The Investment Analysts Journal

Number 40 – Summer 1994/95

Die Beleggingsontleders Tydskrif

Nommer 40 – Somer 1994/95

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Three factors were identified that contribute significantly to the extent and magnitude of the anomalies. A discriminant function of these factors correctly classified nine out of ten pairs of shares for which no non-isolated anomalies were detected and 45 out of 47 pairs that had non-isolated anomalies.

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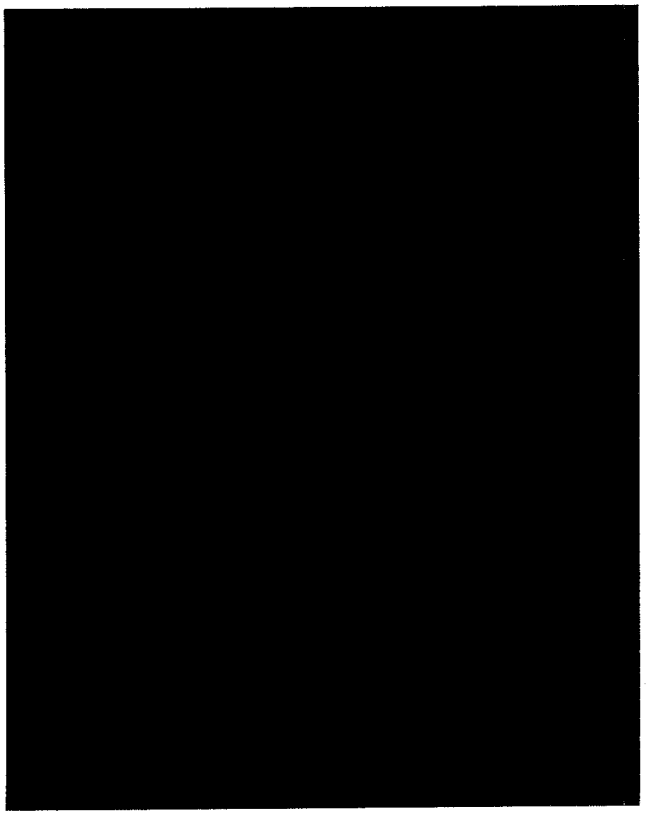

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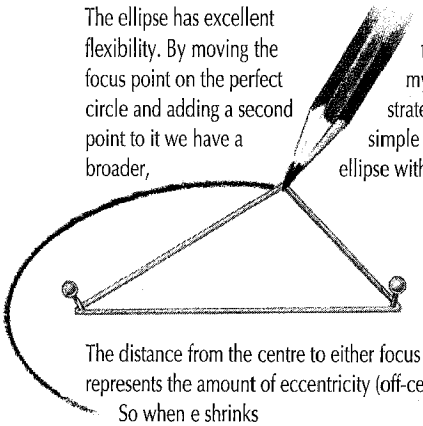

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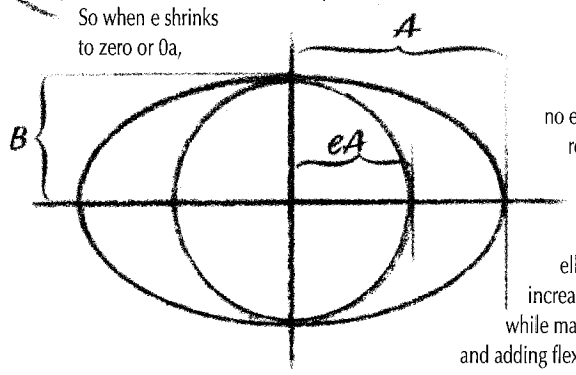

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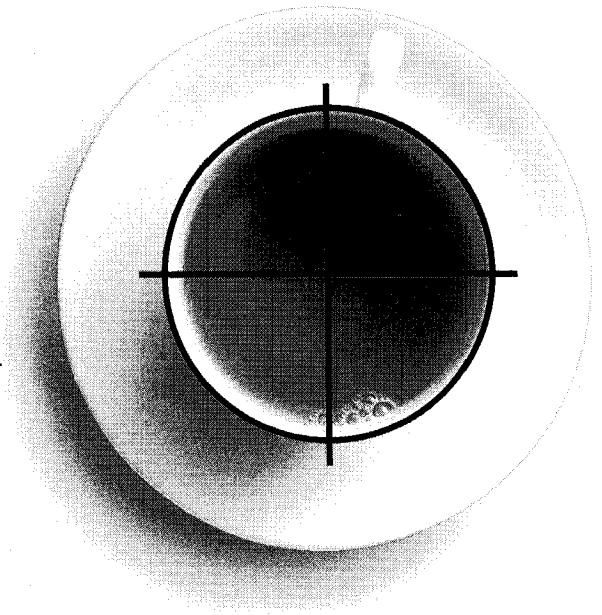

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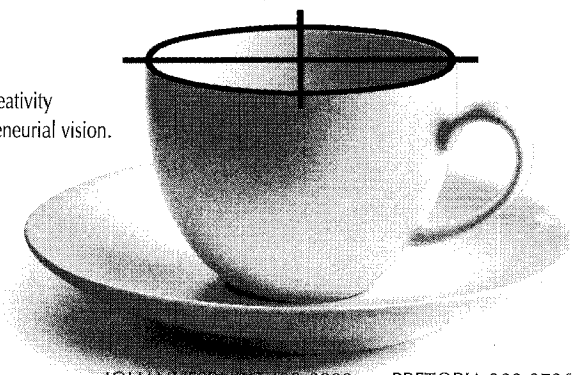

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The Investment Analysts Journal

Fortieth issue – Summer 1994/95

Die Beleggings-ontleders Tydskrif

Veertigste uitgawe – Somer 1994/95

In March 1994, just before the General Election, the ANC published its policy framework for reconstruction and development in South Africa. This was an ambitious document premised on the meeting of basic needs in 'n post-apartheid society but providing, also, elaboration as to what was required for human resource development, the growth of the economy, democratising the state and society, and actual implementation of the specified programme. It was drawn up through a process of wide consultation within the ANC itself (especially at grass roots level) but also within the broader South African community. Inputs were obtained not only from community organisations and trade unions, the obvious constituency bodies of the ANC, but from individuals and organisations as well within the formal business sector. In this way it was intended, at least from an ANC perspective, to provide an evenhanded approach to the country's economic problems and to the search for their solutions. It was a remarkable document in many respects and not least of all because of the comprehensive evaluation it provided of South African society at the conclusion of over three hundred years of white minority rule. Nothing like it had been seen before from any political party.

