of Beta stationarity, as they each imply that the level of risk *within* the portfolio is not constant over time. As newly acquired 'under-priced' shares are added to the portfolio and currently held shares removed, the risk-profile of that portfolio will alter due to the changing composition of shares making up the total portfolio. It has also been shown by Chan[54] that the level of risk attached to certain shares will change over time as the market corrects the 'under' and 'over' pricing of shares.

Finally, by employing macro-forecasting techniques, the manager may intentionally change the risk profile of a portfolio in anticipation of movements in the market. Should the manager feel 'bullish' (bearish) about the market, he will increase (decrease) the Beta of the portfolio, enabling the portfolio to rise (fall) by a larger (lesser) extent than the market.

As mentioned in the previous chapter, many portfolio performance evaluations have been published, but they have typically made use of the Sharpe,Treynor and Jensen methodologies of performance measurement. These measures have been discussed previously in great detail.

Survivorship bias occurs when certain funds show superior performance over other funds that no longer exist or, alternatively, no longer exist in their original form. Survivorship

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[52] Eugene Fama, "Components of Investment Performance," Journal of Finance , (vol. 84, 1972), pp. 381-417.
[53] G. Alexander, P. Benson, and C. Eger, "Timing Decisions and the Behaviour of Mutual Fund Systematic Risk," Journal of Financial and Quantitative Analysis , (vol. 17, 1982), p.316.
[54] K.Chan, "On the contrarian investment strategy," Journal of Business , (vol. 61, 1988), p. 321.

bias thus refers particularly to studies that involve looking at the *persistance of performance* in mutual funds over at least *two* time periods, i.e. should a fund be a 'top' performer over an initial period of time, is it reasonable to predict that it will continue to perform in a successful manner in the subsequent period. Problems of survivorship bias occur when measuring persistance in performance, as one only observes those funds that *have* survived into the second period. If one can assume that the probability of survival depends on a fund's past performance, then one would expect that those managers who survived would have *higher ex post* returns than those which did not manage to survive[55]. This implies that past performance figures will be *biased* by the survivorship of certain funds, as one only observes and compares the performance of those funds that have survived, totally *excluding* any funds that collapsed over the time period under observation.

Other difficulties in performance measurement include the problems of sensitivity of performance results to the chosen benchmark portfolio, as well as that of the impact of market timing strategies on measuring performance. Roll[56] has shown that the relative performance of the fund being measured would differ depending on the particular benchmark portfolio used. Should the riskiness of the benchmark portfolio be less than that of the portfolio against which it is being measured, the relative performance of the measured fund would be enhanced. The opposite result will occur when the benchmark portfolio is inherently more risky than the portfolio against whose performance it is being measured.

55 Stephen Brown, William Goetzmann, and Roger Ibbotson, "Survivorship Bias in Performance Studies," The Review of Financial Studies, (vol. 5, no. 4, 1992), pp. 553-580.
56 Richard Roll, "A Critique of the Asset Pricing Tests," Journal of Financial Economics, (vol. 4, no. 4, 1977), pp. 129-176.

Given the inherent difficulties with traditional performance evaluation methods, Cornell[57] developed a 'benchmark free' approach to portfolio performance measurement in 1979. Subsequently this approach was extended by Copeland and Mayers[58] in 1982, and refined in a number of articles by Grinblatt and Titman[59]. The new 'benchmark free' approach is based on the 'Event Study' methodology, where the 'event' is the reallocation of individual assets within a portfolio from one period to another by an 'informed' versus an 'uninformed' portfolio manager.

3.5: The 'Event Study' Methodology

The 'Event Study' is not a new idea in financial research. The basic idea behind the 'Event Study Method' is that one looks at two distinct time periods: the first is that which occurs prior to the existence of a specific 'event', while, the second period is that occurring after the 'event'. One then compares the results from these two distinct time periods to determine the impact which the 'event' had on the specific data under analysis. Common examples of this would be to examine the impact which the Gulf war had on stock prices listed on the New York Stock Exchange; or to measure the extent to which the local Los Angeles and/or American insurance companies in general were affected by the Los Angeles' riots, where hundreds of millions of dollars worth of damage was caused over just a few days.

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57 Bradford Cornell, "Asymmetric Information and Portfolio Performance Measurement," *Journal of Financial Economics*, (vol. 7, 1979), pp. 381-390.
58 Thomas Copeland and David Mayers, "The Value Line Enigma - A Case Study of Performance Evaluation Issues," *Journal of Financial Economics*, (vol. 10, 1982), pp. 289-321.
59 Mark Grinblatt and Sheridan Titman, "Portfolio Performance Evaluation: Old Issues and New Insights," *Review of Financial Studies*, (vol. 2, no. 3, 1989b), pp. 393-421.
__________, "Persistance of Mutual Fund Performance," *Journal of Finance*, (vol. XLVII, no. 5, 1992), pp. 1977-1983.
__________, "Performance Measurement without Benchmarks: An Explanation of Mutual Fund Returns," *Journal of Business*, (vol. 66, no. 1, 1993), pp. 47-68.

Employing 'event study' methodology in these cases, one would look at the respective share indices or individual share prices *before* the Gulf War broke out, and then compare them to the indices or prices after the war's conclusion. From these results one would then be able to determine those shares which were most significantly affected by the war, or could alternatively determine which segment of the market suffered minimal losses. This information can be helpful as it gives investors a better idea of what to expect should war break out again, and they in turn will be able to make more informed investment decisions *before* any similar future 'events' occur.

To summarise we may conclude that event studies are useful to investors as they provide them with information on how markets have reacted to specific past events. This, in turn, helps investors in trying to discern the way the market will perform after an anticipated future event.

The 'benchmark free' evaluation technique used by Grinblatt and Titman relies heavily on the assumption that there are basically two types of managers:- 'informed' and 'uninformed' managers[60]. An 'informed' manager is one who is able to forecast the performance of particular shares in a 'superior' fashion[61] due to his ability to interpret information which he receives in the form of a 'message' at the *beginning* of a certain period. An 'uninformed' manager does not receive these informational messages prior to the event and, as a result, makes his predictions based only on past information.

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60 David Mayers and E. Rice, "Measuring Portfolio Performance and the Empirical Content of Asset Pricing Models," *Journal of Financial Economics*, (vol. 7, 1979), pp. 3-28. Mayers and Rice were the first to introduce the idea of portfolio managers have asymmetric information upon which many authors have based their research and writing. Mayers and Rice's work is discussed in more detail in section 3.7.1.

61 Bradford Cornell, "Asymmetric Information and Portfolio Performance Measurement," *Journal of Financial Economics*, (vol. 7, 1979), pp. 381-390.

Given the informational messages received by the 'informed' manager, he will then reduce the weightings of the shares within the portfolio that he predicts will fall, while he will increase the relative weightings of the shares that he thinks are going to rise in value in the future. Thus a share's weighting will rise due to a combination of the total proportion of 'weaker' shares relative weightings falling, coupled with increased weightings of the potentially positive performing shares. Thus for the informed investor one would expect to find a positive correlation between the weightings of a particular asset and it's returns in a subsequent period. An 'informed' investor would therefore achieve a positive covariance between the relevant weightings and returns of shares within his portfolio. 'Uninformed' managers, in contrast, would have a covariance of weightings and returns that would tend toward zero. This would occur due to any positive returns being made on a number of shares within the portfolio being 'reversed out' by a number of corresponding negatively performing shares.

3.6: Early South African Unit Trust Performance Studies

Since their initial introduction in 1965 there has been extensive investigation of the performance of South African Unit Trust funds. However, the early research done on these unit trust funds concentrated on making use of the Sharpe, Treynor and Jensen performance measures which are, as previously noted, fundamentally flawed. Taylor[62], in his 1977 paper, analysed ten unit trust funds over a six year period covering 1970 through to 1976. He made substantial use of the Sharpe, Treynor and Jensen performance measures and calculated, after risk-adjustment, that the ten funds made on average about 2.4% less return per annum when compared to the market. However this difference was

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[62] C. Taylor, "The Performance of South African Investment Trusts and Mutual Funds", (unpublished MBA research report, University of the Witwaterstrand, 1977). Cited from an article by E. Knight and C. Firers' "The Performance of South African Unit Trusts 1977-1986," *South African Journal of Economics,* (vol. 57, no.1, 1989).

not significant at the 5% confidence level. Taylor noted the problems of Beta stability and stationarity, and found that the Betas which he used displayed neither stability nor stationarity. Taylor noted that for this reason the empirical validity of the market equilibrium model used to adjust for risk was in question.

In 1976[63] Gilbertson investigated eleven funds for the period 1970-1976. He assumed, although his investigation subsequently showed otherwise, that Beta was stationary[64]. Gilbertson found that the funds under investigation on average earned 1.1% less per annum than the market when adjusted for risk. Out of the eleven funds employed in this study, two funds seemed to show consistently higher performance over certain periods, but these returns were not found to be statistically significant at the 5% level. Gilbertson nevertheless concluded that the strong form of the Efficient Market Hypothesis[65] could be said to hold.

In 1982, Gilbertson and Vermaak[66] followed up Gilbertson's previous work with another study in which they investigated eleven funds over the period 1974-1981. In contrast to Gilbertson's earlier findings they concluded that the funds outperformed at least three market indices which they had chosen as 'benchmark' portfolios and against which they measured performance. They further found there was one particular fund that consistently outperformed both the market and all other funds; however, neither Beta stationarity nor Beta stability were found to exist.

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[63] E. Knight and C. Firer cite results from B. Gilbertson, "The Performance of South African Mutual Funds. Johannesburg Consolidated Investment Company," Unpublished report, (no. F76/84, 1976).
[64] E. Knight and C. Firer, "The Performance of South African Unit Trusts 1977-1986," *South African Journal of Economics*, (vol. 57, no.1, 1989), pp. 52-68.
[65] E.Knight and C.Firer, "The Performance of South African Unit Trusts 1977-1986.", *South African Journal of Economics*, (vol. 57, no. 1, 1989), pp. 52-54. The strong form of the Efficient Market Hypothesis suggests that current market prices reflect all information, whether this information is publicly or privately held. If this strong form does hold in the market, everyone (even insider traders) would find it impossible to make abnormal returns on the stock market.
[66] B. Gilbertson and Vermaak, "The Performance of South African Mutual Funds:1974-1981," *The Investment Analysts Journal*, (vol. 20, 1982), pp. 35-45.

3.7: The Development of the Grinblatt and Titman Portfolio Change Measure

Roll[67] showed that, in the context of the traditional CAPM, the Securities Market Line (SML) could not be used as 'an unambiguous performance measure'. Roll[68] stated that if the index which was used to calculate Betas were Mean-Variant Efficient, then all shares would plot exactly on the SML. It would, therefore, not be possible for fund managers to 'pick' out either 'over' or 'under' priced shares.

However, Mayers and Rice[69] demonstrated that if one adds the assumption of asymmetric information, the SML *could* be used to distinguish superior performance. The introduction of asymmetric information led Cornell[70] to develop a new technique to measure performance *without* the use of a benchmark or market index. It was upon this framework that Grinblatt and Titman laid the foundation for their Portfolio Change Measure which is employed in this thesis. Accordingly a more in-depth look at this body of work and how the Grinblatt-Titman Performance measure was developed will now be highlighted.

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67 Richard Roll in his two articles,"A Critique of the Asset Pricing Theory's Tests," *Journal of Financial Economics* , (vol. 4, no. 4, 1977), pp. 129-176, and "Ambiguity when Performance is measured by the securities market line," *Journal of Finance*, (vol. 33, no. 4, 1978), pp. 1051-1069, discusses in great detail the use of the CAPM in measuring a share's return, and points out the shortfalls associated in using it.

68 Richard Roll, "A Critique of the Asset Pricing Theory's Tests," *Journal of Financial Economics*, (vol. 4, no. 4, 1977), pp. 129-176.

69 David Mayers and E. Rice, "Measuring Portfolio Performance and the Empirical Content of Asset Pricing Models", *Journal of Financial Economics*, (vol. 7, 1979), pp. 3-28.

70 Bradford Cornell, "Asymmetric Information and Portfolio Performance Measurement," *Journal of Financial Economics*, (vol. 7, 1979), pp. 381-390.

3.7.1: The Mayers and Rice Framework

Mayers and Rice accepted that the major assumptions of the CAPM held. However, they added as an additional assumption the concept of 'asymmetric information'. This implied there were *two* classes of investors which they called *'informed'* and *'uninformed'*. Mayers and Rice further assumed that the 'informed' investor had a zero weighting in the market. 'Informed investors' were to be distinguished from other investors in that they received information in the form of a 'message' at the *start* of a certain time period. Based on this information, they were then able to make an 'informed' assessment on the probable distribution of that state which would occur at the end of a specified period. Conversely, 'uninformed investors' did not receive this information prior to but rather only at the end of the specified period. Consequently they could only hold *unconditional* beliefs regarding the state that would occur in the future. They were, nonetheless, rational investors since they made use of all available information at the time they *initially* invested.

Mayers and Rice argued that investors utilising their conditional probability assessments, would choose a portfolio that fell on the Mean-Variant Efficient Frontier[71]. Because of the assumption that the informed investor has a zero weighting in the market - Mayers and Rice invoked this assumption since, without it, the derivation of the entire CAPM model would break down - the portfolio that the uninformed investor would choose must be that of the market M; that is, the market portfolio which lies on the efficient frontier. Following on from this, Mayers and Rice proposed that 'using either long-run sample data or their probability beliefs, the uninformed investors will conclude that all individual securities plot on the security market line when Betas are computed against the market portfolio[72].

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[71] Bradford Cornell, "Asymmetric information and Portfolio Performance Measurement," Journal of Financial Economics, (vol. 7, 1979), pp. 381-390.
[72] Bradford Cornell, "Asymmetric Information and Portfolio Performance Measurement," Journal of Financial Economics , (vol .7, 1979), p. 383.

Implied in this proposition is the fact that uninformed investors are not able to use the SML to calculate which securities are either over-or-under priced. However, we can say that progressing from one period to the next, returns will be *ex-post* inefficient and a number of securities will not plot on the SML. We can also assume that because investors act rationally, there is no regular pattern in the error terms for each security since the investor would otherwise be able to use this to his advantage and improve his probability assessments of the securities in which he is interested.

Mayers and Rice then extended their argument and said that although uninformed investors perceived the error term as random, the informed investor received a 'message' which gave him superior information. The informed investor would then be able to determine which error terms would be positive and which negative. Accordingly, informed investors would buy those securities for which the error term is positive and sell short the securities which would give a negative return. By continually following this strategy, the informed investor would be able to achieve superior returns consistently and over time.

Thus Mayers and Rice showed that, contrary to Roll's 1978 argument, if the 'uninformed' investor used the returns generated by the 'informed' investor to estimate the respective Beta, it would lead him to believe that the returns to the informed investor would plot *above* the SML. In this way Mayers and Rice showed how one could use the SML to measure the performance and, in particular, any superior or abnormal performance that investors were able to achieve.

There are three major problems with the Mayers and Rice framework which bear note: Firstly, their assumption that 'informed' investors have a zero weighting in the market is clearly unrealistic. As the 'informed' investor is able to generate superior performance on a consistent basis, the 'informed' investor will be accumulating wealth at a greater rate than will the 'uninformed' investor, and would thus constitute an increasing proportion of the market. The 'uninformed' investor, noticing that the 'informed' investor is able to achieve superior returns, would also transfer his funds to the 'informed' investment managers. Informed managers would, therefore, control the vast majority of the market in a very short time.

Secondly, as Roll pointed out, the use of benchmark, or market, portfolios is highly flawed. What exactly constitutes the 'market' portfolio, and what level of risk one should hold are two fundamental problems the investor faces. Roll argued that, given the assumptions underlying CAPM, abnormal performance can only occur if the market proxy is inefficient; he argues, in effect, that evidence of abnormal performance is *prima facie* evidence that the benchmark employed is *not* mean-variant efficient. Therefore, empirical tests of the CAPM are, simultaneously, tests of the theory itself and the mean-variant efficiency of the portfolio that was chosen as the 'market proxy'. One is therefore not able to determine whether a manager who plots above the SML curve is achieving a superior performance.

Finally the Mayers and Rice model is not able to measure the *relative* performance amongst the superior investment managers. Managers are simply denoted as being either 'informed' or 'uninformed', with their relative superiority not being measured in any manner at all.

3.7.2: Cornell's performance measurement

In 1979, Cornell also developed a performance measurement designed to overcome the shortcomings of Mayers and Rice's theory. Cornell was specifically trying to overcome the one fundamental flaw in the Mayers and Rice framework, which is that their entire approach was based upon the underlying assumption that the CAPM holds, and as Roll[73] pointed out, the CAPM has yet to be tested.

Cornell's proposed portfolio measure proceeds as follows[74]:

(1) Take a sample prior to the period being tested and estimate the mean return on all the individual securities[75].

(2) Observe the individual weightings of the securities within the portfolio of the portfolio manager who is being studied at the *beginning of the test period*, and calculate his expected return for that first period by multiplying the weightings by the computed returns;

(3) Record his *actual* return for the first period and compute the unexpected return that was achieved; then,

(4) Repeat this exercise over the entire test period and compile a complete series of unexpected returns for the entire period. Finally, calculate the mean of the series of unexpected returns to determine whether this differs significantly from zero.

This test differs from that of Mayers and Rice and many of the previously developed performance measures in that the test <u>*does not*</u> require any explicit models regarding the measurement or pricing of risk. No use of Beta is necessary and, as a result, the inherent flaws associated with their use are avoided. An added benefit of this technique is that

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[73] Richard Roll, "A Critique of the Asset Pricing Theory's Tests," <u>*Journal of Financial Economics*</u> ,(vol. 4, no. 4 , 1977), pp. 129-176.

[74] The following section closely follows Bradford Cornell, "Asymmetric Information and Portfolio Performance Measurement," <u>*Journal of Financial Economics*</u>, (vol. 7, 1979), p. 386.

[75] In a competitive market, the appropriate non-measurable risk premium is impounded in this return.

portfolio managers can be ranked according to their relative performances. The better informed managers are those who have larger unexpected returns. A t-statistic can be used to rank the relative performance of the managers, with the difference between two manager's mean unexpected returns being the numerator in the calculation.

Cornell's methodology is also based upon the 'Event Study' idea, as one is looking at a specific portfolio held over two distinct periods of time, with the 'event' being that of the changed composition of the shares held within the particular portfolio under investigation.

3.7.3: Value Line Enigma - as researched by Copeland and Mayers[76]

Value Line is one of the world's largest investment advisory companies and they provide a number of investment information services to their subscribers. Their research covers over 1700 stocks and the company employs well over 200 people. Part of the information they provide includes supplying their customers with performance predictions covering the forthcoming twelve months on a large number of stocks. This is done by ranking shares on a scale from 1 to 5[77], with a ranking of 1 indicating a favourable performance in the future and a ranking of 5 indicating unfavourable performance. On average 53% of stocks are ranked with a 3; with 18% being ranked either a 2 or 4; and finally only 6% are ranked either with a 1 or 5. All information that is used in helping to rank the securities is based upon publicly known and available information.

[76] Thomas Copeland and David Mayers, "The Value Line Enigma (1965-1978) - A Case Study of Performance Evaluation Issues," *Journal of Financial Economics*, (vol. 10, 1982), pp. 289-321.

[77] The current ranking system as used by Value Line was started in 1965. Basically, four criteria are used in the ranking of securities, namely, (1) the price and earnings of one security relative to all others; (2) year to year relative changes in earnings from one quarter to the next; (3) a price momentum factor; and finally, (4) an earnings 'surprise' factor.

Prior to Copeland and Mayers's work, Black[78] had undertaken an evaluation of the Value Line predictions making considerable use of the Jensen's measurement method which is largely based on the standard Capital Asset Pricing Model. Black's research showed significant abnormal performance for those securities which were rated either a 1,2,4 or 5 by Value Line. Copeland and Mayers thought this was a startling result needing further investigation, as it was in direct conflict with the semi-strong form of the Efficient Market Hypothesis. They also had difficulty accepting Black's use of the Jensen methodology for reasons previously stated in this work.

Copeland and Mayers specifically looked at the performance of assets as recommended by the Value Line Investment Survey . They concentrated their research on the thirteen year time period between 1965 and 1978, and based their performance evaluation technique on the method developed by Cornell, which emphasised making use of a *future* benchmark technique, as opposed to using benchmarks developed from *historical* data. In this manner they avoided selection bias problems as well as the well known difficulties associated with the Capital Asset Pricing Model.

Copeland and Mayers obtained their core data from the *Value Line Investment Survey* as well as from the Centre for Research in Securities Prices (CRSP) files. The CRSP files contain, among other information, the returns for all American Stock Exchange (Amex), New York Stock Exchange and NASDAQ listed securities. The Value Line Survey also indicates what securities have been assigned a different rating from the previous week, and whether the rating has moved in an upward or downward direction.

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[78] F.Black, "Yes Virginia, there is hope: Test of the Value Line ranking system,", (*Graduate School of Business, University of Chicago)*, Chicago, (no. IL, May, 1971).

Copeland and Mayers developed two main data sets. The first set, for the period November 1965 through to February 1978 was comprised of the Value Line performance ratings collected at intervals of twenty six weeks for a total of twenty four periods. The second set of data they devised was composed of all the changes in ranking of securities[79], with these being collected at thirteen week intervals for a total of forty eight periods. Finally Copeland and Mayers constructed a 'market index' from a weekly equally weighted arithmetic average rate of return index of all the CRSP listed securities[80].

Copeland and Mayers defined the 'test period' as the twenty six week period *following* the recommendations as set out by Value Line for the "ranking" data set, and the thirteen week period directly following the recommendations for the set of data showing the "change" in rankings. They then calculated both the weekly excess rates of return as well as standardised rates of return covering the entire test period.

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[79] The first set of data contained on average 1 270 securities, while the second set, showing the change in rankings, consisted on average of 39 upgraded and 41 downgraded securities for each time period.
[80] Thomas Copeland and David Mayers," The Value Line Enigma - A Case Study of Performance Evaluation Issues," *Journal of Financial Economics*, (vol. 10, 1982), pp. 289-321.

The portfolio rate of return is calculated as follows :-

EQ.3.1: $$R_{pt} = \ln(1 + \Sigma R_{jt} / N_t)$$

where; R_{jt} = weekly rate of return for security j in the portfolio during week t of period p; and

N_t = number of firms[81].

The mean return for the benchmark is calculated as follows:-

EQ.3.2: $$R_p = \Sigma R_{pt} / T$$

where T = number of weeks in benchmark period.

R_{pt} is calculated for each week in both the test and benchmark periods and R_p as calculated above is the average weekly portfolio rate of return from the benchmark period. Copeland and Mayers also calculated the estimated standard deviation of the portfolio rate of return over the benchmark period. They then used their results from these calculations, along with the mean benchmark return, to calculate the standardised portfolio rate of return for each particular week of the test period. This standardised rate of return is equivalent to a t-statistic for the portfolio excess rate of return in that particular week. All of the above standardised rates of return are then averaged to get an *average weekly standardised portfolio rate of return*. One can then use the following t-statistic to measure whether there is any significance of excess rate of return in performance for any particular

[81] N is subscripted by 't' to note the possibility of firms either listing or delisting; however, Copeland and Mayers point out that the amount of listing and delisting is minor.

weeks within the test period. The t-statistic can be written as follows with degrees of freedom equal to the number of periods within the entire measured time frame:

EQ.3.3: $$t_W = SR_{pW}/(1/\sqrt{48})$$

where: SR_{pW} = standardised portfolio rate of return for week w.

Finally, Copeland and Mayers calculated the average cumulative excess rate of return to see whether this result gave them a figure that deviated from zero.

Copeland and Mayers decided to make use of two benchmark periods. The first benchmark they used was the twenty-six week period directly *after* the test period, and the second was a fifty-two week period also directly *after* the test period. They used the shorter period, as well as the longer one, in order to minimise the potential problem of non-stationarity. Copeland and Mayers also noted that as long as the seasonality is stationary from one year to the next, it would not affect the outcome of their results.

3.7.3.1: Results from the investigation

The cumulative raw returns on an unadjusted basis showed a large degree of discriminating ability on the part of Value Line to predict the performance of shares in the future. The performance results achieved for the various portfolios was ordered precisely in line with their respective rankings. Portfolios with a ranking of 1 achieved an average six month return of 7.38% compared to a portfolio ranked 5 which achieved a mere 0.37%. The mean return benchmarks calculated corresponded accordingly to a security selection strategy that assigns high risk securities to portfolio 1 and lower risk securities to portfolio 5. However the respective Betas calculated for the 5 portfolios did not fully explain the differences in risk holdings, with portfolios 1 and 5 achieving roughly the same Beta's (1.042 vs 1.003 respectively).

The results of the Value Line excess rate of return performance for the 'ranking' portfolios indicated a significant degree of abnormal performance, particularly in the portfolio ranked 1. Excess rates of return were also found at all levels of ranked portfolios. It should also be noted that in all cases the performance of all five portfolios is in almost perfect order according to the Value Line rankings. This outcome substantiates Value Line's claim that it has substantial discriminating ability.

In conclusion, Copeland and Mayers stated that their findings did not necessarily suggest that the market was inefficient. They found that if one took a 1% brokerage commission into account on the buying and selling of the securities, the investor would not have been able to make any abnormal profits if one tried to follow Value Line recommendations on a strict trading basis. However should an investor have followed a more conservative "modified buy and hold" strategy, it might have been possible to make small abnormal profits over time.

3.7.4: The Grinblatt and Titman Portfolio Change Measure

Grinblatt and Titman, in a number of in-depth studies[82], followed Copeland and Mayers by developing and expanding Cornell's idea of having a benchmark-free performance measurement.

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[82] Mark Grinblatt and Sheridan Titman, "Mutual Fund Performance:An analysis of Quarterly Portfolio Holdings," *Journal of Business*, (vol. 62, 1989), pp. 393-416.
______________, "Portfolio Performance Evaluation: Old Issues and New Insights," *Review of Financial Studies*, (vol. 2, no. 3, 1989), pp. 393-421.
______________, "Persistance of Mutual Fund Performance," *Journal of Finance*, (vol. 47, 1992), pp. 1977-1983.

Grinblatt and Titman noted that none of the traditional measures of portfolio performance utilized information on the composition of the evaluated portfolio. They further noted that when the composition of the portfolio under consideration was used, the need to compare returns to a benchmark portfolio was eliminated[83]. By avoiding the use of a benchmark portfolio, the evaluator would then be able to by-pass problems attendant upon the use of one.

The fundamental premise of the Grinblatt-Titman methodology is that, for 'informed' managers, the expected returns on assets change over time. By successfully predicting when individual assets have higher (lower) than average returns, a fund manager can increase (decrease) the percentage weightings of those assets in his portfolio. Therefore, for 'informed' managers, asset weightings over time, should be positively correlated with their associated conditional expected returns. For 'uninformed' managers, expected asset returns are perceived as constant over time; therefore, the percentage holdings of the portfolio's individual assets should be uncorrelated with their subsequent returns. According to Grinblatt and Titman[84], a convenient measure which permits the evaluation of a portfolio's performance based on these assumptions is the aggregation of the covariance's between individual asset returns and their portfolio weights:

______________, "Performance Measurement without Benchmarks: an Examination of Mutual Fund Returns," *Journal of Business*, (vol. 66, no. 1, 1993), pp. 47-68.

[83] Mark Grinblatt and Sheridan Titman, "Performance Measurement without Benchmarks: An Examination of Mutual Fund Returns," *Journal of Business*, (vol. 66, no. 1, 1993), pp. 47-68.

[84] Mark Grinblatt and Sheridan Titman, "Performance Measurement without Benchmarks: An Examination of Mutual Fund Returns," *Journal of Business*, (vol. 66, no. 1, 1993), pp. 47-68.

EQ.3.4: $\text{cov} = \Sigma \left(E[w_i r_i] - E[w_i]\, E[r_i] \right)$

where: w_i = portfolio weight of the i'th share; and,

r_i = the return of the i'th share.

This measure of covariance can be thought of as the actual expected return of a managed portfolio where asset weights and returns are *correlated* minus the expected return on a portfolio where the weights and returns are *uncorrelated.* In addition, the second term inside the brackets can be seen as the appropriate adjustment for risk 'since it represents the expected return of a constant weight portfolio with the same average risk as the evaluated portfolio[85]. For the 'uninformed' manager, the first and second terms should be approximately equal so that the covariance is equal to zero. For informed managers who are able to successfully adjust their portfolios so as to take advantage of changing returns on various assets, this covariance term should be significantly positive.

We can rewrite EQ. 3.4 in the following two ways:

EQ.3.5: $\text{cov} = \Sigma\, E(w_i(r_i - E[r_i]))$; and,

EQ.3.6: $\text{cov} = \Sigma\, E([w_i - E[w_i]r_i)$

Grinblatt and Titman refer to the EQ. 3.6 as the foundation for their new measure. As opposed to the Event Study Measure (based upon EQ. 3.5) which requires one to estimate the unconditional return ($E[r_i]$), the new measure only requires one to estimate the *expected weight* of the assets. EQ. 3.6, which lays the foundation for Grinblatt and

[85] Mark Grinblatt and Sheridan Titman, "Performance Measurement without Benchmarks: An Examination of Mutual Fund Returns," *Journal of Business*, (vol. 66, no. 1, 1993), pp. 47-68.

Titman's 'Portfolio Change Measure'. It therefore indicates how to calculate a covariance between portfolio weights and the return of a *single* asset. To calculate the Portfolio Change Measure, one is required to aggregate the covariance measures from EQ. 3.4 for *each* asset over the particular sample period. The **Portfolio Change Measure** (PCM) is thus equal to:

EQ.3.7: $$PCM = \Sigma\Sigma(r_{it} [w_{it} - w_{i,t-1}])$$

where: r_{it} = return on the i'th share in period t; and,

w_{it} = weighting of the i'th share in period t.

In EQ. 3.7, $w_{i,t-1}$ gives one an estimate of asset i's expected portfolio weight at time t, and Grinblatt and Titman assume that one can use the actual returns in period t+1 as a proxy for the expected return in period t (r_{it}). Under the null hypothesis of no 'superior' information, current and past asset holdings are uncorrelated with current asset returns. This will cause EQ. 3.7 to converge towards zero. Should the manager be 'informed', changes in asset weightings will be positively correlated to returns, and the Portfolio Change Measure have a net positive outcome.

The Portfolio Change Measure overcomes one of the major weaknesses found in the Event Study Measure -- that of its sensitivity to the survival of assets currently being held in the portfolio for a future period of time. Should an asset no longer exist shortly after it has been included in a portfolio that has just been evaluated, the investor's holdings of that particular asset is not able to be utilised in assessing the portfolio's performance. This creates a 'survivorship' bias in both small and large samples. The Portfolio Change Measure, which applies current and past portfolio weights to returns in the forthcoming period, overcomes this problem of survivorship bias by construction. This is due to the fact that the particular security has to be present in *all* three time periods for it to have any effect on the portfolio performance measurement. Should it not appear in all three periods it would not be possible to calculate the performance measure for that particular security over that period.

The Portfolio Change Measure is also able to avoid all the shortcomings of employing a benchmark portfolio, as portfolio risk is never *directly* quantified. Rather, the key assumption is that mean asset returns are stationary over the relevant sample period. Should this assumption be violated, then even the uninformed manager can 'game' the results and achieve an overall positive performance result.

A problem arises with the Portfolio Change Measure should the portfolio's Beta suffer from Beta non-stationarity over time. This can occur when a portfolio manager increases the average risk of the portfolio over a period of time. This, in turn, will cause the expected return on the portfolio to have an upward trend. Increased risk-taking by the portfolio manager may then be misinterpreted as indicating abnormal performance. The zero-cost portfolio used to evaluate this particular manager's performance will have a positive Beta, implying a positive performance measure, even though the manager is 'uninformed'. However, as the sample size increases, this bias is significantly reduced. Evidence of a systematic increase in portfolio risk can be obtained by resorting to traditional benchmark methods based on the Capital Asset Pricing Model, and estimating a zero-cost Beta by regressing the returns calculated by the Portfolio Change Measure on some market proxy.

Different lags may also be used when calculating the relevant changes in asset holdings. This is a useful technique as it provides an insight into how long it takes for certain information to be revealed and incorporated into an individual asset as well as portfolio returns. It is thus important to use the appropriate time lags. For example, if the information is incorporated quickly, e.g. within a one-quarter period, changes in the weightings of the individual assets on a quarterly basis will provide a more accurate measure of performance when compared to using longer lag periods. If information is incorporated more slowly, e.g. over a twelve month period, it would be preferable for an annual lag period to be used. If the information is incorporated into prices more slowly than the particular time lag used, then the Portfolio Change Measure will be biased downwards, and vice versa.

3.7.4.1: Grinblatt and Titman's investigation in detail

In 1993 Grinblatt and Titman[86] investigated 155 American mutual funds over a ten year period from 31 December 1974, through to 31 December ,1984.

They calculated two zero-cost portfolios for each mutual fund respectively. The first zero-cost portfolio made use of quarterly lags in calculating the Portfolio Change Measure, while in the second portfolio annual lags were used when calculating the change in weightings for the individual assets.

These changes in weightings (differenced weights) were then multiplied by the monthly returns achieved by the various assets (the monthly returns were calculated by compounding the daily returns of the assets) and then summed to achieve the monthly returns of the respective zero-cost portfolio. This process was then repeated for each quarter and year respectively, so that a time series of over a 100 monthly portfolio returns was achieved. These monthly portfolio returns were then summed and averaged in groups

[86] Mark Grinblatt and SheridanTitman, "Performance Measurement without Benchmarks: An Examination of Mutual Fund Returns," *Journal of Business*, (vol. 66, no. 1, 1993), pp. 47-68.

of four and twelve respectively to get quarterly and annual average portfolio returns. Grinblatt and Titman thus ended up with a 1-quarter and a 4-quarter time series of average returns in the format of their Portfolio Change Measure.

The average returns calculated in the time series do not represent the abnormal returns of a particular mutual fund, but rather the abnormal returns that an individual investor could have received had he bought all the assets on the funds current quarterly report and sold short all the assets on the funds quarterly report from the previous quarter (assuming quarterly lags for the calculations). Given the null hypothesis - that no fund managers have superior information - as well as the assumption that the systematic risk of the current portfolio is the same as the systematic risk of the portfolio in the previous time period, then the above two time series measures represent the average returns of both zero-cost and zero-systematic-risk portfolios. One would thus expect both measures to have values of zero.

3.7.4.2: Summarised Results of their Investigation

Grinblatt and Titman concluded that the evidence indicated that the quarterly holdings of the mutual funds under investigation achieved, on average, positive abnormal performance results over the period January 1,1976 through to March 31, 1985. The aggressive growth funds were found to have the best overall performance. These results correspond to their 1989 investigation[87] in which similar results were reported. However, in contrast to their 1989 investigation, by making use of the Portfolio Change Measure which requires one to observe *portfolio holdings*, none of their results could have been adversely affected by the use of an inefficient benchmark portfolio.

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[87] Mark Grinblatt and Sheridan Titman, "Mutual Fund Performance: An Analysis of Quarterly Holding," *Journal of Business*, (vol. 62, 1989), pp. 393-416.

They also found that portfolio managers who showed superior or abnormal performance were able to achieve this on a fairly consistent basis. Thus funds that had superior performance in the first period tended to maintain this superior performance through into the second sample period. Funds that achieved a negative performance result in the first sample period tended to remain lagged behind the leaders through the second period as well by showing a performance figure that was indistinguishable from zero.