From a white business point of view, however, there were many things that were troubling about that pre-election ANC economic manifesto. For example, it was a tabulation of imperatives rather than an actual game plan for meeting them. The word "must" occurred with excessive frequency. It also tended to confuse basic human rights with legitimate objectives of policy. Access to fresh drinking water, housing and health care were all placed in the arena of rights without regard to what the consequences would be were a government in the real world not able to satisfy them, and in the relatively short term. Apartheid was blamed for everything bad about the old South Africa. Yet, at the same time, the failure of the economy was attributed to the failure of the market economy, as a system. Thus, the excuse was provided for large scale state intervention. The irony was missed that apartheid itself represented a massive intrusion into the operations of the market and was, thus, a prime cause of the economy's dismal performance. Exogenous factors such as oil price shocks, structural shifts in the global economy (adverse for all mineral-based exporters), periods of extended and severe drought, and also political unrest (encouraged by the ANC itself as an instrument of political change), were either ignored or understated. The manifesto, indeed, appeared too much to argue the case for state intervention in economic processes and too little to take account of macroeconomic constraints that would make the realisation of its objectives very difficult even given a continuing improvement in the global economy to which the South African economy is inextricably linked.

Much water has flowed under the bridge since those heady days. The election was won by the ANC and it has had to assume office, albeit within the framework of a government of national unity. On doing so, it has had to confront an economy in an advanced state of social breakdown as far as its black communities are concerned, but also an economy gearing itself up for cyclical and secular recovery. The challenge of office for new ministers, most of whom have had no previous experience either of parliamentary life or of public administration, has been formidable, yet they have met the challenge and on the whole come through impressively. Some have

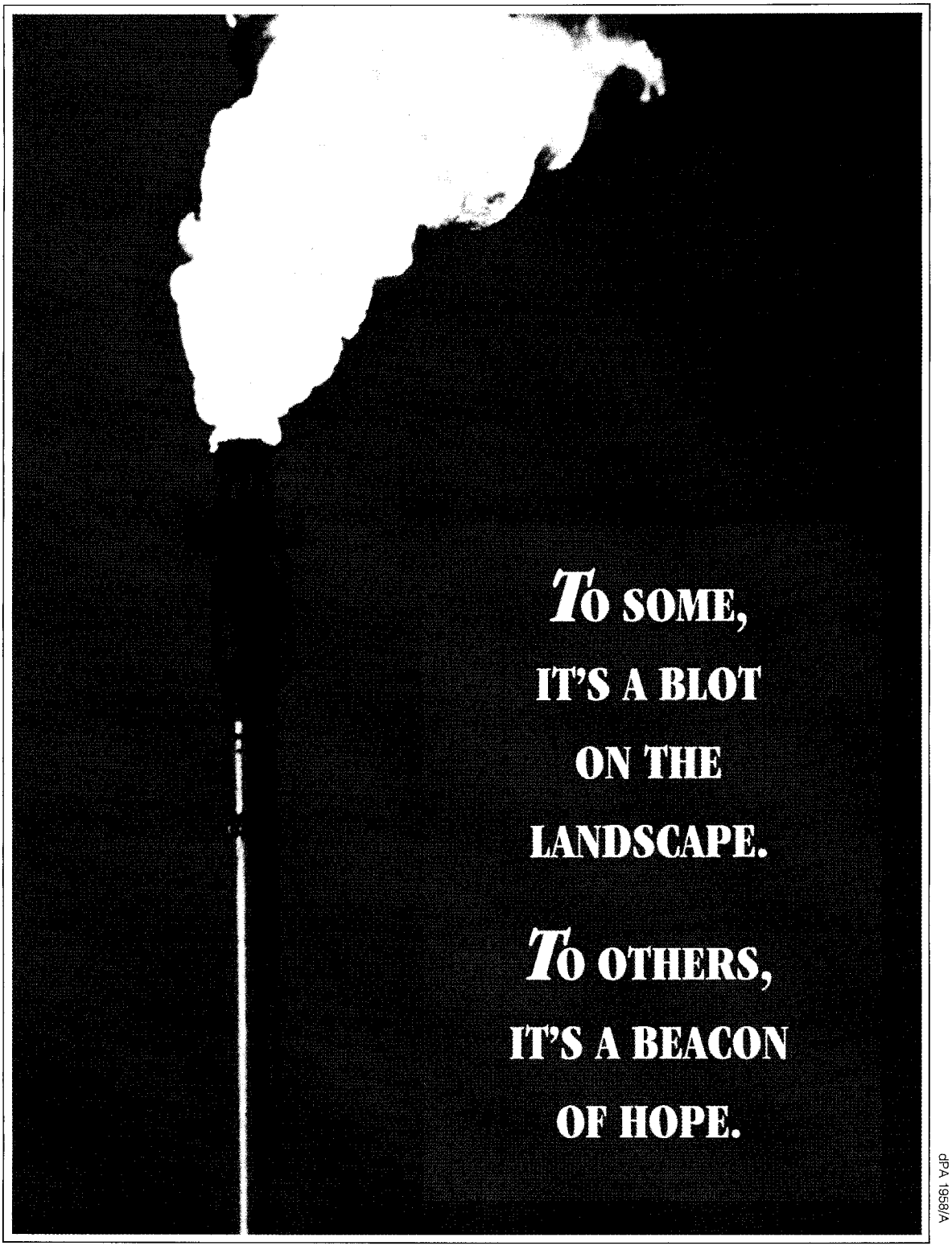
Gedurende Maart 1994, kort voor die algemene verkiesing, het die ANC sy beleidsraamwerk vir heropbou en ontwikkeling in Suid-Afrika gepubliseer. Hierdie was 'n ambisieuse dokument met as veronderstelling die bevrediging van basiese behoeftes in 'n postapartheid samelewing. Dit het ook voorsiening gemaak vir die uitbouing van vereistes onderliggend aan die ontwikkeling van menslike bronne, ekonomiese groei, demokratisering van die staat en die samelewing, en daadwerklike implementering van die gespesifiseerde programme. Dit is opgestel deur 'n proses van breë konsultasie binne die ANC (veral op voetsoolvlak), maar ook binne die breër Suid-Afrikaanse samelewing. Bydraes is ontvang van gemeenskapsorganisasies en vakunies, voor die hand liggende kieserskorpse van die ANC, sowel as van individue en organisasies binne die formele sakesektor. Die doel hiervan, altans vanuit ANC-perspektief, was om 'n onpartydige benadering tot die land se ekonomiese probleme daar te stel, en oplossings daarvoor te kry. Dit is in baie opsigte 'n merkwaardige dokument, onder andere weens die omvattende evaluering van die Suid-Afrikaanse samelewing aan die einde van meer as driehonderd jaar van wit minderheidsoorheersing.