Grinblatt and Titman concluded that just because certain mutual funds achieve significant abnormal performance over certain periods of time, this does not imply that *individual investors* can achieve the same positive returns by investing in the relevant mutual funds. As Grinblatt and Titman pointed out, on average, fund expenses and transactions costs dissipate away the abnormal investment performance so that the net performance of these funds ends up being close to zero. However, Grinblatt and Titman noted that due to the fact that the investment holdings of mutual funds are made public when the quarterly reports are published, if investors mimicked these funds it would be possible for them to achieve the same positive performance results. Additionally, when these results are adjusted *solely* for commissions, excluding the additional expenses faced by unit trust fund holders[88], it is possible for the investor to achieve a net *abnormal* return on his investment.

Grinblatt and Titman also stated that none of their results were adversely affected by the existence of either survivorship bias, the January Effect, or a change in the systematic risk of certain assets within the respective portfolios. They substantiated these claims by using a number of conventional statistical tests, as well as by comparing the results obtained from their Portfolio Change Measure against results obtained using the more 'traditional' benchmark evaluation techniques.

[88] The issue of transaction costs is discussed in full in Chapter 5.

In the author's opinion, the Portfolio Change Measure is a most effective and efficient method of portfolio performance evaluation, and it is this measure that will be used in the remainder of this work. The measure has been adapted slightly for South African data, but none of the modifications should affect the validity of the results in any way. The following chapter explains the methodology developed and used herein.

CHAPTER FOUR

Adaption of Grinblatt and Titman Methodology for South African Data

4.1: Introduction

This chapter will explain the methodology followed by the author in this undertaking. It will be observed that the techniques used herein are heavily reliant on Grinblatt and Titman's 'Portfolio Change Measure' as discussed in detail in the previous chapter.

The underlying data in this research consists of the quarterly portfolio reports of the respective unit trust funds under consideration. A total of thirty-two funds were considered for this research[89], with the earliest fund beginning in June 1970. All funds were analysed through to December 1992. Regrettably, the coverage of some of the funds is incomplete inasmuch as some of the funds did not have data available for the earliest periods of their existence. The resulting database contains up to 90 quarterly observations on portfolio composition for the earliest funds, and as few as 3 quarterly observations for the newest funds.

[89] A list of the thirty two funds and their respective starting dates can be found at the end of this chapter.

The reports used were those published and released to the public by the various unit trust companies themselves. Thus all information used in this research is openly available to the public and contains no confidential information at all. It is for this reason that the author decided to use the *actual* names of the funds under scrutiny, rather than label them with the use of mnemonics.

The reports include relevant detailed information under the following headings: shares held by company, number of shares held, market capitalisation and, the percentage of the entire portfolio which each individual shareholding constitutes. Thus all the relevant information required in making use of the Grinblatt and Titman methodology was obtained directly from the unit trust quarterly reports as issued by the various management companies[90].

4.2: The methodology followed

The methodology that the author followed in calculating the relevant Portfolio Change Measures for both the one-quarter and four-quarter lags is explained below.

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[90] It should be noted that no income unit trust funds were analysed in this research. This is due to the fact that the entire portfolio of these funds consists of holding fixed interest securities with limited amounts of cash. No equities at all are held within the portfolio. Because the Grinblatt and Titman methodology is designed more specifically to analyse equity based portfolios, the author concluded that an inaccurate result would be achieved should the income funds be analysed on the same basis as the equity funds. There are also various problems with measuring the 'return' on a quarterly basis for individual fixed interest securities. One of the biggest problems faced is deciding which interest rate should be used in calculating the resale (market value) value of the various securities. This is primarily due to the fact that the various securities all have differing time lengths to maturity, as well as holding differing inherent levels of risk.

4.2.1: One-quarter methodology

The underlying data from the unit trust quarterly reports enabled the author to calculate a zero-cost portfolio for each unit trust fund, quarter to quarter. This was achieved by calculating the change in the share weightings from time period t-1 to time period t. Multiplying these 'differenced' weights by the returns to the shares in time periods t through t+1 and then summing across all shares in the specified portfolio yielded Grinblatt and Titman's Portfolio Change Measure. It should be noted that this return was calculated on a capital gain and dividend basis. The returns on individual shares were calculated using the following equation:

EQ.4.1: Return on share j[91] $= ([p_{jt} + d_{jt}] - p_{jt-1}) / p_{it-1}$

where: p_{jt} = current price of asset j;

d_{jt} = dividends received in past quarter for asset j[92];and

p_{jt-1} = price of asset j at end of previous quarter.

[91] No return was calculated for cash balances held within the portfolio, as it was assumed that all fund managers would be able to achieve the same return on cash balances if they deposited the money in a commercial bank at the standard money market or 32 day deposit rate.

[92] All dividends for the respective shares, were obtained from the Cape Town stockbroking firm of Simpson Mckie Inc. Simpson Mckie record the entire history of any dividends paid out by any particular share on the Johannesburg Stock Exchange, from the date of the share's inception, through to the current period. They also record the exact month in which the dividend is received, enabling the author to know in which quarter to add the dividend into the 'return' calculation. In doing so, one has to assume that the number of shares held by the unit trust on which dividends were paid in a particular quarter was equal to the number of shares held at the beginning of the *following* quarter. Thus in the case where shares were held in the previous quarter but no longer held, there is, then, the implicit assumption that *no* dividends were received for that particular share. These assumptions are not too heroic in the case of South African companies, since as a historic and conventional matter, the concentration of dividend payments tend to be in February and September; thus making it necessary, in any given year, to only calculate Rates of Return, inclusive of dividends, for two of the four quarters.

All the totals calculated by multiplying the returns of all the individual assets by their respective change in weightings are then summed to obtain a quarterly covariance measure as set out by Grinblatt and Titman's EQ. 3.7: ($PCM = \Sigma\Sigma(r_{it} [w_{it} - w_{i,t-1}]$). Each unit trust fund will thus generate a time series of quarterly covariances where the number of observations depend on when the unit trust was initially established. These covariances can be thought of as a measure of the *additional gain (or loss)* return that the fund manager achieved for the fund's investors by altering the composition of the portfolio over the quarter, as opposed to adopting a buy and hold strategy. In effect this process mimics the returns which an investor could have achieved had he bought those shares listed by the fund on the day the quarter ended, and simultaneously sold short those shares which the fund held at the beginning of the previous period.

4.2.2: Four-quarter methodology

To facilitate the further comparison of these results with those achieved by Grinblatt and Titman, it was decided to further calculate the Portfolio Change Measures based on a four-quarter lag. By lengthening the time period covered (from six months to one year) for the calculation, one can determine whether portfolio managers have longer time horizons in mind when making their investment decisions. One is then able to observe whether there is any significant difference in performance between the one-quarter and four-quarter Portfolio Change Measures.

A zero-cost portfolio was again calculated for each unit trust fund; however, instead of using time periods t-1 (the quarter prior to the quarter in time period 't')and t+1 (the quarter following the quarter in time period 't'), the time periods were extended both forward and backwards by a quarter. Accordingly time periods t-2 (two quarters prior to the quarter in time period 't') and t+2 (two quarters following the quarter in time period 't') were used in calculating the change in weightings and share returns respectively. One is thus looking at data that covers a one year, instead of a six month, period.

4.2.3: The Portfolio Change Measure

The *average* return for each portfolio's quarterly time series of covariances (Grinblatt and Titman's EQ. 3.7) is equivalent to the 'Portfolio Change Measure'. Given our null hypothesis that no portfolio manager has superior information, and assuming that the portfolio's systematic risk has remained constant, one expects the Portfolio Change Measure of a zero-cost portfolio to have a value tending towards zero. However if portfolio managers *are* informed, one would expect the Portfolio Change Measure to have a significantly positive outcome.

This results from the fact that the 'informed' manager correctly predicts which shares will perform well in the subsequent quarter, and buys relatively more of these assets, while selling those assets that he believes are going to perform less well. A positive change in weighting multiplied with a positive return will give one a positive covariance; likewise, a negative change in weighting, when multiplied by a negative return, will give one a net *positive* outcome, and of course, a positive (negative) return multiplied by a negative (positive) return will yield a *negative* outcome. When summed, the more accurately a manager is able to predict the performance of the individual assets within the portfolio, the larger will be his quarterly covariance, as well as his Portfolio Change Measure. Should the manager incorrectly predict the performance of an asset, he will end up having a *negative* covariance for that particular asset, and this in turn will lower the manager's summed quarterly covariance.

4.3: Table of South African Data Analysed

Quarterly covariances[93] were calculated for the majority of unit trust funds in South Africa, from their date of inception[94] through to December 1992. The table overleaf contains a detailed list of the unit trust funds that were analysed[95].

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[93] One-quarter lags were calculated for all the unit trust funds listed in Table 4.1; however, the four-quarter lags were only calculated for funds that had been in existence for a minimum of twenty-five quarters. This resulted in the four-quarter lags being calculated for nine of the listed unit trust funds.
[94] The author, where possible, has calculated the quarterly covariances for the funds under investigation; however, in some cases (particularly the funds started pre 1970) it was not possible to collect all the relevant data from the fund's inception. In these cases the author's calculations start from the earliest possible date from when information was available. In some cases, only a handful of the very early reports were obtained, with many periods of data missing. Again, in cases like these the author only started the calculations from the period when all the information was available. The funds for which the calculations do not begin at their date of inception are clearly marked in Table 4.1.
[95] "The JSE Handbook", *Johannesburg Stock Exchange*, (Johannesburg: Flesch Financial Publications, August , 1993), pp. 263-270.

TABLE 4.1			
LIST OF SOUTH AFRICAN UNIT TRUST FUNDS ANALYSED			
FUND NAME	**DATE FORMED**	**STARTING DATE OF DATA**	**NUMBER OF QUARTERS**
Sage Fund	June 1965	June 1970	90
Sanlam Index Fund	October 1965	September 1980	49
Sanlam Industrial Fund	August 1966	September 1980	49
Old Mutual Investors Fund	October 1966	September 1985	29
UAL Unit Trust	April 1967	June 1987	22
Sanlamtrust	May 1967	September 1980	49
Sanlam Mining Fund	March 1969	September 1980	49
Sanlam Dividend Fund	August 1969	September 1980	49
Guardbank Growth Fund	January 1970	June 1987	22

FUND NAME	DATE FORMED	STARTING DATE OF DATA	NUMBER OF QUARTERS
Standard Bank Mutual Fund	May 1973	March 1985	31
UAL Mining Fund	October 1969	June 1987	22
Standard Bank Gold Fund	October 1982	March 1985	32
Guardbank Resources Fund	April 1987	September 1987	21
Metboard Mutual Fund	November 1987	March 1991	7
Syfrets Growth Fund	April 1987	September 1987	21
Old Mutual Mining Fund	July 1987	December 1987	20
UAL Selected Opportunities	July 1987	December 1987	20
Sage Resources Fund	August 1987	June 1989	14
Momentum Fund	November 1987	March 1988	18
NBS Hallmark	August 1988	December 1988	16

FUND NAME	DATE FORMED	STARTING DATE OF DATA	NUMBER OF QUARTERS
Norwich Unit Trust	August 1988	December 1988	16
Southern Life Equities Fund	October 1988	March 1989	15
Southern Life Mining Fund	October 1988	March 1989	15
Old Mutual Gold	February 1990	June 1990	10
Commercial Union Growth Fund	March 1990	September 1990	9
Old Mutual Industrial Fund	May 1990	September 1990	9
IGI Unit Trust	June 1990	September 1990	9
BOE Growth Fund	June 1990	December 1990	8
Fedgrowth	February 1991	June 1991	6
Syfrets Trustee	October 1991	March 1992	3
Metropolitan Life	October 1991	March 1992	3
Old Mutual Top Companies	November 1991	March 1992	3

CHAPTER FIVE

Presentation and Discussion of Results obtained from Data

5.1: Introduction

This chapter sets out the results of the research, along with the statistical tests performed. Only summary data is given in this chapter, while more detailed data is available in the appendix.

5.2: Results obtained from 1-quarter lagged data

The layout of results obtained can be broken down into four main categories. The basic results of the Portfolio Change Measure (PCM), along with other relevant statistics, such as the range of the data and it's standard deviations are presented. Secondly, a number of t-statistic tests were calculated on this data, to determine whether there was any significant performance amongst unit trust fund managers. The relevant information and results are shown.

Thirdly, rank correlation tests were performed to determine whether there is persistence in performance amongst unit trust fund managers. In other words, this determines whether a unit trust fund manager can consistently achieve significant levels of excess return for the fund under his control, from one time period to the next.

Finally, a number of regressions were performed on the Johannesburg Stock Exchange All Share Index and each funds respective PCM's, to determine whether the market and the fund's PCM's moved in conjunction, and thus whether fund managers were able to 'predict' the market.

5.2.1: The Portfolio Change Measure

Table 5.1 gives the results obtained from the research.

TABLE 5.1 PERFORMANCE CHANGE MEASURE South African Unit Trusts, 1970 -1992				
FUND	**MEAN (PCM)[a]**	**STANDARD DEVIATION[b]**	**RANGE - low[c]**	**RANGE - high[d]**
Board of Executors	0.459	0.894	-0.615	2.926
Commercial Fund	-0.164	1.045	-2.156	1.063
Fedgrowth Fund	0.285	0.466	-0.271	1.013
Guardbank Growth Fund	-0.023	0.699	-1.646	1.059
Guardbank Resources	0.203	1.714	-3.267	4.421
IGI Unit Trust Fund	-0.300	0.692	-1.462	0.550
Metfund	-0.134	1.603	-3.475	1.764
Metropolitan Fund	0.544	1.544	-0.427	2.304
Momentum Life	0.087	1.864	-3.905	3.635

FUND	MEAN (PCM)[a]	STANDARD DEVIATION[b]	RANGE - low[c]	RANGE - high[d]
NBS Hallmark Fund	0.684	1.666	-1.888	4.708
Norwich Fund	0.002	1.141	-2.206	2.244
Old Mutual Gold Fund	-0.538	0.746	-1.361	0.092
Old Mutual Industrial Fund	0.183	1.436	-2.649	2.811
Old Mutual Investors Fund	0.040	1.129	-2.700	3.807
Old Mutual Mining Fund	-0.261	0.866	-2.655	1.314
Old Mutual Top Fund	-0.538	0.746	-1.361	0.092
Sage Fund	0.066	0.823	-3.058	2.929
Sage Resources	0.292	0.906	-1.071	2.349
Sanlam Dividend Fund	0.389	1.596	-3.850	4.604
Sanlam Index Fund	-0.119	0.902	-2.200	2.907
Sanlam Industrial Fund	-0.038	1.201	-1.907	4.210
Sanlam Mining Fund	-0.006	1.458	-3.966	4.131
Sanlam Trust Fund	-0.026	1.175	-3.213	1.937
Southern Equity Fund	-0.086	0.939	-2.387	1.046
Southern Mining Fund	-0.423	1.163	-3.327	1.159
Standard Gold Fund	0.452	1.626	-3.031	4.333
Standard Mutual Fund	0.082	1.405	-2.508	4.980
Syfrets Growth Fund	-0.115	1.040	-2.639	1.822
Syfrets Trustee Fund	-0.265	0.340	-0.649	0.000

FUND	MEAN (PCM)[a]	STANDARD DEVIATION[b]	RANGE - low[c]	RANGE - high[d]
UAL Mining Fund	-0.605	1.152	-2.889	1.439
UAL Selected Fund	0.140	1.237	-2.475	2.059
UAL Trust Fund	-0.301	1.181	-3.509	1.577
ARITHMETIC MEANS	0.005	1.148		

a *The mean Portfolio Change Measure for each particular fund. Further details of each fund may be found in Appendix B at the end of this thesis.*

b *The standard deviation of each funds Portfolio Change measure over the period the fund was studied. Further details may be found in Appendix B at the end of this thesis.*

c *The lowest Portfolio Change Measure achieved over the relevant period by that particular fund.*

d *The highest Portfolio Change Measure achieved over the relevant period by that particular fund.*

A total of 800 quarterly reports were analysed resulting in a total of 736 PCM results being achieved[96]. This gives one an average amount of 23 PCM's, equivalent to a 5 year and 9 month period for each unit trust fund under investigation.

The average Portfolio Change Measure (PCM) across all funds was 0.005[97], with a relatively high standard deviation of 1.148. The average PCM did not vary over an extremely large range, with the lowest PCM being -0.605 and the highest being 0.684. Of a total of 32 funds under investigation, 15 had a positive average PCM with the remaining 17 having a negative PCM. The above results clearly show that unit trust funds in South Africa do not exhibit any sign of 'significantly' superior performance over and above the returns that could have been obtained by an 'uninformed' manager or investor.

[96] As the Grinblatt and Titman Portfolio Change Measure (PCM) requires one to make use of three consecutive quarterly reports for each PCM calculation, one does not have all the relevant data for the first and last quarters of each fund under consideration. Thirty two funds were under investigation, resulting in the inability to calculate sixty four PCM's. It is for this reason that the author ended up with 736 final PCM from an original 800 quarterly reports.

[97] This is a similar result to that which Grinblatt and Titman achieved in their investigation of 155 American mutual funds. They calculated an overall Portfolio Change Measure (PCM) of 0.37 for the funds using one quarter lags. This is in contrast to their results using four quarter lags which resulted in an overall statistically significant PCM of 2.04.

This is depicted in an average PCM of 0.005 which shows that when one considers all unit trust funds within South Africa, their respective portfolio managers have only managed to gain an additional 5/1000 (five-thousandths) of a percent additional return per quarter over and above that which an 'uninformed' manager would have achieved.