Nooit voorheen is enigiets soortgelyks van enige politieke party teëgekom nie.

Vanuit 'n wit sakeperspektief egter, is daar baie wat pla rondom hierdie pre-eleksie ekonomiese manifes van die ANC. Dit was byvoorbeeld 'n tabulering van imperatiewe, eerder as 'n daadwerklike plan van aksie om daaraan te voldoen. Die woord 'moet' het oormatig en by herhaling voorgekom. Dit was ook geneig om basiese menseregte met gegronde beleidsdoelwitte te verwar. Toegang tot vars drinkwater, behuising en gesondheidsorg is binne die arena van regte geplaas, sonder inagneming van die gevolge vir 'n regering indien hulle dit nie in die realiteit kon bevredig nie, en op die relatiewe kort termyn. Apartheid is blameer vir alles wat sleg was in die ou Suid-Afrika. Mislukking van die ekonomie is egter terselfdertyd toegeskryf aan die mislukking van die markekonomie, as 'n sisteem. Sodoende is 'n verskoning geskep vir grootskaalse staatintervensie. Die ironie dat apartheid juis massiewe inmenging in markprosesse verteenwoordig het, en daarom 'n primêre oorsaak van die droewige ekonomiese vertoning was, is misgekyk.

Eksogene faktore, soos die skokke van die olieprys, strukturele veranderings in die wêreldekonomie (ongunstig vir alle uitvoerders van mineraalprodukte), langdurige en ernstige droogtes, asook politieke onrus (deur die ANC aangemoedig as instrument van politieke verandering), is óf geïgnoreer, óf onderbeklemtoon. Die manifes het inderdaad gelyk té veel die saak vir staatintervensie in ekonomiese prosesse te bepleit, en té min rekening gehou met makroekonomiese beperkings, wat die realisasie van sy doelwitte sou bemoeilik, selfs al sou die wêreldekonomie, waaraan die Suid-Afrikaanse ekonomie onlosmaaklik verbind is, steeds verbeter.

Baie water het in die see geloop sedert daardie onstuimige dae. Die ANC het die verkiesing gewen en moes bewind aanvaar, al was dit dan ook binne die raamwerk van 'n regering van nasionale eenheid. Sodoende moes hul die ekonomie in 'n gevorderde stadium van sosiale ineenstorting, wat die swart gemeenskappe betref, konfronteer. Terselfdertyd was die ekonomie egter gereed vir sikliese en sekulêre herstel. Die



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South Africans somehow have to reconcile their desperate need for development with the deeply rooted desire to protect their natural heritage. Fraser Alexander helps enlightened companies to develop and implement environmental management programmes which find a sensible balance between growth and conservation.

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shown considerable ability in coming to grips with the most complex and difficult issues, and have brought a refreshing openmindedness to their consideration of the issues themselves. It is difficult not to conclude that the country is at least being run as well as it was before, and in many instances is being run far better. Between 1990 and 1994 former President F W de Klerk set an admirable example of leadership. Under any circumstances, his would have been a difficult act to follow. Yet President Mandela has followed it and done so with such dignity and wisdom that the country can count itself fortunate indeed.

The RDP White Paper that has now been issued reflects many of the changes that have just been described. While it remains loyal to the ANC's commitment to redistribution and social upliftment, it also embraces the understanding that what can be done in such a direction has to be constrained by the dictates of fiscal and monetary prudence. If growth is neglected in the White Paper, it is because its authors now fully accept that getting the deficit before borrowing down significantly as a percentage of GDP is a matter of high national priority. The notion that South Africa as a small open economy can pull itself up by its own bootstraps through deficit spending is firmly rejected. Indeed, something very strange is beginning to happen. Almost imperceptibly, the ANC, the party of nationalisation and excessive government spending, is becoming the party of privatisation and fiscal restraint. Moreover, through its commitment to openness and transparency, and a more competitive economy, it is becoming transformed into the guardian of the market system much to the discomfort of the business community which has always preached competition but actively sought protection and subsidies at any given opportunity.

Of course, this is an oversimplification of how things stand at present, but it is not an outrageous oversimplification. If the present ANC-led government continues along the path it is following, it will become the guardian just described and that will be positive for the South African economy and for the growth that it so greatly needs. Pragmatism in South Africa will have won the day once again over dogmatism as it did with the country's political transformation – to the great surprise of the world and the surprise, no less, of the country's own people.

Finally, it is important to say that the RDP party political manifesto which was issued by the ANC before the general election was not a document that could have been adopted by a government of national unity as a policy document in its own right. That is the role the RDP White Paper has now to assume. However in its present form, it still does not fill such a role completely. The process of consultation, active rather than passive (as happens with the simple giving of evidence to parliamentary standing committees), needs to be extended to include interest groups other than those comprising the ANC's own immediate alliance. It is through inclusiveness that common ownership will follow, and common ownership is the key to transforming a party political manifesto into a national vision.

The Editor

bewinduitdaging vir nuwe ministers, waarvan die meerderheid geen vorige ervaring van óf parlementêre lewe, óf publieke administrasie gehad het nie, was formidabel. Hulle het egter die uitdaging aanvaar, en oor die algemeen beïndruk. Sommige het aansienlike vermoëns aan die dag gelê om uiters komplekse en moeilike kwessies te hanteer en het in die proses 'n verfrissende openheid openbaar.

Dit is moeilik om nie tot die slotsom te kom dat Suid-Afrika ten minste so goed bestuur word soos in die verlede nie, en in sommige gevalle selfs beter nie. Tussen 1990 en 1994 het die voormalige President FW de Klerk 'n bewonderenswaardige voorbeeld van leierskap gestel. Om sy voorbeeld te moes volg, sou onder enige omstandighede moeilik wees. President Mandela het dit nietemin kon doen, en wel met soveel waardigheid en wysheid, dat Suid-Afrika inderdaad trots kan wees.

Die HOP Witskrif wat pas verskyn het, reflekteer baie van die veranderings wat hier beskryf word. Dit bly lojaal teenoor die ANC se verbintenis tot herverdeling en maatskaplike hervorming, maar is sensitief daarvoor dat wat in dié verband gedoen kan word, in toom gehou moet word deur omsigtige fiskale en monetêre oorwegings. Indien die Witskrif groei verontagsaam, is dit omdat skryfwers nou aanvaar dat om die tekort voor lenings te verminder as 'n persentasie van die BBP, 'n kwessie van primêre nasionale prioriteit is.

Die idee dat Suid-Afrika, as 'n klein oop ekonomie, op eie krag kan regruk deur begrotingstekorte, word verwerp. Trouens, iets baie vreemds is aan die gebeur. Die ANC, die party van nasionalisering en oormatige regeringsbesteding, het so te sê ongemerk die party van privatisering en fiskale inkorting geword. Hulle is boonop besig om 'n gedaanteverwisseling te ondergaan; deur hul verbintenis tot openheid en deursigtigheid, en 'n meer mededingende ekonomie, het hulle die bewaker van die marksisteem geword, tot verleentheid van die sakegemeenskap wat nog altyd kompetisie verkondig het, maar terselfdertyd en te eniger tyd beskerming en subsidieë probeer verkry het.

Dit is natuurlik 'n oorvereenvoudiging van hoe sake tans staan, maar dit is nie 'n verregaande oorvereenvoudiging nie. Indien die huidige ANC-beheerde regering voortgaan op hierdie weg, sal hulle inderdaad die bewaker word waarna hier verwys word. Dit sal positief wees vir enersyds die Suid-Afrikaanse ekonomie, en andersyds vir die groei waaraan daar so 'n wesenlike behoefte bestaan. Pragmatisme sou weereens oorwin het oor dogmatisme in Suid-Afrika, soos wat dit gedurende die land se politieke transformasie gedoen het – tot groot verbasing van die wêreld, en groot verwondering van die land se eie mense.

Dit is laastens belangrik om te meld dat die party-politieke manifes wat die ANC voor die algemene verkiesing uitgereik het, nie 'n dokument was wat deur 'n regering van nasionale eenheid as 'n beleidsdokument in eie reg aangeneem kon gewees het nie. Dit is die rol wat die Witskrif nou moet aanvaar. In sy huidige vorm vervul dit egter nog nie so 'n rol volledig nie. Die konsultasieproses, aktief eerder as passief (soos eenvoudige aflê van getuienis voor die parlementêre staandekomitees getuig), moet uitgebou word om ander belangegroepe, nie net dié met ANC-alliansies nie, in te sluit. Deur inklusiwiteit sal algemene eiendomsreg ontwikkel, en algemene eiendomsreg is die sleutel om 'n party-politieke manifes in 'n nasionale visie te transformeer.

Die Redakteur

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Minimum variance hedge ratio analysis for the South African share index futures market: Duration and expiration effects

ABSTRACT

The minimum variance hedge ratio (HR*) and the classic or beta hedge ratio are commonly used decision rules in drawing up a hedging strategy. Research regarding the superiority between HR* and the beta hedge ratio that had been done on the US market has yielded mixed results.

This study investigates the stability of HR* for the Johannesburg Stock Exchange All Share, All Gold and Industrial Indices futures contracts with respect to hedge duration and time to contract expiration. Hedge durations of one, two and four weeks are compared, and these are further subdivided into the number of weeks remaining until contract expiration. The HR* values are analysed for predictable trends, and statistical comparisons are made with the beta hedge ratio.

The results show that the minimum variance hedge ratios are significantly less than the beta hedge ratio of 1, and that they increase as hedge duration increases from one to four weeks. The results also show that, in general, the HR* values increase, although only slightly, towards the beta hedge ratio as hedges are lifted closer to contract expiration. The study concludes that hedging an established cash portfolio with share index futures contracts should be viewed as a dynamic process; contracts should be added to the hedged portfolio as hedge durations increase and approach the contract expiration date.

1. INTRODUCTION

The South African financial futures market has matured substantially since the inception of an informal market trading futures contracts on the Johannesburg Stock Exchange (JSE) All Share, All Gold and Industrial Indices in 1987. The passing of the Financial Markets Control Act (Act 55) in May 1989 has led to the establishment of the formal market on August 10 1990, and judged in terms of growth in trading volume and open-interest positions, the market has been quite successful. Trading in the financial futures market facilitates two types of activity, namely hedging and speculation. Hedging provides a means to reduce the risk of unexpected price changes by transferring such risk to speculators who are more willing to bear the risk. The difference in fluctuations in the prices of futures contracts and the prices of their underlying securities in the spot market implies that the success of a hedging strategy depends on applying the proper hedge ratio. The two most commonly used hedge ratios are the minimum variance hedge ratio and the classic or beta hedge ratio.

Comparisons between the effectiveness of the minimum variance hedge ratio (HR*) and that of the beta hedge ratio are popular in hedging literature. The objective of this study is to examine the stability of HR* for JSE All Share, All Gold and Industrial Indices futures contracts with respect to hedge duration and time to contract expiration. Comparisons are drawn between hedge durations of one, two and four weeks, and are further analysed for the number of weeks remaining until contract expiration.

The article is structured as follows: Section 2 examines the theory of hedging, with specific emphasis on hedge ratio determination and measurement of hedging effectiveness. In Section 3 related literature on the hedging performance of American futures markets and on empirical work done on those markets are surveyed.

Section 4 covers the data and the treatment of data, as well as the research method, while Section 5 presents and discusses the research results. In conclusion, Section 6 gives a summary of the research results and conclusions.

2. THEORIES OF HEDGING

Traditional hedging theory views the hedger as a risk minimiser who takes a position in the futures market that is equal but opposite in sign to his position in the cash market. For example, a hedger who holds X units of share indices in his portfolio will protect himself against the risk of loss from a decline in the cash price by selling X futures on that portfolio. This implies that the hedge ratio is always one. This traditional model of hedge ratio determination is commonly referred to as the naive model.