Further, while an adjustment for transactions costs[98] has not been included, our findings suggest that when such an adjustment is made, investors in unit trust funds on average, would receive negative excess returns. The transaction costs one could adjust for are many. The main transaction costs would be those incurred in the buying and selling of shares which involve brokerage fees every time a buy or selling order is instituted. There is also the additional cost to the unit trust fund investor of the management company's administration fee. The amount of the fee can vary from one company to the next, but on average is 1.5% of the market value of the fund. This fee is usually deducted quarterly. Over and above these costs, the unit trust fund management company has to pay the salaries of the portfolio manager and all his/her assistants, as well as any performance bonuses that may have been decided upon.

The author also argues that the results of the research have shown that huge bonuses paid on the basis of total performance of the fund are not necessarily the correct incentive, as even an 'uninformed' manager can achieve good positive results on a rising market. Rather, these bonuses should be paid according to a significant level of additional return that managers achieve over and above that of what an 'uninformed' manager could achieve. Stated differently, they should only be compensated for the amount of *'value' they have added* to the fund through their respective portfolio manipulations or configurations.

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[98] This result is similar to the conclusions drawn by Grinblatt and Titman in their investigation into the United States of America mutual fund industry.

It is also of note that although the average PCM was a positive 0.005, just over half of the funds averaged a net *negative* PCM. The average PCM for the seventeen negative funds was -0.232 compared to an average PCM of 0.260 for the fifteen positive funds. Again this supports our proposition that portfolio managers are *unable* to consistently predict positive movements in the market to a significant degree, and a substantial number of managers actually 'lose' the unit trust fund a significant amount of return every quarter due to incorrect predictions on market movements.

5.2.3: The T-test :- A test to find significant levels of performance.

Two t-tests were performed to measure whether any degree of significant performance existed. The first test compares the funds to the market in general, with the second test determining whether any one fund significantly outperforms any of its competitors. The above two tests can be expressed as follows:

T- test 1:

1) Null hypothesis: Ho: $\mu = 0$ *(i.e.: on average the portfolio manager was not able to add any value to the portfolio's return)*

2) Alternative hypothesis: Ha: $\mu > 0$ *(i.e.: on average a significant positive value was added to the portfolio's return)*

T- test 2:

1) Null hypothesis: Ho: $\mu = 0.005$ *(i.e.: on average the value added to the portfolio's returns is the same as the average added across all funds by managers)*

2) Alternative hypothesis: Ha: $\mu > 0.005$ *(i.e.: on average the value added to the portfolio's return exceeds the value added across all other funds by managers)*

The results of these tests are set out in Table 5.2.

TABLE 5.2			
T - STATISTIC OF MEAN OF FUND AGAINST: a) Mean of the market; b) Mean of all funds under investigation. (5% significance level)			
	1	**2**	**3**
	t - STATISTIC[a] (a)	**t -STATISTIC[b] (b)**	**Critical t - values[c] (from tables)**
Board of Executors	1.452	1.436	1.895
Commercial Fund	-0.470	-0.485	1.860
Fedgrowth Fund	1.498	1.471	2.015
Guardbank Growth Fund	-0.161	-0.196	1.721
Guardbank Resources	0.542	0.529	1.725
IGI Unit Trust Fund	-1.300	-1.322	1.860
Metfund	-0.221	-0.229	1.943
Metropolitan Fund	0.585	0.579	2.920
Momentum Life	0.198	0.186	1.740
NBS Hallmark Fund	1.642	1.630	1.753
Norwich Fund	0.007	-0.010	1.753
Old Mutual Gold Fund	-0.877	-0.891	1.833
Old Mutual Industrial Fund	0.382	0.371	1.860

	t - STATISTIC[a] (a)	t -STATISTIC[b] (b)	Critical t - values[c] (from tables)
Old Mutual Investors Fund	0.190	0.166	1.701
Old Mutual Mining Fund	-1.358	-1.383	1.729
Old Mutual Top Fund	-1.249	-1.260	2.920
Sage Fund	0.760	0.703	1.662
Sage Resources	1.205	1.185	1.771
Sanlam Dividend Fund	1.706	1.684	1.677
Sanlam Index Fund	-0.923	-0.962	1.677
Sanlam Industrial Fund	-0.221	-0.250	1.677
Sanlam Mining Fund	-0.028	-0.052	1.677
Sanlamtrust Fund	-0.154	-0.184	1.677
Southern Equity Fund	-0.354	-0.375	1.761
Southern Mining Fund	-1.408	-1.425	1.761
Standard Gold Fund	1.572	1.555	1.696
Standard Mutual Fund	0.324	0.305	1.697
Syfrets Growth Fund	-0.506	-0.528	1.725

	t - STATISTIC[a] (a)	t -STATISTIC[b] (b)	Critical t - values[c] (from tables)
Syfrets Trustee Fund	-1.349	-1.375	2.920
UAL Mining Fund	-2.463	-2.483	1.721
UAL Selected Fund	0.506	0.488	1.729
UAL Trust Fund	-1.195	-1.215	1.721

a *T-statistic measuring whether any significant value was added to the total return of the fund by the fund manager. The mean of the market used was $\mu = 0$: fund managers add no value.*

b *T-statistic measuring whether the value added to the portfolio's return is the same as the average added across all funds. The mean for all funds used in the calculation was $\mu = 0.005$: being the mean as calculated in Table 1.*

c *The critical t-statistic as found in any standard tables for a 5% significance level. By comparing these values to those in columns 1 and 2, one can measure whether any significant performance occurred.*

The general formula for the t-statistic[99] used can be written as follows:

$$t = (\bar{X}-\mu)/(s/\sqrt{n})$$

where: X = sample mean

μ = population mean

s = sample standard deviation

n = number of data points

[99] We make use of the t-statistic due to the fact that we are only using a sample of data and not an entire 'population'. A standard Z-score which could be used to measure any significant performance among the various unit trust funds can only be used when the population variance or standard deviation is known. As the author is only using a sample of data, and the fact that some unit trust funds have fewer than twenty data points, the t-statistic must be used. The t-statistic is used when 'δ', the true population standard deviation is replaced by 's', an *estimated* standard deviation, with 's' itself being a random variable varying from sample to sample. The size of the sample influences the accuracy of our estimates. The larger the sample the closer the estimate is to its true value. The t-distribution against which the t-statistic is measured takes into account the size of the sample from which 's' is calculated. The t-test is a one-tailed test as opposed to the Z-test which can be either a one or two-tailed test. Being a one tailed test, should the t-statistic fall within the t-distribution, this shows no significant performance, whereas should it fall outside the t-distribution, one can reject the null hypothesis and accept abnormal performance.

The hypothesis that was tested with the first t-statistic in Table 5.2 was whether any portfolio fund managers were able to achieve any significant excess return over and above that which would have been achieved with a buy-and-hold strategy. Our null hypothesis is therefore that managers *cannot* outperform the market and that they do *not* have 'hot hands'. It is a one sided t-test[100] as we are only testing to see whether they can positively outperform a portfolio managed using a buy and hold strategy. If managers are 'informed' and as a result have 'hot hands', we would expect their average PCM for their particular portfolio to be significantly different from zero. We take zero to be the population mean as our null hypothesis is that unit trust fund managers *cannot* outperform a fund that is managed with a buy and hold strategy.

Should the particular fund's t-statistic fall outside the relevant t-distribution range[101], we would reject the null hypothesis and conclude that managers *do* possess 'hot hands' and that they can consistently outperform a portfolio managed on a buy and hold strategy in terms of a significant level of excess return.

The results show that out of a total of thirty two funds, only one was significant at the 95% confidence level. Sanlam Dividend Fund achieved a t-statistic of 1.706, which falls outside the t-distribution amount of 1.677. This leaves one with a marginally significant positive performance result of 0.029. As a result we would reject the null hypothesis and accept that the Sanlam Dividend Fund manager *is* able to gain the fund a significantly positive return and in turn may have 'hot hands'.

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[100] Since we have hypothesized that managers are 'uninformed', we wish to determine whether the Performance Change Measure is significantly greater than zero.

[101] The t-distribution figure is arrived at by looking at the relevant number of data points used in calculating the relevant t-statistic. The number of data points will vary from fund to fund as the number of quarters analysed for each fund varied considerably. To find the relevant benchmark t-distribution from any standard t-distribution table, one makes use of degrees of freedom. The degrees of freedom used is equivalent to the number of data points analysed *less* one. The degrees of freedom rule states 'for each parameter we estimate prior to estimating another parameter we lose one degree of freedom'. This is cited from Les Underhill, *Introstat*, (Cape Town: Juta & Co., 1987), p. 265.

There were only two other funds, namely NBS Hallmark and Standard Bank Gold Fund, which came close to having a t-statistic inside the rejection region. They were an average of -0.116 inside of their critical t-values. All of the remaining 29 funds fell well inside of their respective t-distributions, resulting in the null hypothesis holding, and the author concludes that these managers do *not* posses any degree of 'hot hands'.

A second t-test was used to test whether any fund was able to significantly outperform any other fund. Our null hypothesis was thus that no unit trust fund manager is able to outperform any other unit trust fund manager. The only difference between this calculated t-statistic and the first is that instead of having a population mean of 0, we use a population mean of 0.005, which is the mean PCM achieved by all the funds under consideration. The results can be seen in column 2 of Table 5.2.

Again, the Sanlam Dividend Fund was the only fund to have a t-statistic greater than it's respective critical t-value. We thus reject the null hypothesis and accept that Sanlam Dividend Fund performed significantly better than any of its competing funds. All other funds were well within their particular t-distribution ranges resulting in one accepting the null hypothesis that no funds can outperform their competitors. Again this suggests that fund managers generally have 'neutral hands' and are unable to positively predict share movements on a regular consistent basis, or the tests have too low a power to show any significant performance[102].

[102] Affleck-Graves, Bradfield, "An Examination of the Power of Univariate Tests of the CAPM: A Simulation Approach," Journal of Economics and Business, (Vol.45, Num.1, Feb. 1993), pp. 17-34.

5.2.4: The Persistence of 'Neutral Hands'.

In order to determine whether there is any consistency in the performance of the various unit trust fund managers, a number of rank correlation tests were undertaken. The funds were ranked for two time periods. Firstly a ten quarter period from June 1990 through September 1992, and secondly a twenty quarter period from December 1987 through September 1992[103]. The results can be seen in Table 5.3 on the following page.

[103] Only funds that were in existence for at least twenty and ten quarters respectively were included in the rank correlation test. It is for this reason that only 16 funds were included in the twenty quarter test and 23 funds in the ten quarter test. There were thus 9 funds in total that had only 9 or fewer PCM observations.

TABLE 5.3

RANK CORRELATION OF FUNDS OVER TWO FIVE QUARTER PERIODS

(30/6/90 - 30/6/91) and (30/9/91 - 30/9/92)

	MEAN - period 1[a]	RANKING[b]	MEAN - period 2[c]	RANKING[d]
Sanlam Dividend Fund	0.682	1	0.249	11
Sanlam Industrial Fund	0.642	2	0.121	13
Sanlam Mining Fund	0.506	3	0.405	8
NBS Hallmark	0.458	4	0.496	7
Standard Bank Gold Fund	0.264	5	2.362	1
Sage Fund	0.195	6	-0.028	19
Old Mutual Investors Fund	0.152	7	0.008	17
UAL Trust Fund	0.066	8	0.32	9
Sanlam Trust Fund	0.056	9	0.525	4
Southern Life Equity Fund	0.037	10	-0.372	22
UAL Selected Fund	0.034	11	0.899	2
Norwich	0.012	12	-0.001	18
Standard Bank Mutual Fund	0.007	13	-0.714	23
Sage Resources	-0.027	14	0.021	18

	MEAN period 1[a]	RANKING[b]	MEAN period 2[c]	RANKING[d]
Guardbank Growth Fund	-0.098	15	0.037	14
Sanlam Index Fund	-0.099	16	0.237	12
Syfrets Growth Fund	-0.107	17	0.500	6
Old Mutual Gold Fund	-0.408	18	-0.221	21
Guardbank Resources	-0.433	19	0.752	3
Old Mutual Mining Fund	-0.594	20	-0.166	20
Momentum Life	-0.896	21	0.519	5
Southern Life Mining Fund	-1.185	22	0.016	16
UAL Mining Fund	-1.309	23	0.289	10
RANK CORRELATION COEFFICIENT: 0.107				

a The mean PCM for each particular fund covering the period 30/6/90 through 30/6/91.
b The ranked position of each fund's mean PCM, ranked from highest to lowest.
c The mean PCM for each particular fund covering the period 30/9/91 through 30/9/92.
d The ranked position of each fund's mean PCM, ranked from highest to lowest.

The results shown in the above table cover the time period from June 1990 through September 1992. To perform a rank correlation test, one must split the data into *two distinct time* periods, and test to see whether there was any persistence in performance from the first time period through to the second.

The data was therefore broken up into two distinct five quarter periods, with the second period following on directly from the first. Each fund's average PCM is calculated for both of the two time periods and then ranked according to performance, with a higher average PCM being ranked above PCM's with lower values. From each fund's respective *change* in ranking from one time period to the next, one is able to calculate the rank correlation[104]. The rank correlation calculated for the two five quarter periods is a low 0.107. This shows a very low degree of persistence, with the correlation coefficient well inside the significant level of 0.413[105], indicating that managers cannot consistently achieve superior market performance.

TABLE 5.4				
RANK CORRELATION OF FUNDS OVER TWO TEN QUARTER PERIODS (31/12/87 - 31/3/90) and (30/6/90 - 30/9/92)				
	MEAN - period 1[a]	**RANKING**[b]	**MEAN - period 2**[c]	**RANKING**[d]
Sanlam Dividend Fund	0.680	1	0.465	3
Guardbank Resources Fund	0.458	2	0.159	9
Sanlam Mining Fund	0.152	3	0.455	4
Sanlamtrust	0.099	4	0.29	6
Guardbank Growth	0.049	5	-0.031	13
Standard Bank Gold Fund	-0.012	6	1.313	1

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[104] To calculate the rank correlation, one first subtracts the funds ranking from the first time period from its ranking in the second time period. This is then squared so as to get rid of any negative numbers. This process is then repeated for all funds under consideration, and the 'squared changes in ranking' are summed together to get a total. To calculate the rank correlation to see whether there is any 'persistence in performance' the following formula is used: 1 - [(s x 6)/((n(n^2-1))] where s = the sum of the squares and n = the number of funds under consideration. The closer the rank correlation is to 1, the greater the degree of persistence in performance. This formula was taken from Les Underhill, *Introstat*, (Cape Town: Juta & Co., 1985), pp. 264-268.

[105] The significant values of the rank correlation coefficients are for a two-sided 5% significance level test. When obtaining the significant values, one uses a figure of 'sample size - 2' to calculate the relevant degrees of freedom. The table used is found in Les Underhill, *Introstat*, (Cape Town: Juta & Co., 1985), p. 428.

	MEAN period 1[a]	RANKING[b]	MEAN period 2[c]	RANKING[d]
Old Mutual Investors Fund	-0.024	7	0.080	11
Old Mutual Mining Fund	-0.147	8	-0.380	15
Sage Fund	-0.159	9	0.084	10
UAL Selected Fund	-0.186	10	0.466	2
Standard Bank Mutual Fund	-0.386	11	-0.354	14
Syfrets Growth Fund	-0.453	12	0.197	7
Sanlam Industrial Fund	-0.462	13	0.382	5
Sanlam Index Fund	-0.545	14	0.069	12
UAL Trust Fund	-0.576	15	0.193	8
UAL Mining	-0.741	16	-0.510	16
RANK CORRELATION COEFFICIENT: 0.371				

a *The mean PCM for each particular fund covering the period 31/12/87 through 31/3/90.*
b *The ranked position of each fund's mean PCM, ranked from highest to lowest.*
c *The mean PCM for each particular fund covering the period 30/6/90 through 30/9/92.*
d *The ranked position of each fund's mean PCM, ranked from highest to lowest.*

For the next rank correlation test the time periods were extended to two ten quarter periods. The author suspected that if one increased the time period, one might expect persistence in performance to strengthen since fund managers would have a longer period of time over which to achieve superior performance. This seemed to be the case as a correlation of 0.371 was achieved. Although this is more than three times that of the five quarter periods, it is still a very low result well inside the significant level of 0.4973, indicating a very small, if any[106], degree of persistence.

[106] For one to conclude that there is any level of persistence in performance one would expect to achieve a rank correlation outcome of at least 0.4973 i.e.: forty-nine percent of the time funds are able to achieve in the second time period similar results to what they achieved in the first time period.

The author also investigated whether the funds showed any persistence in performance when they were ranked according to investment objective[107]. By investment objective one means whether they are specialist funds, aggressive funds or the more common general equity funds, which carry a balanced spread of equities. Again the correlation was performed for two five quarter, and then ten quarter time periods. The results are shown in Table 5.5 and Table 5.6 respectively.

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[107] The funds were grouped according to groupings devised by the University of Pretoria's Professor Hugo Lambrechts. It is set out in Hugo Lambrechts, "Unit Trusts Survey," *Annual Survey*, (no. 5, 1992), pp. 20-24.

TABLE 5.5				
RANK CORRELATION OF FUNDS OVER TWO FIVE QUARTER PERIODS - GROUPED ACCORDING TO INVESTMENT OBJECTIVE CATEGORIES (30/6/90 - 30/6/91) and (30/9/91 - 30/9/92)				
	MEAN - period 1[a]	**RANKING**[b]	**MEAN - period 2**[c]	**RANKING**[d]
GENERAL EQUITY FUNDS				
Sanlam Dividend Fund	0.682	1	0.249	6
NBS Hallmark	0.458	2	0.496	4
Sage Fund	0.195	3	-0.028	11
Old Mutual Investors Fund	0.152	4	0.008	9
UAL Trust Fund	0.066	5	0.320	5
Sanlam Trust Fund	0.056	6	0.525	1
Southern Life Equity Fund	0.037	7	-0.372	12
Norwich	0.012	8	-0.001	10
Standard Bank Mutual Fund	0.007	9	-0.714	13
Guardbank Growth Fund	-0.098	10	0.037	8
Sanlam Index Fund	-0.099	11	0.237	7
Syfrets Growth Fund	-0.107	12	0.500	3
Momentum Life	-0.896	13	0.519	2
AVERAGE	0.035		0.136	
RANK CORRELATION COEFFICIENT: -0.126				

	MEAN - period 1[a]	RANKING[b]	MEAN - period 2[c]	RANKING[d]
MINING AND RESOURCES FUND				
Sanlam Mining Fund	0.506	1	0.405	2
Sage Resources	-0.027	2	0.021	4
Guardbank Resources	-0.433	3	0.752	1
Old Mutual Mining Fund	-0.594	4	-0.166	6
Southern Life Mining Fund	-1.185	5	0.016	5
UAL Mining Fund	-1.309	6	0.289	3
AVERAGE	-0.507		0.219	
RANK CORRELATION COEFFICIENT: 0.371				
REMAINING FUNDS				
Sanlam Industrial Fund	0.642	1	0.121	3
Standard Bank Gold Fund	0.264	2	2.362	1
UAL Selected Fund	0.034	3	0.899	2
Old Mutual Gold Fund	-0.408	4	-0.221	4
AVERAGE	0.133		0.790	
RANK CORRELATION COEFFICIENT: 0.400				

a The mean PCM for each particular fund covering the period 30/6/90 through 30/6/91.
b The ranked position of each fund's mean PCM, ranked from highest to lowest.
c The mean PCM for each particular fund covering the period 30/9/91 through 30/9/92.
d The ranked position of each fund's mean PCM, ranked from highest to lowest.

There was absolutely no persistence shown in performance among the general equity funds; the results in fact show a *negative* rank correlation of -0.126 (significant value of 0.5529). Again, this indicates that managers are unable to outperform the market consistently, as managers who perform well in one time period are unable to sustain this superior performance through to the second time period. Higher but by no means significant performance results were found for the mining and resources fund (0.371 against a significant value of 0.811) and the 'remaining funds' (0.400 against a significant value of 0.950).

TABLE 5.6				
RANK CORRELATION OF FUNDS OVER TWO TEN QUARTER PERIODS - RANKED ACCORDING TO INVESTMENT OBJECTIVE CATEGORIES (31/12/87 - 31/3/90) and (30/6/90 - 30/9/92)				
	MEAN - period 1[a]	**RANKING[b]**	**MEAN - period 2[c]**	**RANKING[d]**
GENERAL EQUITY FUNDS				
Sanlam Dividend Fund	0.680	1	0.465	1
Sanlamtrust	0.099	2	0.290	2
Guardbank Growth	0.049	3	-0.031	8
Old Mutual Investors Fund	-0.024	4	0.080	6
Sage Fund	-0.159	5	0.084	5
Standard Bank Mutual Fund	-0.386	6	-0.354	9
Syfrets Growth Fund	-0.453	7	0.197	3
Sanlam Index Fund	-0.545	8	0.069	7
UAL Trust Fund	-0.576	9	0.193	4
AVERAGE	-0.146		0.110	
RANK CORRELATION COEFFICIENT: 0.333				

	MEAN - period 1[a]	RANKING[b]	MEAN - period 2[c]	RANKING[d]
MINING AND RESOURCES FUNDS				
Guardbank Resources Fund	0.458	1	0.159	2
Sanlam Mining	0.152	2	0.455	1
Old Mutual Mining Fund	-0.147	3	-0.38	3
UAL Mining	-0.741	4	-0.51	4
AVERAGE	-0.069		-0.069	
RANK CORRELATION COEFFICIENT: 0.800				
REMAINING FUNDS				
Standard Bank Gold Fund	-0.012	1	1.313	1
UAL Selected Fund	-0.186	2	0.466	2
Sanlam Industrial Fund	-0.462	3	0.382	3
AVERAGE	-0.22		0.720	
RANK CORRELATION COEFFICIENT: 1.000				

a *The mean PCM for each particular fund covering the period 31/12/87 through 31/3/90.*
b *The ranked position of each fund's mean PCM, ranked from highest to lowest.*
c *The mean PCM for each particular fund covering the period 30/6/90 through 30/9/92.*
d *The ranked position of each fund's mean PCM, ranked from highest to lowest.*

In line with other results, when the time period was extended to two ten quarter periods, the rank correlations increased considerably. A rank correlation among the general equity funds of 0.333 (against a significant value of 0.666) was obtained, again showing no significant amount of persistence. Amongst the more specialist funds however, a larger correlation coefficient was found. Rank correlations of 0.800 (against a significant value of 0.950) and 1.000 (against a significant value of 0.996) were obtained for the 'Mining and Resources funds', and the 'Remaining funds' respectively. Thus there seems to be a certain amount of persistence in performance amongst these funds, but due to there being only a statistically very *small* number of funds (four in the former and three in the latter) included in the test, no accurate conclusions should be drawn.

5.3: Results obtained from 4-quarter lagged data

As with the 1-quarter lags, a number of statistical tests were carried out for 4-quarter lags

5.3.1: The Portfolio Change Measure using a 4-quarter lag

Table 5.7 overleaf sets out results obtained from the research.

TABLE 5.7

PERFORMANCE CHANGE MEASURE
(4-quarter lags)

South African Unit Trust Funds, 1970-1992

Fund	Mean (PCM)[a]	Standard Deviation[b]	Range - low[c]	Range - high[d]	Number of quarters[e]
Old Mutual Investors	0.302	2.582	-3.728	8.266	26
Sagefund	0.097	1.915	-6.025	5.595	86
Sanlamtrust	-0.621	2.153	-9.832	4.213	47
Sanlam Index Fund	-0.152	1.409	-4.220	2.559	47
Sanlam Mining Fund	0.019	2.155	-5.275	5.137	47
Sanlam Dividend Fund	1.593	3.043	-6.164	7.292	47
Sanlam Industrial Fund	0.874	1.905	-2.916	6.443	47
Standard Gold Fund	0.124	1.551	-2.737	3.317	26
Standard Mutual Fund	0.445	2.492	-4.795	5.406	26
Arithmetic Means	0.298	2.134			

a *The mean Portfolio Change Measure for each particular fund. Further details of each fund may be found in Appendix B at the end of this thesis.*
b *The standard deviation of each funds Portfolio Change measure over the period the fund was studied. Further details may be found in Appendix B at the end of this thesis.*
c *The lowest Portfolio Change Measure achieved over the relevant period by that particular fund.*
d *The highest Portfolio Change Measure achieved over the relevant period by that particular fund.*
e *The number of quarters included in the given statistics*

A total of nine unit trust funds were used for this analysis; thus the research included 399 quarterly reports deriving a resultant 363 PCM's[108]. The average PCM across the nine funds was 0.298[109] with a high standard deviation of 2.134. The average PCM varied over quite a large range with the highest observed value being 8.266 and the lowest -9.832. Of the nine funds evaluated, 7 had a positive average PCM with only 2 being in negative figures.

Although the average PCM for the 4-quarter lags of 0.298 is higher than the 0,005 achieved for the 1-quarter lags, it is still not a particularly high figure. It is in contrast to the statistically significant average PCM of 2.04[110] calculated by Grinblatt and Titman for the 155 American mutual funds they investigated. This indicates that while managers may nonetheless have a more 'long term' view in mind when altering portfolios, they are *still unable* to achieve any significant level of additional returns to the portfolio. *'Value-added'* to the portfolio by management is minimal.

5.3.2: The t-test: A test to find significant levels of performance

The same two t-tests were performed on the relevant 4-quarter data as was done on the 1-quarter data to determine whether any significant levels of performance existed between both the funds and the market, as well as between the funds themselves. All the tests were performed at the 5% significance level with the results set out in Table 5.8 below.

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108 Similar to the 1-quarter lag calculations, the Grinblatt and Titman PCM requires one to cover a five quarter period when calculating the 4-quarter PCM. One thus loses two PCM's at the beginning and end of the time periods, resulting in 363 PCM's being achieved from 399 quarterly reports.

109 This is in contrast to Grinblatt and Titman's four quarter lag result, which was a statistically significant 2.04.

110 Mark Grinblatt and Sheridan Titman,"Performance Measurement without Benchmarks: An Examination of Mutual Fund Returns,"*Journal of Business*, (vol. 66, no. 1, 1993), pp. 47-68.

TABLE 5.8 T-STATISTIC OF MEAN OF FUND AGAINST: a) Mean of the market; b) Mean of all funds under investigation. (5% significance level - 4-quarter lags)			
	1	2	3
	t-statistic[a] (a)	t-statistic[b] (b)	Critical t-values[c] (from tables)
Old Mutual Investors	0.596	0.007	1.708
Sagefund	0.469	-0.973	1.663
Sanlamtrust	-1.977	-2.926	1.678
Sanlam Index Fund	-0.739	-2.189	1.678
Sanlam Industrial Fund	3.145	2.072	1.678
Sanlam Mining Fund	0.060	-0.887	1.678
Sanlam Dividend Fund	3.588	2.917	1.678
Standard Gold Fund	0.407	-0.572	1.708
Standard Mutual Fund	0.910	0.300	1.708

a T-statistic measuring whether any significant value was added to the total return of the fund by the fund manager. The mean of the market used was $\mu = 0$: fund managers add no value.

b T-statistic measuring whether the value added to the portfolio's return is the same as the average added across all funds. The mean for all funds used in the calculation was $\mu = 0.005$: being the mean as calculated in Table 1.

c The critical t-statistic as found in any standard tables for a 5% significance level. By comparing these values to those in columns 1 and 2, one can measure whether any significant performance occurred.

The first t-test tests the null hypothesis that portfolio managers *cannot outperform* the market due to having 'hot hands'. The results show that out of a total of nine funds, only two show any signs of significant performance. Sanlam Dividend Fund (which was the *only* significant performer when using 1-quarter lags) coupled with the Sanlam Industrial Fund were the only two significant performers, both being well outside the critical level of 1.678. One thus rejects the null hypothesis and accepts that these two funds *are* able to achieve a significant amount of 'value-added'.

A similar result was achieved when testing whether any one portfolio manager can outperform another on a regular basis (the second t-test) in Table 5.8. Again, it was the same two fund managers who showed significant levels of performance when compared to their competitors. It is interesting to note that no other managers came close to being significant performers, with the nearest manager being a full 1.407 within his relevant critical t-value.

5.3.3: The Persistence of 'Neutral Hands'.

Two rank correlation tests were performed to determine if there was any consistency achieved in the performance of the nine funds under consideration. The first correlation covered the ten quarter period from March 1990 through June 1992. The second period covered was that for a twenty quarter period from September 1987 through June 1992. The results are shown in Table 5.9.

TABLE 5.9				
RANK CORRELATION OF FUNDS OVER TWO FIVE QUARTER PERIODS (4-quarter lags) (30/3/90 - 30/3/91) and (30/6/91 - and 30/6/92)				
	MEAN - period 1[a]	**RANKING**[b]	**MEAN - period 2**[c]	**RANKING**[d]
Sanlam Dividend Fund	5.71	1	4.053	1
Old Mutual Investors	0.301	2	0.730	3
Sanlam Mining Fund	0.176	3	-0.690	9
Sanlamtrust	-0.325	4	0.383	7
Standard Mutual Fund	-0.437	5	1.545	2
Sagefund	-0.598	6	0.690	6
Sanlam Industrial Fund	-0.895	7	1.416	3
Sanlam Index Fund	-1.024	8	0.838	4
Standard Gold Fund	-1.093	9	-0.592	8
RANK CORRELATION COEFFICIENT: 0.200				

a *The mean PCM for each particular fund covering the period 30/3/90 through 30/3/91.*
b *The ranked position of each fund's mean PCM, ranked from highest to lowest.*
c *The mean PCM for each particular fund covering the period 30/6/91 through 30/6/92.*
d *The ranked position of each fund's mean PCM, ranked from highest to lowest.*

TABLE 5.9 (contd.)

RANK CORRELATION OF FUNDS OVER TWO TEN QUARTER PERIODS

(4-quarter lags)

(30/9/87 - 31/12/89) and (31/3/90 - 30/6/92)

	MEAN - period 1[a]	RANKING[b]	MEAN - period 2[c]	RANKING[d]
Sanlam Dividend Fund	2.036	1	4.881	1
Standard Gold Fund	0.880	2	-0.843	9
Sanlam Mining Fund	0.212	3	-0.257	8
Sanlam Industrial Fund	-0.154	4	0.261	4
Sanlam Index Fund	-0.797	5	-0.093	7
Standard Mutual Fund	-1.170	6	0.554	2
Old Mutual Investors	-1.290	7	0.515	3
Sagefund	-1.426	8	0.046	5
Sanlamtrust	-1.560	9	0.029	6
RANK CORRELATION COEFFICIENT: -0.067				

a The mean PCM for each particular fund covering the period 30/9/87 through 31/12/89.
b The ranked position of each fund's mean PCM, ranked from highest to lowest.
c The mean PCM for each particular fund covering the period 31/3/90 through 30/6/92.
d The ranked position of each fund's mean PCM, ranked from highest to lowest.

As with the 1-quarter lagged data, there was a very low degree of consistency in performance shown amongst the funds. The correlation coefficient for the two five-quarter periods was a low 0.200 (against a significant level of 0.666) showing no consistency whatsoever. In contrast to the 1-quarter lagged data whose correlation coefficient increased for the two ten-quarter periods to 0.371 from 0.107, the 4-quarter lagged coefficient dropped dramatically to an extremely low -0.067 (against a significant level of 0.666). This shows negative correlation, implying absolutely *no* persistence in performance for the nine funds over that particular twenty quarter period.

5.3.4: Relationship between PCM and J.S.E. Index

The final analyses performed were a number of regressions of each unit trust funds PCM's against the Johannesburg Stock Exchange (J.S.E.) All Share Index[111] over time. The J.S.E. All Share Index data consisted of the level of the J.S.E. Index on the last day of each month, covering the period January 1980 through December 1992. The All Share Index was used as the author was of the opinion that this index would best represent movements in the general marketplace. Further research could perhaps regress the more specialist unit trust funds against their respective indices i.e.: mining unit trust funds against the mining index and industrial funds against the industrial index.

The author wanted to test whether there was any relationship between movements over a three month period in the J.S.E. Index and the particular fund's PCM for the relevant quarter. One would expect that if the market is generally rising, resulting in upward pressure on the J.S.E. Index, the portfolio manager, if 'informed', would make a fairly large amount of 'positive' manipulations to the portfolio. This would cause a net positive

[111] The data for the J.S.E. Index was obtained by using ECOCATS, Standard Bank of South Africa's computer information system.

PCM value. The regression thus tests to see whether a rising market *does* necessarily imply a *high* PCM value, or whether, in fact, even in a rising market, the portfolio manager is not able to consistently add value to the funds return through manipulating the composition of the portfolio.

The J.S.E. data was then transformed to make it compatible with the relevant PCM data. This was done by summing the relevant three months of the J.S.E. Index data, and then dividing it by three to get an *average* level of the index over that particular three month time period. These average data points were then adjusted by a base year index so as to convert the data into *percentage change* data. In other words each data points tells one by what percentage the J.S.E. Index either increased or decreased over a three month time period. After these adjustments one ends up with four relevant J.S.E. Index percentage change data points for each year, with each data point corresponding to a particular PCM.