The underlying assumption of the traditional theory of hedging is that the price changes in a cash position will be offset by an equal price change in the futures market. The advantages provided by financial futures depend on how close the underlying security's cash price follows the future's price, where the difference between the cash and futures prices is called the *basis*. This theory argues that the basis and changes in the basis are negligible because of the possibility of actually making or taking delivery of the futures contract (opposed to making an offsetting trade). The naive model therefore maintains that a hedge ratio of one is still optimum, and that because cash and futures prices generally move together, and the possibility of making or taking delivery, the hedger will be ensured that changes in futures prices are very close to changes in cash prices. Ederington (1979), however, criticises this "very close" as being too vague an idea to accept the traditionalist's view because of his argument that if futures prices reflect expected future cash prices, then there is no definite reason why changes in futures prices should be equal to changes in cash prices.

Working (see e.g. Ederington, 1979) views the hedger as an investor who does not primarily seek to avoid risk, but who also wishes to maximise his expected return arising from anticipations of favourable relative price movements in the cash and future markets. He emphasises that, since hedgers take positions in both the spot and the futures markets, their concern is relative, not absolute price changes. Working argues that, in contrast to expectation that cash and futures prices move together, most hedging takes place in expectation that there will be a change in the relationship between cash and futures prices. Holders of share index portfolios will, according to Working's theory, hedge if the basis was expected to diminish and will not hedge if the basis was expected to increase.

Johnson (1960) and Stein (1961), by application of modern portfolio theory, integrate the risk avoidance of the traditional theory with Working's maximisation of expected profits. In modern portfolio theory decisions are based on achieving the minimum level of risk at each possible return level. Johnson and Stein argue that futures are bought for the same risk – return reasons than any other financial security. In contrast to the

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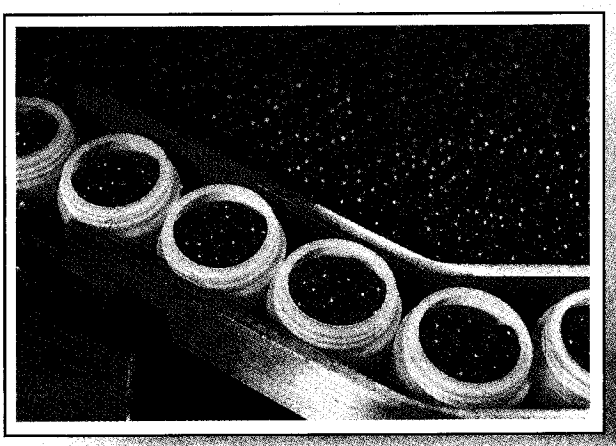

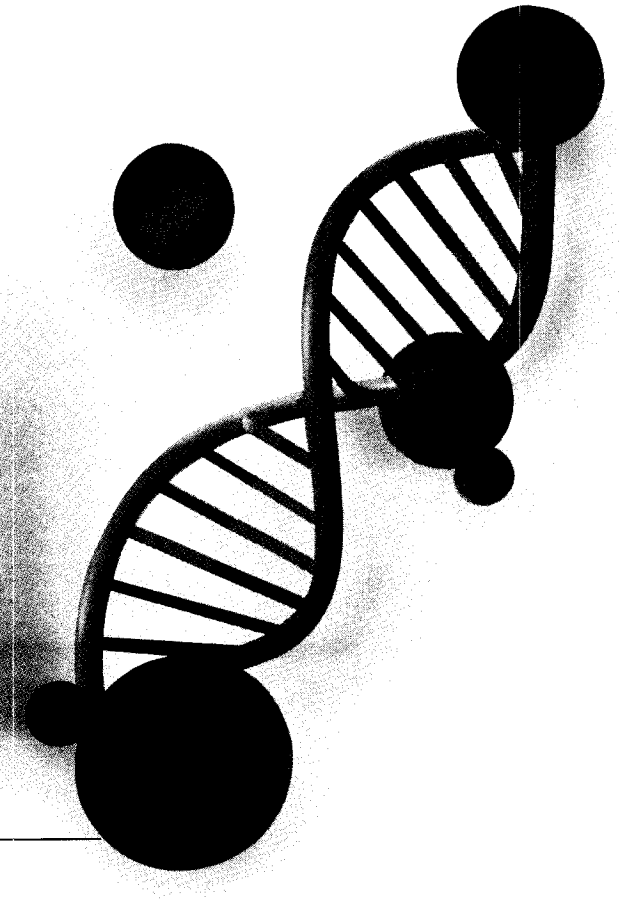

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traditional theory that hedgers should always be fully hedged and Working's hypothesis (although he realises that it is not always the case) that hedgers will be completely hedged or unhedged, Johnson and Stein argue that hedgers will hold both hedged and unhedged share portfolios. This application of portfolio theory to hedging results in a hedging decision rule commonly known as the minimum variance hedge ratio (HR*).

2.1 Hedge ratio determination

Since price changes of futures contracts and their underlying cash securities are often not of the same magnitude, a successful hedging strategy is determined by applying the proper hedge ratio. The hedge ratio represents the number of futures contracts held relative to the number of cash positions it covers. There are various methods for determining the hedge ratio. The two hedge ratios invariably found in research literature, however, are the minimum variance hedge ratio and the beta hedge ratio. Other hedge ratios encountered in the literature study are all applicable to non-share index futures contracts. In this regard, the interested reader is referred to Schwarz, Hill and Schneeweis (1986).

2.1.1 *Minimum variance hedge ratio*

The application of modern portfolio theory has led to the development of the minimum variance hedge ratio. The investment portfolio is defined in terms of two assets, namely a futures position and a cash position. The variance of price changes in a portfolio consisting of positions in the futures and spot markets is given by (see e.g. Lindahl, 1992):

$$\sigma^2(\Delta p_t) = x_s^2\,\sigma^2(\Delta s_t) + x_f^2\,\sigma^2(\Delta f_t) + 2\,x_s\,x_f\,cov\,(\Delta s_t, \Delta f_t) \quad \ldots(1)$$

where:

Δs_t, Δf_t, Δp_t = the price change during period t of the spot, futures, and a portfolio of spot and futures, respectively;

x_f = the proportion of the portfolio held in futures contracts;

x_s = the proportion of the portfolio held in the spot commodity which equals 1 by assumption;

σ^2 = variance of price changes.

An important difference between the minimum variance hedge ratio model and the basic portfolio model is that the cash and futures market positions are not viewed as substitutes. In fact, the spot market holdings, x_s, are viewed as fixed (hence the assumption that $x_s = 1$), and the real issue is how much of these shares to hedge.