Each fund's PCM's was first plotted against the J.S.E. Index percentage change data points over the relevant time period. The graphs can be seen overleaf:-

Figure 1: UAL Selected Fund and JSE Index (% change)

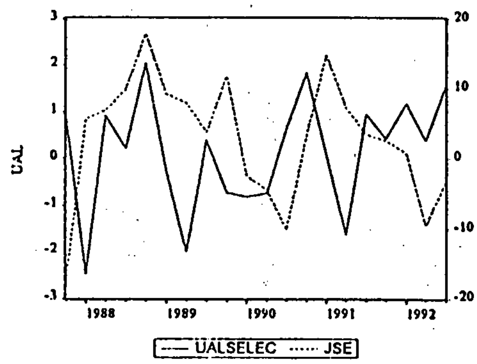


Figure 2: UAL Trust Fund and JSE Index (% change)

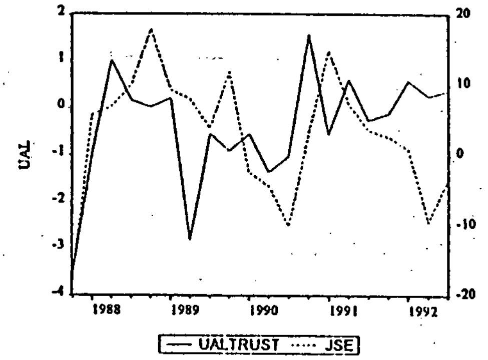


Figure 3: UAL Mining Fund and JSE Index (% change)

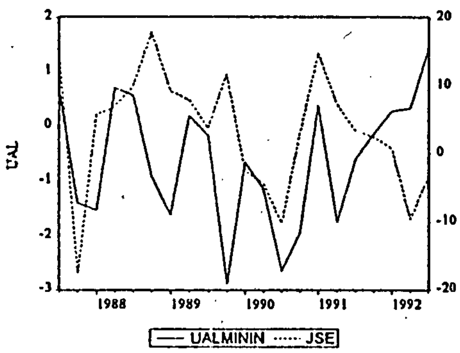


Figure 4: Southern Life Equity Fund and JSE Index (% change)

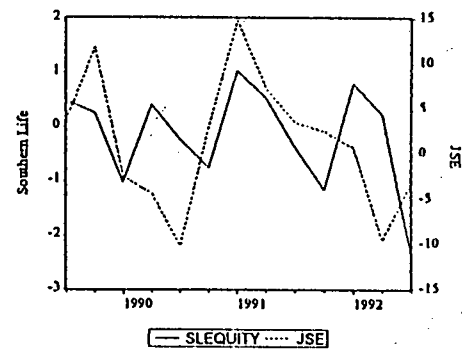


Figure 5: Southern Life Mining Fund and JSE Index (% change)

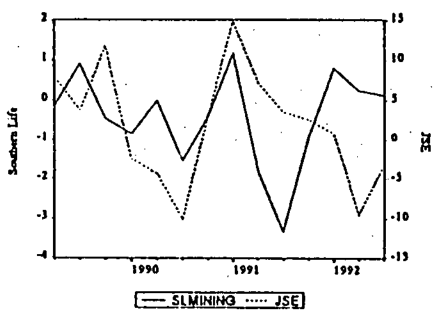


Figure 6: Old Mutual Investors Fund and JSE Index (% change)

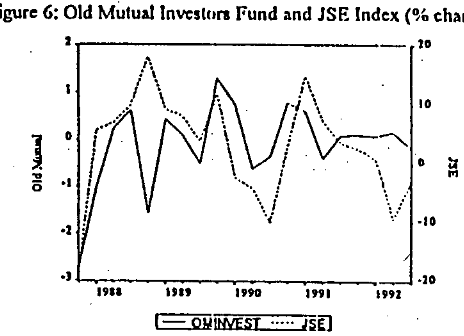


Figure 7: Old Mutual Mining Fund and JSE Index (% change)

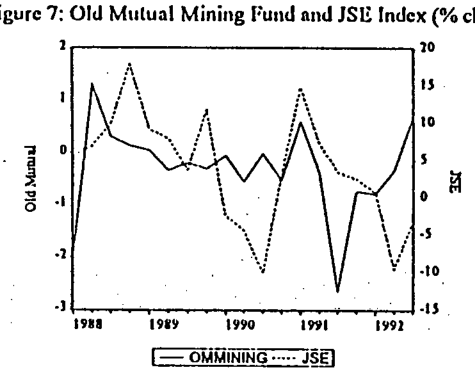


Figure 8: Old Mutual Gold Fund and JSE Index (% change)

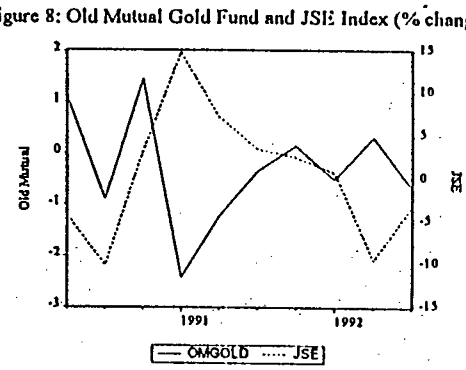


Figure 9: Norwich Fund and JSE Index (% change)

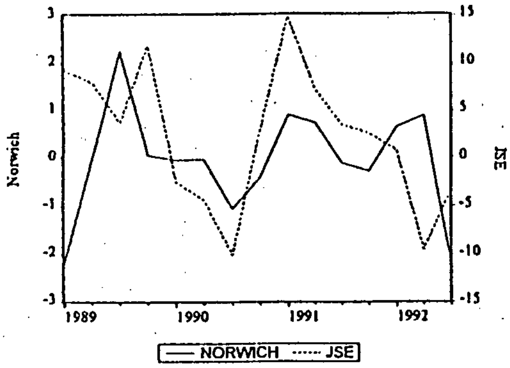


Figure 9: NBS Hallmark fund and JSE Index (% change)

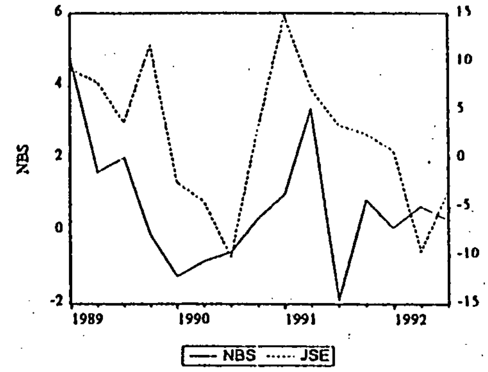


Figure 11: Momentum Life Fund and JSE Index (% change)

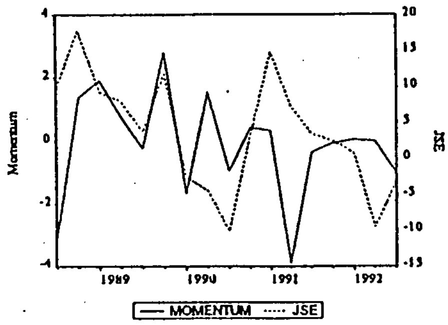


Figure 12: Guardbank Growth Fund and JSE Index (% change)

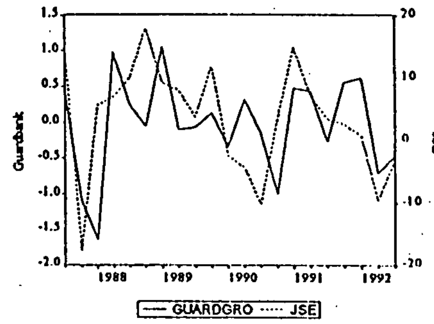


Figure 13: Guardbank Resources Fund and JSE Index (% change)

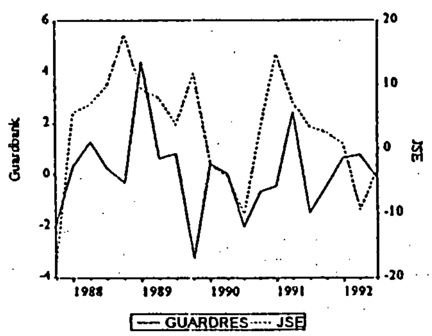


Figure 14: Syfrets Growth Fund and JSE Index (% change)

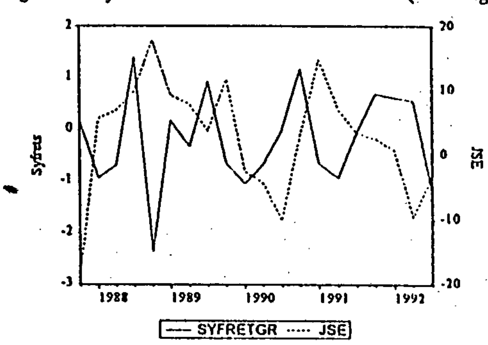


Figure 15: Standard Bank Gold Fund and JSE Index (% change)

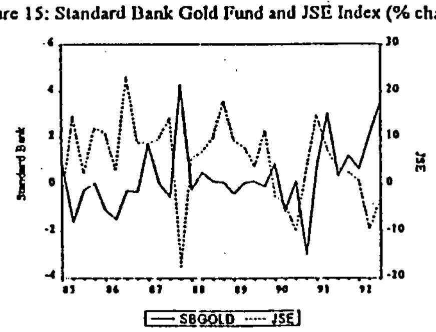


Figure 16: Standard Bank Mutual Fund and JSE Index (% change)

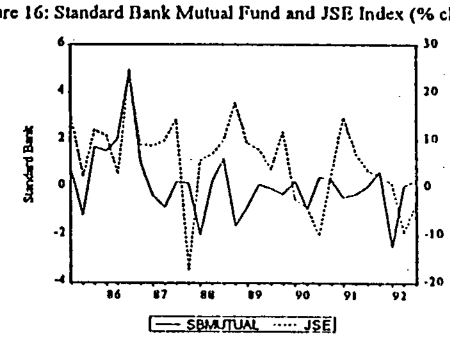


Figure 17: Sanlam Index Growth Fund and JSE Index (% change)

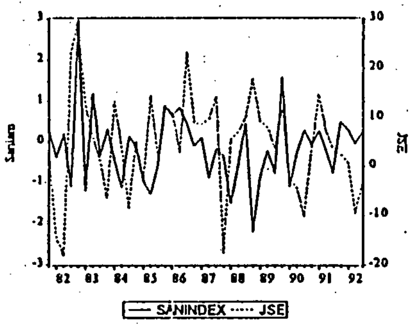


Figure 18: Sanlam Industrial Fund and JSE Index (% change)

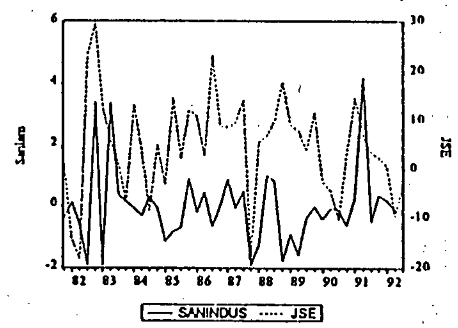


Figure 19: Sanlam Trust Fund and JSE Index (% change)

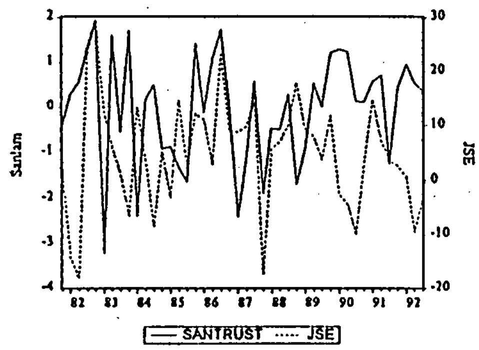


Figure 20: Sanlam Mining FUnd and JSE Index (% change)

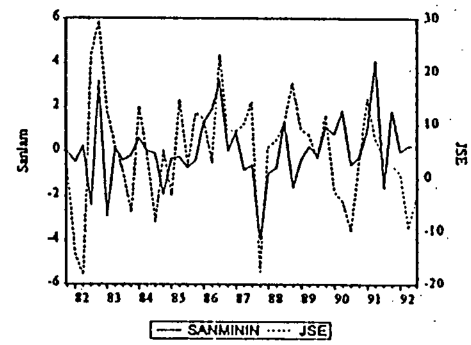


Figure 21: Sanlam Dividend Fund and JSE Index (% change)

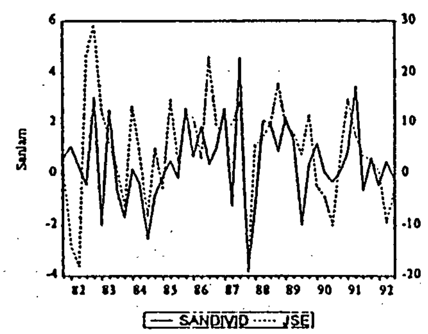


Figure 22: Sage Resources Fund and JSE Index (% change)

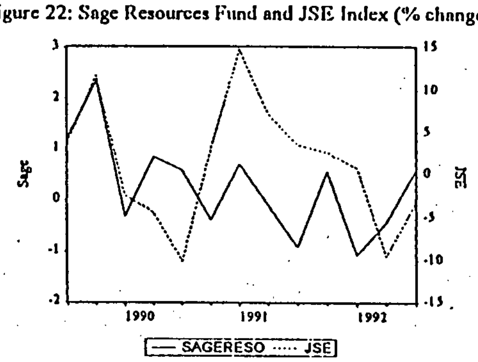
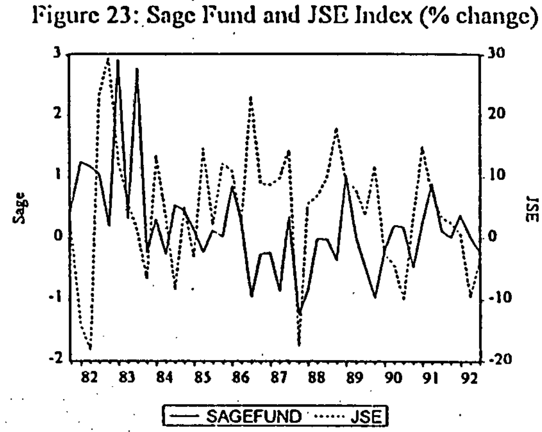


Figure 23: Sage Fund and JSE Index (% change)



The regressions were then calculated to see whether there was any relationship between movements over a three month period in the J.S.E. Index and the particular funds PCM for the relevant quarter. To calculate the regression we assumed the J.S.E. Index to be the independent variable and the quarterly PCM's to be the dependent variable. A second regression was also calculated using a three month lag for the J.S.E. index. The results are set out in Table 5.10 below:

TABLE 5.10 REGRESSION OF UNIT TRUST FUND'S QUARTERLY PCM'S AGAINST THE J.S.E. INDEX			
NAME OF FUND	**R-SQUARED**[a]	**R-SQUARED (3 month lag)**[b]	**CHANGE**[c]
Guardbank Growth Fund	0.27	0.19	-0.08
Guardbank Resources Fund	0.05	0.11	0.06
Momentum Life Fund	0.04	0.01	-0.03
NBS Hallmark Fund	0.20	0.26	0.06
Norwich Fund	0.02	0.03	0.01
Old Mutual Gold Fund	0.22	0.19	-0.03
Old Mutual Investors Fund	0.10	0.01	-0.09

NAME OF FUND	R-SQUARED[a]	R-SQUARED (3 month lag)[b]	CHANGE[c]
Old Mutual Mining Fund	0.01	0.04	0.03
Sage Fund	0.00	0.02	0.02
Sage Resources Fund	0.10	0.00	-0.10
Sanlam Dividend Fund	0.17	0.04	-0.13
Sanlam Index Fund	0.00	0.01	0.01
Sanlam Industrial Fund	0.02	0.05	0.03
Sanlam Mining Fund	0.05	0.01	-0.4
Sanlamtrust Fund	0.00	0.03	0.03
Southern Life Equity Fund	0.12	0.16	-0.04
Southern Life Mining Fund	0.00	0.07	0.07
Standard Gold Fund	0.19	0.02	-0.17
Standard Bank Mutual Fund	0.07	0.00	-0.07

NAME OF FUND	R-SQUARED[a]	R-SQUARED (3 month lag)[b]	CHANGE[c]
Syfrets Growth Fund	0.07	0.00	-0.07
UAL Mining Fund	0.01	0.00	-0.01
UAL Selected Fund	0.01	0.00	-0.01
UAL Trust Fund	0.14	0.02	-0.12

a The result achieved when regressing the fund's PCM against the J.S.E. All Share Index.The result shows to what extent movements in the fund's PCM is related to movements in the All Share Index.

b The result achieved when regressing the fund's PCM against the J.S.E. All Share Index lagged by a three month period. The result shows to what extent movements in the fund's PCM are related to movements in the All Share Index that occurred three months hence.

c This result is calculated by subtracting the original regression result from the lagged regression result.

It can be seen from Table 5.10 that the highest fit achieved was 0.27 by the Guardbank Growth Fund, implying that 27% of the changes in the Guardbank fund's PCM can be explained by movements of the J.S.E. Index. The average R-squared over all twenty three funds was a low 0.08. This clearly shows that there is very little relationship between movements of the J.S.E. Index and movements of a portfolio managers PCM's over the same period of time.

It was for this reason that the author decided to perform a similar regression making use of the fund's relevant PCM's and the J.S.E. Index. However, this time the index was lagged by a quarter, such that for example the J.S.E. Index December data point was regressed against the March PCM of the relevant unit trust fund. The reasoning behind the lag was that if the market was generally rising, this would be exhibited in a rising J.S.E. Index. However, for those managers who took advantage of this rising market, this might only be reflected in their PCM in the *following quarter*.

This regression resulted in a high of 0.26 achieved by the NBS Hallmark Fund and an average over all funds of 0.05. Again, this shows very little is explained by movements in the index, implying that a rising market does not necessarily imply that portfolio managers will achieve a high PCM in the following time period. These results again emphasize that managers have great difficulty predicting movements in the market on a *consistent* basis, and that even when the market is generally rising, it does not necessarily mean that fund managers are able to 'gain' the portfolio a large *additional* return over and above the return that would have been achieved had they adopted a buy and hold investment strategy.

CHAPTER SIX

Conclusions and Future Research

6.1: Summary of Conclusions

With the large level of investor interest in the South African unit trust fund industry, there is a very real need for the measurement of fund performance. To date, most research involving unit trust fund performance measurement has involved the use of Betas and a benchmark 'market portfolio' against which performance is compared. However, by using the benchmark-free methodology developed by Grinblatt and Titman, one is able to avoid many of the fundamental flaws encountered in earlier research, in particular those of Beta stability and stationarity, as well as the problems noted by Roll associated with the use of 'benchmark' portfolios.

By using the Portfolio Change Measure which automatically impounds a measure for risk, the author found that there was no predominant evidence suggesting unit trust funds in South Africa exhibit decided levels of superior performance. Using 1-quarter lagged data, it was found that out of a total of 32 funds, only 1 was able to consistently achieve superior levels of performance. Using 4-quarter lagged data, 2 funds out of the 9 that were analysed achieved significant performance levels. One could thus conclude that the performance obtained by portfolio managers is not inconsistent with that which could be obtained by an 'uninformed' manager and/or investor. While the author has not included an adjustment for transaction costs, the findings suggest that if such an adjustment were made, investors on average would receive negative returns. These findings are not unlike those obtained by Grinblatt and Titman for United States of America mutual funds when using 1-quarter lagged data. However, in contrast to our results for South Africa, Grinblatt and Titman did find a greater degree of significant performance by United States of America mutual funds when using the 4-quarter lagged data. The author's results lend further support to the argument that the South African equities market is, in fact, an efficient one.

It should be noted that although fund managers were *not* able to consistently outperform the market, neither did any managers consistently perform *worse* than that of the market. Fund managers have therefore played a major role in 'safeguarding' investors investments by making sure that a return at least roughly equivalent to that of the market is achieved.

In addition, while we have observed that South African unit trust fund managers have 'cold hands', the author also tested to determine whether fund managers who exhibited the 'best' performance in earlier periods did so consistently through time. A number of rank correlation tests were calculated, with the results conclusively showing that there is very little 'persistence' in performance amongst fund managers. In other words, if a fund manager performed well in one period it does not imply that he will perform well in the subsequent period.