Since the main objective of hedging is to achieve maximum price variability risk reduction, the problem can be reduced to that of determining the minimum variance hedge ratio HR*, or simply by minimising Eq. (1) with respect to the proportion of the portfolio held in futures contracts, x_f. This minimum risk hedge ratio can be obtained by setting the partial derivative of Eq. (1) with respect to x_f equal to 0 (see Hill & Schneeweis, 1982):

$$\frac{\delta\sigma^2(\Delta p_t)}{\delta x_f} = 2x_f\,\sigma^2(\Delta f_t) + 2cov\,(\Delta s_t, \Delta f_t) = 0 \quad \ldots(2)$$

Solving Eq. (2) yields HR*:

$$HR^* = -\frac{cov\,(\Delta s_t, \Delta f_t)}{\sigma^2\,(\Delta f_t)} \quad \ldots(3)$$

A short position in futures is represented by $x_f < 0$ and a long position by $x_f > 0$. Since a short position is required to hedge an established share portfolio, Eq. (3) changes to

$$HR^* = \frac{cov\,(\Delta s_t, \Delta f_t)}{\sigma^2(\Delta f_t)} \quad \ldots(4)$$

HR* thus represents the proportion of futures contracts needed to hedge an established cash position when the hedger's goal is to maximise risk reduction. The value of HR*, also known as the portfolio model's optimal hedge ratio, is equivalent to the slope coefficient of a regression of futures price changes (the independent variable) on spot price changes (the dependent variable). It is emphasised again that HR* is based on an established cash position, a major assumption of this study. The measure of hedging effectiveness associated with this strategy of hedge ratio determination is commonly called R^2, the coefficient of determination of the regression Eq. (4), for which HR* is the regression coefficient.

2.1.2 *Beta hedge ratio*

Traditional hedging theory views hedgers as taking futures positions equal in magnitude but opposite in sign to their position in the cash market by employing the classic 1:1 hedge ratio. However, when this naive model for hedge ratio determination is used when the cash position consists of a share portfolio, it is necessary to adjust the number of futures contracts for a total hedge by the portfolio's beta.

Beta is a statistic used to describe the share portfolio's tendency to increase or decrease in relation to the market and is equivalent to the slope coefficient of a regression of market returns (the independent variable) on spot portfolio returns (the dependent variable). In equation form (see e.g. Lindahl, 1992):

$$\beta = \frac{cov\,(R_s, R_M)}{\sigma^2\,(R_M)} \quad \ldots(5)$$

where:

R_s = return on the spot portfolio;

R_M = return on the market, where the index underlying the futures contract is used as a proxy for the market.

A beta of 1 refers to a portfolio that changes in value precisely like the market, whereas a portfolio with a beta of 1,2 refers to one that will rise or fall in value 1,2 times as fast as the average market return. In this case a full hedge can be achieved by applying a hedge ratio of 1,2 – i.e. the futures position must be 20% larger than the cash position.

2.2 Measurement of hedging performance

The classic economic rationale for hedging with financial futures is to reduce risk, i.e. to substitute exposure to the risk of price variability in the cash market with exposure to the risk of changes in the basis. Hedging effectiveness, therefore, is measured by the proportional reduction in the price changes variance of the unhedged security that arises from a hedged opposed to an unhedged position. The traditional method of measuring hedging effectiveness is to focus on the relationship between the variability of the basis and the variability of the cash price. In this regard, Schwarz *et al.* (1986) show that the following equation holds:

$$\text{Hedging effectiveness } (E_t) = \frac{1 - HR\ var\,(B_t)}{var\,(CP_t)} \quad \ldots(6)$$

where:

HR = actual hedge ratio;

var (B_t) = variability of the basis, which is equal to the variability (spot price – futures price);

var (CP_t) = variability of the spot price.

However, when the minimum variance hedge ratio model is used, the coefficient of determination, R^2, is the most popular measure of hedging effectiveness. R^2 refers to the coefficient of determination of a regression of futures price changes

(the independent variable) against cash price changes (the dependent variable), and is a statistic that describes the maximum risk reduction potential of a hedge. Lindahl (1989) notes that R^2 represents the percentage reduction in the variance of the unhedged or cash position when variance is minimised and that it is defined as follows:

$$R^2 = 1 - (\text{var}(R^*)/\text{var}(U)) \quad \ldots (7)$$

where:

var (R*) = the minimum variance of the cash, futures portfolio;
var (U) = the variance of the unhedged or cash position.

An R^2 of 1 is possible if perfect correlation exists between futures and cash price changes. A shortcoming of the R^2 statistic, however, is that expected price changes and unexpected price changes are not separated when ordinary least squares regressions are performed. A perfect R^2 of 1 is not possible over any but the shortest time interval due to the systematic tendency for the basis to diminish over time. Nevertheless, the R^2 risk reduction statistic is still the most widely used measure of hedging effectiveness.

In practice, higher R^2 values have become synonymous with greater risk reduction and increased hedging effectiveness. However, this is only true under certain conditions. The condition for a particular spot position is crucial when making R^2 comparisons. Reliable comparisons can only be made where the data set of the cash positions are identical. The R^2 statistic describes the percentage of the variance of cash price changes that is explained by futures price changes. Therefore, if the data set of the cash position is identical for two hedges that are being compared, the variance of the unhedged cash position is identical and a larger R^2 means that the amount of unexplained variance (the resulting basis risk) is less. In this case, it can be concluded that the hedge with the higher R^2 is more effective. Ederington (1979) argues that R^2 should be greater the longer the hedge duration is because absolute cash price changes should generally be greater over longer periods and futures prices would have more time to respond to this.

It must be emphasised that R^2 is a relative measure of hedging effectiveness and, therefore, valid R^2 comparisons for two hedges with different levels of cash price variability cannot be made. Referring to this study, comparing, for example, different R^2 values of the All Share Index is an obvious example of a valid comparison, whereas direct comparison of R^2 values of the All Share and All Gold Indices, for example, is not permissible.

2.3 Cost-of-carry model and hedging

One reason for the success of hedging with share index futures is that it offers the possibility of directly managing the market component of risk of a share index portfolio. At contract expiration, a full hedge completely eliminates market risk, and the combined portfolio of spot and futures positions earns the risk-free rate of return.

The cost-of-carry model for valuation of financial futures in mathematical terms is given by:

$$C_T - C_t + C_tD = F_T - F_t + C_tR_f \quad \ldots (8)$$

where:

C_T = market value of index portfolio at contract expiration;
C_t = market value of index portfolio at date t;
D = dividend yield to expiration date of contract at date t;
F_T = futures price at expiration;
F_t = futures price at date t; and
R_f = risk-free rate of return to expiration date of contract at date t.