6.2: Current Trends

Yet another important reason why the measurement of fund management performance will be of growing importance is that, as the industry becomes more and more competitive in its attempt to secure a share of investors' funds, the greater the need by both potential investors and fund management to know more about how well the particular funds are being managed. Investors will want to know which funds give them maximum returns, while directors of fund management companies will want to know which of their managers and analysts have better performance records, thereby allowing management to increase the size of the funds under their control. At the same time, this will constrict the size of funds supervised by 'poor performing' managers and analysts. The Portfolio Change Measure can be used as an excellent management tool to assess the performance of the various fund managers and analysts.

It is widely reported that in the United States of America, the $2-trillion mutual fund industry is fighting the 'big squeeze'[110]. Low interest rates in America in the early Nineties meant that investors were induced to switch cash holdings in the bank into the riskier bond and equity mutual fund industry which was offering superior returns. However, currently with falling financial markets and worldwide upward pressure on interest rates, the flood of money into the mutual fund industry is slowing down dramatically[111].

Increased competition amongst funds is leading to larger amounts of derivatives being used by mutual funds to increase their respective returns[112]. Sometimes these investments pay off handsomely, but almost as often they lead to large losses, thereby causing sharp drops in the value of the unit trust. Investors' concerns over the use of derivatives is already putting pressure on regulators to enact legislation making it obligatory for funds to be more open about their riskiness and what potential future risks the fund managers might be permitted to take. Again, this brings us back to the *raison d'être* or importance of measuring fund management performance. For the safekeeping of investors' money it is essential that the bigger the risks portfolio managers may be entitled to take, the *more* carefully they need to be monitored and subsequently their performance analysed.

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[110] "Running out of Steam," *The Economist*, (Dec. 24, 1994), pp. 103-104.
[111] American analysts predict only a 10-12% growth rate in mutual fund assets for the coming few years, as compared to 20% and more in the early nineties. Mutual funds are relying on much of this growth coming from 'baby-boomers' investing inherited wealth, as well as by increasing amounts of people investing their retirement money in mutual funds.
[112] "Running out of Steam," *The Economist*, (Dec. 24, 1994), p. 103.

6.3: Suggestions for Future Research

Possible future research that can be undertaken is the re-calculation of the size of the Portfolio Change Measure net of expenses and transaction costs. Further research should explicitly test whether the possibility exists that those unit trust fund managers which exhibit better performance do so by incurring higher levels of risk.

Many avenues of possible research will also open up with the increasing use of derivatives by portfolio managers. The measurement of the net 'gains or losses' to the total return of the fund by the additional use of derivatives could be undertaken, and how well the results correspond to the additional levels of risk that are incurred.

Unit trust funds in South Africa have become a permanent, and useful, part of the financial environment, and with competition growing amongst the various funds, pressure on fund managers to get an 'additional' amount of return is ever increasing. As long as this pressure for increased levels of performance exists, there is will be a very real need to both evaluate and measure fund management performance.

Detailed Statistics
of
Data

Basic statistics for Standard Deviations
17:59:54 11-14-1994

Number of data points	=	32
Number of valid points	=	32
Lowest value	=	0.340
Highest value	=	1.864
Range	=	1.524
Mean	=	1.148
Standard deviation	=	0.373
Coefficient of variation	=	0.324
Skewness	=	-0.101
Kurtosis	=	-1.973
Median	=	1.141

Basic statistics for Means
18:03:11 11-14-1994

Number of data points	=	32
Number of valid points	=	32
Lowest value	=	-0.605
Highest value	=	0.684
Range	=	1.289
Mean	=	0.005
Standard deviation	=	0.307
Coefficient of variation	=	59.185
Skewness	=	-0.174
Kurtosis	=	-1.328
Median	=	-0.023

Basic statistics for Standard Deviations (Y on Y)
10:18:26 12-27-1994

Number of data points	=	9
Number of valid points	=	9
Lowest value	=	1.409
Highest value	=	3.043
Range	=	1.634
Mean	=	2.134
Standard deviation	=	0.515
Coefficient of variation	=	0.241
Skewness	=	0.717
Kurtosis	=	-1.692
Median	=	2.153

Basic statistics for Means of Funds (Y on Y)
10:20:12 12-27-1994

Number of data points	=	9
Number of valid points	=	9
Lowest value	=	-0.621
Highest value	=	1.593
Range	=	2.214
Mean	=	0.298
Standard deviation	=	0.635
Coefficient of variation	=	2.132
Skewness	=	1.118
Kurtosis	=	-0.133
Median	=	0.124

Basic statistics for Board of Executors
12:39:15 11-13-1994

Number of data points	=	8
Number of valid points	=	8
Lowest value	=	-0.615
Highest value	=	2.311
Range	=	2.926
Mean	=	0.459
Standard deviation	=	0.894
Coefficient of variation	=	1.949
Skewness	=	-0.489
Kurtosis	=	-1.766
Median	=	0.353

Basic statistics for IGI
12:40:27 11-13-1994

Number of data points	=	9
Number of valid points	=	9
Lowest value	=	-1.462
Highest value	=	0.550
Range	=	2.012
Mean	=	-0.300
Standard deviation	=	0.692
Coefficient of variation	=	-2.303
Skewness	=	-0.750
Kurtosis	=	-1.374
Median	=	-0.377

Basic statistics for Metropolitan Life
12:34:52 11-13-1994

Number of data points	=	3
Number of valid points	=	3
Lowest value	=	-0.427
Highest value	=	2.304
Range	=	2.731
Mean	=	0.522
Standard deviation	=	1.544
Coefficient of variation	=	2.956
Skewness	=	0.230
Kurtosis	=	-2.155
Median	=	-0.310

Basic statistics for Commercial Union
12:36:40 11-13-1994

Number of data points	=	9
Number of valid points	=	9
Lowest value	=	-2.516
Highest value	=	1.063
Range	=	3.579
Mean	=	-0.164
Standard deviation	=	1.045
Coefficient of variation	=	-6.362
Skewness	=	-0.417
Kurtosis	=	-1.323
Median	=	0.108

Basic statistics for Fedgrowth
12:31:41 11-13-1994

Number of data points	=	6
Number of valid points	=	6
Lowest value	=	-0.271
Highest value	=	1.013
Range	=	1.284
Mean	=	0.285
Standard deviation	=	0.466
Coefficient of variation	=	1.635
Skewness	=	0.249
Kurtosis	=	-1.947
Median	=	0.137

Basic statistics for NBS Hallmark
12:33:40 11-13-1994

Number of data points	=	16
Number of valid points	=	16
Lowest value	=	-1.888
Highest value	=	4.708
Range	=	6.596
Mean	=	0.684
Standard deviation	=	1.666
Coefficient of variation	=	2.436
Skewness	=	-0.309
Kurtosis	=	-2.050
Median	=	0.364

Basic statistics for Guardbank Growth Fund
12:48:39 11-13-1994

Number of data points	=	22
Number of valid points	=	22
Lowest value	=	-1.646
Highest value	=	1.059
Range	=	2.705
Mean	=	-0.023
Standard deviation	=	0.669
Coefficient of variation	=	-28.975
Skewness	=	0.072
Kurtosis	=	-2.299
Median	=	-0.056

Basic statistics for Guardbank Resources Fund
12:51:16 11-13-1994

Number of data points	=	21
Number of valid points	=	21
Lowest value	=	-3.267
Highest value	=	4.421
Range	=	7.688
Mean	=	0.203
Standard deviation	=	1.714
Coefficient of variation	=	8.426
Skewness	=	0.203
Kurtosis	=	-1.451
Median	=	0.236

Basic statistics for Old Mutual Gold Fund
12:42:06 11-13-1994

Number of data points	=	10
Number of valid points	=	10
Lowest value	=	-2.436
Highest value	=	1.445
Range	=	3.881
Mean	=	-0.314
Standard deviation	=	1.132
Coefficient of variation	=	-3.603
Skewness	=	-0.473
Kurtosis	=	-1.674
Median	=	-0.512

Basic statistics for Old Mutual Top Companies
12:43:02 11-13-1994

Number of data points	=	3
Number of valid points	=	3
Lowest value	=	-1.361
Highest value	=	0.092
Range	=	1.453
Mean	=	-0.538
Standard deviation	=	0.746
Coefficient of variation	=	-1.387
Skewness	=	-0.604
Kurtosis	=	-1.793
Median	=	-0.344

Basic statistics for Metfund
17:51:02 11-14-1994

Number of data points	=	7
Number of valid points	=	7
Lowest value	=	-3.475
Highest value	=	1.764
Range	=	5.238
Mean	=	-0.134
Standard deviation	=	1.603
Coefficient of variation	=	-11.964
Skewness	=	0.466
Kurtosis	=	-2.016
Median	=	0.124

Basic statistics for Old Mutual Investors Fund
17:55:30 11-14-1994

Number of data points	=	29
Number of valid points	=	29
Lowest value	=	-2.700
Highest value	=	3.807
Range	=	6.507
Mean	=	0.040
Standard deviation	=	1.129
Coefficient of variation	=	28.051
Skewness	=	-0.315
Kurtosis	=	-2.025
Median	=	0.098

Basic statistics for Old Mutual Mining Fund
12:27:23 11-13-1994

Number of data points	=	20
Number of valid points	=	20
Lowest value	=	-2.655
Highest value	=	1.314
Range	=	3.969
Mean	=	-0.263
Standard deviation	=	0.866
Coefficient of variation	=	-3.291
Skewness	=	-0.689
Kurtosis	=	-0.129
Median	=	-0.307

Basic statistics for Norwich
12:30:33 11-13-1994

Number of data points	=	16
Number of valid points	=	16
Lowest value	=	-2.206
Highest value	=	2.244
Range	=	4.450
Mean	=	0.002
Standard deviation	=	1.141
Coefficient of variation	=	567.078
Skewness	=	-0.193
Kurtosis	=	-1.575
Median	=	-0.035

Basic statistics for Sage Resources Fund
16:17:13 11-14-1994

Number of data points	=	14
Number of valid points	=	14
Lowest value	=	-1.071
Highest value	=	2.349
Range	=	3.419
Mean	=	0.292
Standard deviation	=	0.906
Coefficient of variation	=	3.099
Skewness	=	-0.639
Kurtosis	=	-1.908
Median	=	0.470

Basic statistics for Sage Fund
16:27:39 11-14-1994

Number of data points	=	90
Number of valid points	=	90
Lowest value	=	-3.058
Highest value	=	2.929
Range	=	5.988
Mean	=	0.066
Standard deviation	=	0.823
Coefficient of variation	=	12.459
Skewness	=	0.367
Kurtosis	=	-0.517
Median	=	0.022

Basic statistics for Sanlam Index Fund (National Growth Fund)
15:28:40 11-14-1994

Number of data points	=	49
Number of valid points	=	49
Lowest value	=	-2.200
Highest value	=	2.907
Range	=	5.107
Mean	=	-0.119
Standard deviation	=	0.902
Coefficient of variation	=	-7.578
Skewness	=	-0.061
Kurtosis	=	-1.698
Median	=	-0.142

Basic statistics for Sanlam Industrial Fund (Trust Selections)
15:32:48 11-14-1994

Number of data points	=	49
Number of valid points	=	49
Lowest value	=	-1.907
Highest value	=	4.210
Range	=	6.117
Mean	=	-0.038
Standard deviation	=	1.201
Coefficient of variation	=	-31.733
Skewness	=	0.892
Kurtosis	=	0.900
Median	=	-0.091

Basic statistics for Sanlamtrust Fund
15:37:37 11-14-1994

Number of data points	=	49
Number of valid points	=	49
Lowest value	=	-3.213
Highest value	=	1.937
Range	=	5.150
Mean	=	-0.026
Standard deviation	=	1.175
Coefficient of variation	=	-44.737
Skewness	=	-0.122
Kurtosis	=	-1.998
Median	=	0.168

Basic statistics for Sanlam Mining Fund (Trust Bank)
15:42:34 11-14-1994

Number of data points	=	49
Number of valid points	=	49
Lowest value	=	-3.966
Highest value	=	4.131
Range	=	8.097
Mean	=	-0.006
Standard deviation	=	1.458
Coefficient of variation	=	-255.934
Skewness	=	0.464
Kurtosis	=	-0.437
Median	=	-0.226

Basic statistics for Sanlam Dividend Fund
12:16:09 01-13-1995

Number of data points	=	49
Number of valid points	=	49
Lowest value	=	-3.850
Highest value	=	4.604
Range	=	8.454
Mean	=	0.389
Standard deviation	=	1.596
Coefficient of variation	=	4.101
Skewness	=	0.178
Kurtosis	=	-1.123
Median	=	0.380

Basic statistics for Momentum Life
12:16:24 01-13-1995

Number of data points	=	18
Number of valid points	=	18
Lowest value	=	-3.905
Highest value	=	3.635
Range	=	7.540
Mean	=	0.087
Standard deviation	=	1.864
Coefficient of variation	=	21.326
Skewness	=	0.086
Kurtosis	=	-1.106
Median	=	-0.003

Basic statistics for Southern Life Equity Fund
12:22:48 11-13-1994

Number of data points	=	15
Number of valid points	=	15
Lowest value	=	-2.387
Highest value	=	1.046
Range	=	3.433
Mean	=	-0.086
Standard deviation	=	0.939
Coefficient of variation	=	-10.959
Skewness	=	-1.006
Kurtosis	=	-0.138
Median	=	0.224

Basic statistics for Southern Life Mining Fund
12:24:50 11-13-1994

Number of data points	=	15
Number of valid points	=	15
Lowest value	=	-3.327
Highest value	=	1.159
Range	=	4.486
Mean	=	-0.423
Standard deviation	=	1.163
Coefficient of variation	=	-2.748
Skewness	=	-0.609
Kurtosis	=	-0.914
Median	=	-0.195

Basic statistics for Standard Bank Gold Fund
17:47:03 11-14-1994

Number of data points	=	32
Number of valid points	=	32
Lowest value	=	-3.031
Highest value	=	4.333
Range	=	7.364
Mean	=	0.452
Standard deviation	=	1.626
Coefficient of variation	=	3.597
Skewness	=	0.999
Kurtosis	=	-0.057
Median	=	0.085

Basic statistics for Standard Bank Mutual Fund
17:50:00 11-14-1994

Number of data points	=	31
Number of valid points	=	31
Lowest value	=	-2.508
Highest value	=	4.980
Range	=	7.488
Mean	=	0.082
Standard deviation	=	1.405
Coefficient of variation	=	17.144
Skewness	=	-0.465
Kurtosis	=	-1.669
Median	=	0.128

Basic statistics for Syfrets Growth Fund
16:14:22 11-14-1994

Number of data points	=	21
Number of valid points	=	21
Lowest value	=	-2.639
Highest value	=	1.822
Range	=	4.461
Mean	=	-0.115
Standard deviation	=	1.040
Coefficient of variation	=	-9.060
Skewness	=	0.380
Kurtosis	=	-1.693
Median	=	-0.051

Basic statistics for Syfrets Trustee Fund
16:15:15 11-14-1994

Number of data points	=	3
Number of valid points	=	3
Lowest value	=	-0.649
Highest value	=	0.000
Range	=	0.649
Mean	=	-0.265
Standard deviation	=	0.340
Coefficient of variation	=	-1.283
Skewness	=	0.082
Kurtosis	=	-2.191
Median	=	-0.146

Basic statistics for UAL Selected Fund
12:06:15 11-13-1994

Number of data points	=	20
Number of valid points	=	20
Lowest value	=	-2.475
Highest value	=	2.059
Range	=	4.534
Mean	=	0.140
Standard deviation	=	1.237
Coefficient of variation	=	8.809
Skewness	=	0.152
Kurtosis	=	-2.215
Median	=	0.373

Basic statistics for UAL Trust Fund
12:08:35 11-13-1994

Number of data points	=	22
Number of valid points	=	22
Lowest value	=	-3.509
Highest value	=	1.577
Range	=	5.086
Mean	=	-0.301
Standard deviation	=	1.181
Coefficient of variation	=	-3.921
Skewness	=	0.148
Kurtosis	=	-2.026
Median	=	-0.124

Basic statistics for UAL Mining Fund
12:10:58 11-13-1994

Number of data points	=	22
Number of valid points	=	22
Lowest value	=	-2.889
Highest value	=	1.439
Range	=	4.328
Mean	=	-0.605
Standard deviation	=	1.152
Coefficient of variation	=	-1.905
Skewness	=	0.040
Kurtosis	=	-1.705
Median	=	-0.600

Basic statistics for Old Mutual Industrial Fund
12:12:43 11-13-1994

Number of data points	=	9
Number of valid points	=	9
Lowest value	=	-2.649
Highest value	=	2.811
Range	=	5.460
Mean	=	0.183
Standard deviation	=	1.436
Coefficient of variation	=	7.828
Skewness	=	0.301
Kurtosis	=	-0.425
Median	=	0.149

Basic statistics for Sanlam Index Fund (National Growth Fund)
23:13:31 12-26-1994

Number of data points	=	47
Number of valid points	=	47
Lowest value	=	-4.220
Highest value	=	2.559
Range	=	6.779
Mean	=	-0.152
Standard deviation	=	1.409
Coefficient of variation	=	-9.245
Skewness	=	-0.387
Kurtosis	=	-1.222
Median	=	-0.002

Basic statistics for Sanlam Mining Fund (Trust Bank)
23:17:37 12-26-1994

Number of data points	=	47
Number of valid points	=	47
Lowest value	=	-5.275
Highest value	=	5.137
Range	=	10.412
Mean	=	0.019
Standard deviation	=	2.155
Coefficient of variation	=	115.807
Skewness	=	0.216
Kurtosis	=	-1.400
Median	=	0.011

Basic statistics for Sanlam Dividend Fund
12:19:49 12-26-1994

Number of data points	=	47
Number of valid points	=	47
Lowest value	=	-6.164
Highest value	=	7.292
Range	=	13.456
Mean	=	1.593
Standard deviation	=	3.043
Coefficient of variation	=	1.911
Skewness	=	0.535
Kurtosis	=	-1.452
Median	=	1.876