Since at contract expiration the futures price equals the cash price by definition, Eq. (8) reduces to:

$$F_t = C_t + C_t(R_f - D) \quad \ldots (9)$$

Eq. (9) shows that at equilibrium the futures price is equal to the cash price plus the cost of carrying the cash portfolio. Since futures contracts can be bought by depositing a low initial margin (currently approximately 10% of the contract value on the local market), whereas cash must be paid for shares, the interest rate multiplied by the cash price represents one component of the cost of carrying the cash portfolio. Holders of a cash portfolio, in contrast to holders of futures contracts, receive dividends on their investment. The dividend yield, therefore, is subtracted from the interest rate to obtain the total cost of carry. However, since the dividend yield is a function of time, the yield differential diminishes as contract expiration is approached.

As futures prices converge towards cash prices as contract expiration is approached, theoretical merit is given to analysing the expiration effect.

2.4 Theory of an expiration effect

The equations for the minimum variance hedge ratio (Eq. (4)) and the beta hedge ratio (Eq. (5)) are very similar. Figlewski (1985) shows that, in the special case in which dividends are nonstochastic and the hedge is held until contract expiration, so that the change in basis is also nonstochastic, the minimum variance hedge ratio is the share portfolio's beta coefficient. While dividends tend to be relatively stable over time, the same is not true of the basis. Therefore, using the beta hedge ratio is unlikely to be optimal, except when the hedge is held until contract expiration. However, as argued in Section 2.3, an equilibrium relationship must exist because, at contract expiration, futures prices equal cash prices, and therefore, HR* might approach the beta hedge ratio as equilibrium is approached at contract expiration. The logical assumption underlying this is that futures prices exhibit less volatility as expiration is approached. Lindahl (1992), however, reports that evidence regarding this is mixed, since futures prices can also become more volatile as contract expiration is approached.

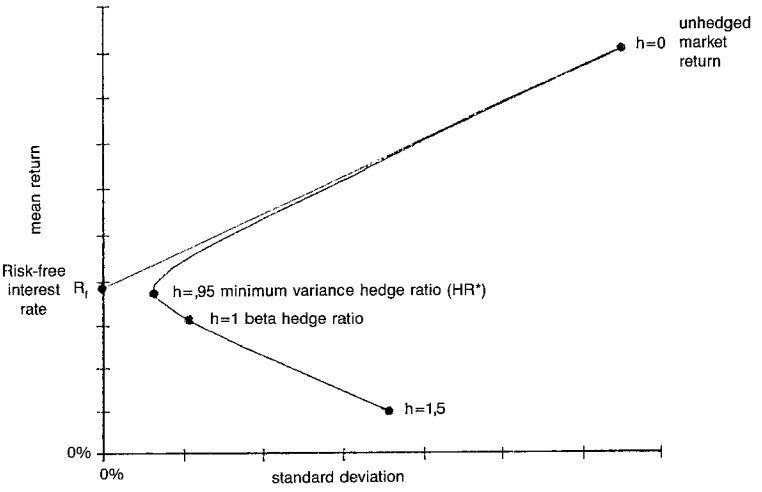

Figure 1:
Typical risk-return profile for share index futures hedges

Source: Lindahl, 1992: 36

Figure 1 illustrates the typical relationship between an *ex post* minimum variance hedge ratio and the beta hedge ratio (Lindahl, 1992). The straight line between h = 0 and R_f

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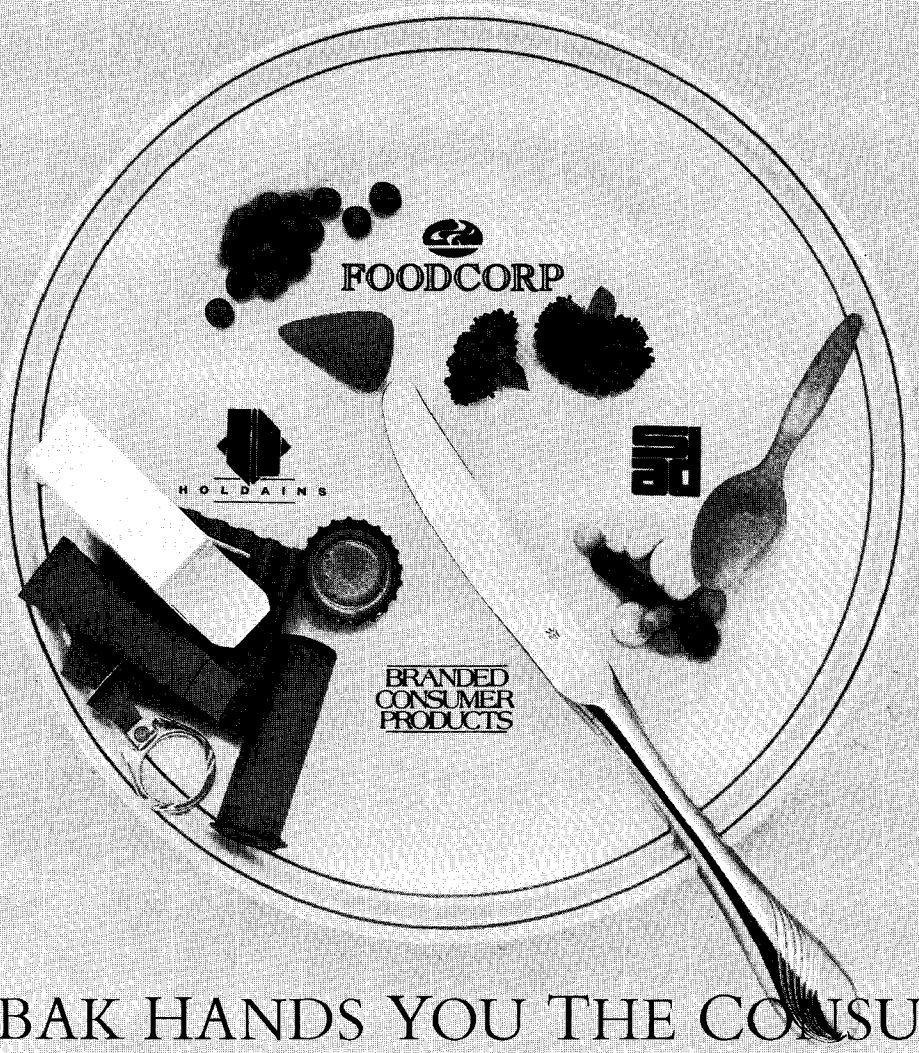

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represents the equilibrium relationship between cash and futures prices, as explained in Section 2.3. As indicated, HR* approaches the beta hedge ratio as expiration is approached, and because of the equilibrium relationship that holds, HR* will be equal to the beta hedge ratio and both ratios will yield the risk-free return. Lindahl (1992) points out that futures prices frequently deviate from equilibrium, and that they are more volatile than spot prices. Therefore, it can be concluded that the minimum variance hedge ratio is usually lower than the classic or beta hedge ratio. The curve in Figure 1 represents the risk-return trade-off profile as the hedge ratio is increased from h = 0 (the unhedged position) to h = 1,5. When futures prices are closer to equilibrium, the risk-return curve is closer to the straight line, and consequently, HR* is closer to the beta hedge ratio.