Basic statistics for Sanlam Industrial Fund (Trust Selections)
12:29:21 12-26-1994

Number of data points	=	47
Number of valid points	=	47
Lowest value	=	-2.916
Highest value	=	6.443
Range	=	9.358
Mean	=	0.874
Standard deviation	=	1.905
Coefficient of variation	=	2.180
Skewness	=	0.178
Kurtosis	=	-0.899
Median	=	0.459

Basic statistics for Sanlamtrust Fund
12:36:27 12-26-1994

Number of data points	=	47
Number of valid points	=	47
Lowest value	=	-9.832
Highest value	=	4.213
Range	=	14.045
Mean	=	-0.621
Standard deviation	=	2.153
Coefficient of variation	=	-3.466
Skewness	=	-0.190
Kurtosis	=	-0.643
Median	=	-0.442

Basic statistics for Old Mutual Investors Club
21:58:41 12-26-1994

Number of data points	=	26
Number of valid points	=	26
Lowest value	=	-3.728
Highest value	=	8.266
Range	=	11.994
Mean	=	0.302
Standard deviation	=	2.582
Coefficient of variation	=	8.539
Skewness	=	-0.389
Kurtosis	=	-2.161
Median	=	0.436

Basic statistics for Standard Bank Gold Fund
22:08:24 12-26-1994

Number of data points	=	26
Number of valid points	=	26
Lowest value	=	-2.737
Highest value	=	3.317
Range	=	6.053
Mean	=	0.124
Standard deviation	=	1.551
Coefficient of variation	=	12.458
Skewness	=	-0.495
Kurtosis	=	-1.635
Median	=	0.079

Basic statistics for Standard Bank Mutual Fund
22:11:46 12-26-1994

Number of data points	=	26
Number of valid points	=	26
Lowest value	=	-4.795
Highest value	=	5.406
Range	=	10.201
Mean	=	0.445
Standard deviation	=	2.492
Coefficient of variation	=	5.601
Skewness	=	-0.431
Kurtosis	=	-1.498
Median	=	0.129

Basic statistics for Sagefund
10:13:55 12-27-1994

Number of data points	=	86
Number of valid points	=	86
Lowest value	=	-6.025
Highest value	=	5.595
Range	=	11.620
Mean	=	0.097
Standard deviation	=	1.915
Coefficient of variation	=	19.663
Skewness	=	-0.431
Kurtosis	=	-0.528
Median	=	0.113

T-STATISTIC OF MEAN AGAINST MARKET MEAN, i.e.0
(95% confidence level)

ME OF FUND:	Mean	Standard Deviation	Quarters	T-statistic		Net Result
mmercial Fund	-0.164	1.045	9	-0.47081	1.86	-2.33081
ard of Executors	0.459	0.894	8	1.452179	1.895	-0.44282
S Hallmark	0.684	1.666	16	1.642256	1.753	-0.11074
dgrowth	0.285	0.466	6	1.498078	2.015	-0.51692
I	-0.3	0.692	9	-1.30057	1.86	-3.16057
mentum	0.087	1.864	18	0.198020	1.74	-1.54197
Mining	-0.263	0.866	20	-1.35816	1.729	-3.08716
Industrial	0.183	1.436	9	0.382311	1.86	-1.47768
Gold	-0.314	1.132	10	-0.87716	1.833	-2.71016
Investors	0.04	1.129	29	0.190794	1.701	-1.51020
Top	-0.538	0.746	3	-1.24911	2.92	-4.16911
gefund	0.066	0.823	90	0.760790	1.662	-0.90120
ge Resources	0.292	0.906	14	1.205920	1.771	-0.56507
tfund	-0.134	1.603	7	-0.22116	1.943	-2.16416
frets Growth	-0.115	1.04	21	-0.50672	1.725	-2.23172
frets Trustee	-0.265	0.34	3	-1.34998	2.92	-4.26998
rwich	0.002	1.141	16	0.007011	1.753	-1.74598
uthern Mining	-0.423	1.163	15	-1.40866	1.761	-3.16966
uthern Equity	-0.086	0.939	15	-0.35471	1.761	-2.11571
L Trust	-0.301	1.181	22	-1.19544	1.721	-2.91644
L Selected	0.14	1.237	20	0.506143	1.729	-1.22285
L Mining	-0.605	1.152	22	-2.46328	1.721	-4.18428
andard Mutual	0.082	1.405	31	0.324951	1.697	-1.37204
andard Gold	0.452	1.626	32	1.572508	1.696	-0.12349
etropolitan	0.522	1.544	3	0.585576	2.92	-2.33442
nlamtrust	-0.026	1.175	49	-0.15489	1.677	-1.83189
nlam Mining	-0.006	1.458	49	-0.02880	1.677	-1.70580
nlam Index	-0.119	0.902	49	-0.92350	1.677	-2.60050
nlam Industrial	-0.038	1.201	49	-0.22148	1.677	-1.89848
nlam Dividend	0.389	1.596	49	1.706140	1.677	0.029140
ardbank Growth	-0.023	0.669	22	-0.16125	1.721	-1.88225
ardbank Resource	0.203	1.714	21	0.542743	1.725	-1.18225
eviations of fund	1.148	0.373				
eans of funds	0.005	0.307				

T-STATISTIC OF MEAN OF FUND AGAINST MEAN OF ALL FUNDS, i.e. 0.005
(95% confidence level)

ɪE OF FUND:	Number of Quarters	T-statistic	T-stat 95% c/i	Net Result
ımercial Fund	9	-0.48516	1.86	-2.34516
ırd of Executors	8	1.436360	1.895	-0.45863
ɜ Hallmark	16	1.630252	1.753	-0.12274
ɪgrowth	6	1.471796	2.015	-0.54320
I	9	-1.32225	1.86	-3.18225
ɪentum	18	0.186639	1.74	-1.55336
Mining	20	-1.38398	1.729	-3.11298
Industrial	9	0.371866	1.86	-1.48813
Gold	10	-0.89113	1.833	-2.72413
Investors	29	0.166944	1.701	-1.53405
Top	3	-1.26072	2.92	-4.18072
gefund	90	0.703155	1.662	-0.95884
ge Resources	14	1.185271	1.771	-0.58572
tfund	7	-0.22941	1.943	-2.17241
frets Growth	21	-0.52875	1.725	-2.25375
frets Trustee	3	-1.37545	2.92	-4.29545
rwich	16	-0.01051	1.753	-1.76351
uthern Mining	15	-1.42531	1.761	-3.18631
uthern Equity	15	-0.37533	1.761	-2.13633
L Trust	22	-1.21529	1.721	-2.93629
L Selected	20	0.488066	1.729	-1.24093
L Mining	22	-2.48364	1.721	-4.20464
andard Mutual	31	0.305137	1.697	-1.39186
andard Gold	32	1.555113	1.696	-0.14088
tropolitan	3	0.579967	2.92	-2.34003
nlamtrust	49	-0.18468	1.677	-1.86168
nlam Mining	49	-0.05281	1.677	-1.72981
nlam Index	49	-0.96230	1.677	-2.63930
nlam Industrial	49	-0.25062	1.677	-1.92762
nlam Dividend	49	1.684210	1.677	0.007210
ardbank Growth	22	-0.19631	1.721	-1.91731
ardbank Resource	21	0.529375	1.725	-1.19562

	Mean	Standard deviation
ɛviations of funds	1.148	0.373
ɛans of funds	0.005	0.307

T-STATISTIC OF MEAN OF FUND AGAINST MARKET MEAN,i.e.0
(95% confidence interval - Y on Y)

ME OF FUND:	MEAN	Standard Deviation	Quarters	T-Statistic		Net Result
nlam Dividend	1.593	3.043	47	3.588911	1.678	1.910911
nlam Industrial	0.874	1.905	47	3.145323	1.678	1.467323
nlam Index	-0.152	1.409	47	-0.73957	1.678	-2.41757
nlam Mining	0.019	2.155	47	0.060444	1.678	-1.61755
nlamtrust	-0.621	2.153	47	-1.97740	1.678	-3.65540
andard Bank Gold	0.124	1.551	26	0.407658	1.708	-1.30034
andard Bank Mutu	0.445	2.492	26	0.910539	1.708	-0.79746
d MUtual Investo	0.302	2.582	26	0.596399	1.708	-1.11160
gefund	0.097	1.915	86	0.469734	1.663	-1.19326
viations of fund	2.134	0.515				
ans of fund	0.298	0.635				

T-STATISTIC OF MEAN OF FUND AGAINST MEAN OF ALL FUNDS,i.e.0.29
(95% confidence interval - Y on Y)

ME OF FUND:	MEAN	Standard Deviation	Quarters	T-Statistic		Net Result
nlam Dividend	1.593	3.043	47	2.917539	1.678	1.239539
nlam Industrial	0.874	1.905	47	2.072890	1.678	0.394890
nlam Index	-0.152	1.409	47	-2.18952	1.678	-3.86752
nlam Mining	0.019	2.155	47	-0.88757	1.678	-2.56557
nlamtrust	-0.621	2.153	47	-2.92631	1.678	-4.60431
andard Bank Gold	0.124	1.551	26	-0.57203	1.708	-2.28003
andard Bank Mutu	0.445	2.492	26	0.300784	1.708	-1.40721
d MUtual Investo	0.302	2.582	26	0.007899	1.708	-1.70010
gefund	0.097	1.915	86	-0.97336	1.663	-2.63636
viations of fund	2.134	0.515				
ans of fund	0.298	0.635				

RANK CORRELATION OF FUNDS OVER TWO FIVE QUARTER PERIODS
(30/6/90 - 30/6/91) and (30/9/91 - 30/9/92)

ND	MEAN (Qu.1)	RANK	MEAN (Qu.2)	RANK	CHANGE	CHANGE SQUARED
nlam Dividend	0.682	1	0.249	11	10	100
nlam Industrial	0.642	2	0.121	13	11	121
nlam Mining Fund	0.506	3	0.405	8	5	25
S Hallmark	0.458	4	0.496	7	3	9
andard Bank Gold	0.264	5	2.362	1	-4	16
ge Fund	0.195	6	-0.028	19	13	169
Investors	0.152	7	0.008	17	10	100
L Trust Fund	0.066	8	0.32	9	1	1
nlam Trust Fund	0.056	9	0.525	4	-5	25
uthern Equity	0.037	10	-0.372	22	12	144
L Selected Fund	0.034	11	0.899	2	-9	81
rwhich	0.012	12	-0.001	18	6	36
andard Mutual	0.007	13	-0.714	23	10	100
ge Resources	-0.027	14	0.021	18	4	16
ardbank Growth	-0.098	15	0.037	14	-1	1
nlam Index Fund	-0.099	16	0.237	12	-4	16
frets Growth	-0.107	17	0.5	6	-11	121
Gold	-0.408	18	-0.221	21	3	9
ardbank Resource	-0.433	19	0.752	3	-16	256
d Mutual Mining	-0.594	20	-0.166	20	0	0
mentum Life	-0.896	21	0.519	5	-16	256
uthern Mining	-1.185	22	0.016	16	-6	36
L Mining Fund	-1.309	23	0.289	10	-13	169
						1807

Rank correlation: 0.107213

RANK CORRELATION OF FUNDS OVER TWO FIVE QUARTER PERIODS
(30/6/90 - 30/6/91) and (30/9/91 - 30/9/92)

ND	MEAN (Qu.1)	RANK	MEAN (Qu.2)	RANK	CHANGE	CHANGE SQUARED
NERAL EQUITY FUND						
nlam Dividend	0.682	1	0.249	6	5	25
S Hallmark	0.458	2	0.496	4	2	4
ge Fund	0.195	3	-0.028	11	8	64
Investors	0.152	4	0.008	9	5	25
L Trust Fund	0.066	5	0.32	5	0	0
nlam Trust Fund	0.056	6	0.525	1	-5	25
uthern Equity	0.037	7	-0.372	12	5	25
rwich	0.012	8	-0.001	10	2	4
andard] Mutual	0.007	9	-0.714	13	4	16
ardbank Growth	-0.098	10	0.037	8	-2	4
nlam Index Fund	-0.099	11	0.237	7	-4	16
frets Growth	-0.107	12	0.5	3	-9	81
mentum Life	-0.896	13	0.519	2	-11	121
ERAGE	0.035769		0.136615			
	Rank correlation:		-0.12637			410
NING AND RESOURCES FUNDS						
nlam Mining Fund	0.506	1	0.405	2	1	1
ge Resources	-0.027	2	0.021	4	2	4
ardbank Resource	-0.433	3	0.752	1	-2	4
d Mutual Mining	-0.594	4	-0.166	6	2	4
uthern Mining	-1.185	5	0.016	5	0	0
L Mining Fund	-1.309	6	0.289	3	-3	9
ERAGE	-0.507		0.2195			
	Rank correlation:		0.371428			22
EMAINING FUNDS						
nlam Industrial	0.642	1	0.121	3	2	4
andard Bank Gold	0.264	2	2.362	1	-1	1
L Selected Fund	0.034	3	0.899	2	-1	1
Gold	-0.408	4	-0.221	4	0	0
ERAGE	0.133		0.79025			
	Rank correlation:		0.4			6

RANK CORRELATION OF FUNDS OVER TWO TEN QUARTER PERIODS
(31/12/87 - 31/3/90) and (30/6/90 - 30/9/92)

ND	MEAN (Qu.1)	RANK	MEAN (Qu.2)	RANK	CHANGE	CHANGE SQUARED
nlam Dividend	0.68	1	0.465	3	2	4
ardbank Resource	0.458	2	0.159	9	7	49
nlam Mining	0.152	3	0.455	4	1	1
nlam Trust	0.099	4	0.29	6	2	4
ardbank Growth	0.049	5	-0.031	13	8	64
andard Bank Gold	-0.012	6	1.313	1	-5	25
Investors	-0.024	7	0.08	11	4	16
Mining	-0.147	8	-0.38	15	7	49
ge Fund	-0.159	9	0.084	10	1	1
L Selected Fund	-0.186	10	0.466	2	-8	64
andard Mutual	-0.386	11	-0.354	14	3	9
frets Growth	-0.453	12	0.197	7	-5	25
nlam Industrial	-0.462	13	0.382	5	-8	64
nlam Index Fund	-0.545	14	0.069	12	-2	4
L Trust Fund	-0.576	15	0.193	8	-7	49
L Mining	-0.741	16	-0.51	16	0	0
						428

Rank Correlation: 0.370588

RANK CORRELATION OF FUNDS OVER TWO TEN QUARTER PERIODS
(31/12/87 - 31/3/90) and (30/6/90 - 30/9/92)

ND	MEAN (Qu.1)	RANK	MEAN (Qu.2)	RANK	CHANGE	CHANGE SQUARED
NERAL EQUITY FUNDS						
nlam Dividend	0.68	1	0.465	1	0	0
nlam Trust	0.099	2	0.29	2	0	0
ardbank Growth	0.049	3	-0.031	8	5	25
Investors	-0.024	4	0.08	6	2	4
ge Fund	-0.159	5	0.084	5	0	0
andard Mutual	-0.386	6	-0.354	9	3	9
frets Growth	-0.453	7	0.197	3	-4	16
nlam Index Fund	-0.545	8	0.069	7	-1	1
L Trust Fund	-0.576	9	0.193	4	-5	25
ERAGE	-0.14611		0.110333			=========
	Rank correlation:		0.333333			80
						=========
NING AND RESOURCE FUNDS						
ardbank Resource	0.458	1	0.159	2	1	1
nlam Mining	0.152	2	0.455	1	-1	1
d Mutual Mining	-0.147	3	-0.38	3	0	0
L Mining	-0.741	4	-0.51	4	0	0
ERAGE	-0.0695		-0.069			=========
	Rank correlation:		0.8			2
						=========
EMAINING FUNDS						
tandard Bank Gold	-0.012	1	1.313	1	0	0
AL Selected Fund	-0.186	2	0.466	2	0	0
anlam Industrial	-0.462	3	0.382	3	0	0
VERAGE	-0.22		0.720333			=========
	Ranl correlation:		1			0
						=========

RANK CORRELATION OF FUNDS OVER TWO TEN QUARTER PERIODS (Y on Y)
(30/9/87 - 31/12/89) and (31/3/90 - 30/6/92)

JND	MEAN (Qu.1)	RANK	MEAN (Qu.2)	RANK	CHANGE	CHANGE SQUARED
ınlam Dividend	2.036	1	4.881	1	0	0
:andard Gold	0.88	2	-0.843	9	7	49
ınlam Mining Fund	0.212	3	-0.257	8	5	25
ınlam Industrial	-0.154	4	0.261	4	0	0
ınlam Index Fund	-0.797	5	-0.093	7	2	4
:andard Mutual	-1.17	6	0.554	2	-4	16
1 Investors	-1.29	7	0.515	3	-4	16
ıgefund	-1.426	8	0.046	5	-3	9
ınlamtrust	-1.56	9	0.029	6	-3	9
						128

Rank correlation: -0.06666

RANK CORRELATION OF FUNDS OVER TWO FIVE QUARTER PERIODS (Y on Y
(30/3/90 - 30/3/91) and (306/6/91 - 30/6/92)

UND	MEAN (Qu.1)	RANK	MEAN (Qu.2)	RANK	CHANGE	CHANGE SQUARED
anlam Dividend	5.71	1	4.053	1	0	0
M Investors	0.301	2	0.73	5	3	9
anlam Mining Fund	0.176	3	-0.69	9	6	36
anlamtrust	-0.325	4	0.383	7	3	9
tandard Mutual	-0.437	5	1.545	2	-3	9
agefund	-0.598	6	0.69	6	0	0
anlam Industrial	-0.895	7	1.416	3	-4	16
anlam Index Fund	-1.024	8	0.838	4	-4	16
tandard Bank Gold	-1.093	9	-0.592	8	-1	1
						96

Rank correlation: 0.2

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