2.5 Duration effect of hedging

Hedging a share portfolio will necessarily lead to basis risk exposure, where basis risk is defined as the risk that futures price changes will not track spot price changes exactly over time. Figlewski (1985) argues that, as the variance of systematic price movements increases relative to basis risk, it can be expected that HR* should increase as hedge duration increases. However, evidence regarding this is mixed, leading to one of the main issues of investigation in this study.

Due to arbitraging activities in the market, a hedged portfolio's basis risk cannot become arbitrarily large, whereas the portfolio's return variance increases directly with time. It thus follows that basis risk as a fraction of total risk should decrease as the hedge duration increases, and therefore, R^2 for a particular hedge should increase as hedge duration increases.

3. Literature review

Although Lindahl (1992) claims to be the first and only to date to research the expiration effect, and the combined duration and expiration effects of hedging with share index futures, Figlewski (1984) investigated the expiration effect, albeit very superficial. Lindahl investigated futures contracts traded on the Chicago Board of Trade's Major Market Index (MMI) and Standard and Poor's 500 Index (S&P 500) which are arithmetic indices. Her empirical work, like that of this study, focused on the stability of HR* with respect to hedge duration and time to contract expiration. One, two and four weeks hedge durations were compared, and were further divided into the number of weeks remaining until contract expiration. The resulting HR*s were analysed for trend predictions and statistically compared with the classic or beta hedge ratio.

Lindahl showed that the minimum variance hedge ratios for MMI and S&P 500 share index futures contracts are significantly less than the beta hedge ratio, and that they increase as hedge duration increases from one to four weeks. Work done by Ederington (1979); Hill and Schneeweis; (1982) and Marmer (1986) on non-share index futures produced similar results with respect to HR*. Figlewski (1984, 1985), however, found that HR*s for the S&P 500 share index futures contract decrease as hedge duration increases from one to four weeks. However, this contradiction can be explained by the fact that Figlewski's sample size was relatively small. In the case of the two week hedge durations, for example, Figlewski made 15 observations, whereas Lindahl had 88 observations for the same hedge duration. Lindahl emphasised that the duration effect is influenced by the fact that longer hedge durations are lifted closer to contract expiration (and HR* tends to increase as hedges approach the contract expiration date). She also found that the values of the R^2 statistic increase as hedge duration increases. This observation is supported by the empirical work of, amongst others, Ederington (1979); Hill, Liro and Schneeweis (1983); and Marmer (1986). In this regard, Figlewski (1984, 1985) and Graham and Jennings (1987) found mixed results for share index futures. They, along with Lindahl, attributed the lower R^2 values for longer hedge durations to sampling error.

With respect to the expiration effect, Lindahl showed that the HR* values increase towards the beta hedge ratio as hedges are lifted closer to contract expiration. The limited amount of work done by Figlewski (1984) in this regard shows that HR* remains stable. It must be pointed out, however, that Figlewski (1984) subdivided his data by months to contract expiration, opposed to Lindahl's weeks, and also that Figlewski's number of observations were very small.

Lindahl's (1992) results show that R^2 values show no increasing trend as contract expiration is approached. Chen, Sears and Tzang (1987) revealed in their study that the contracts closer to expiration have higher R^2 values. However, their study was carried out on a commodity futures contract, namely energy futures. It must be reiterated that, since R^2 is a relative measure of hedging effectiveness, summary comparisons regarding R^2 must be done with caution.

When the duration and expiration effects had been considered together, Lindahl's (1992) results confirmed that HR* values for one and two week hedges increase towards the classic hedge ratio of 1 as hedges approach the contract expiration date. Lindahl (1992) further analysed the expiration effect by estimating rates of convergence of HR* towards the beta hedge ratio. She showed that, on average, HR* values for one and two week MMI and S&P 500 hedges increase by approximately 1% per week during the last ten weeks of contract life.

4. Data and research method

As the empirical work in this study was concerned with the near futures contracts in the March-June-September-December cycle only, nonoverlapping hedge durations of one, two and four weeks on the JSE All Share, All Gold and Industrial Indices futures contracts were defined for hedges lifted between 0 and 11 weeks before contract expiration. Futures prices were thus represented by the near futures contracts in this quarterly cycle, and cash prices by the respective share indices.

The study used data on the three indices from March 1988 to March 1993. The reason for eliminating the earlier data of the SIF market from this study is that Snell (1990) has found that pricing inefficiency existed in that market since its inception in early 1987 until the first part of 1988, and that HR* is significantly influenced by futures contract mispricings.

Weeks were defined using Friday-to-Friday closing prices. Therefore, since only the last 12 weeks before contract expiration were considered, 11 weekly price change observations per quarter could be obtained, except in the 4 cases where the Friday closing prices coincided with the contract expiration date. This resulted in, for example, 224 observations for the one week duration hedges (5 years of data x 4 quarterly expiration dates x 11 observations per quarter plus the 4 abovementioned observations).

To investigate the stability of HR* with respect to hedge duration, ordinary least squares (OLS) simple regressions were run for the time period as a whole (covering near contracts in March 1988 up to near contracts in March 1993) for nonoverlapping one, two and four week hedge durations that were lifted from 0 to 11 weeks of contract expiration. This resulted in 224 observations in the case of one week hedge durations. The same reasoning yielded 104 observations and 44 observations for the two week and four week hedge durations respectively.

The simple OLS regression is given by:

$$\Delta s_t = \beta_0 + \beta_1 \Delta f_t + e_t \quad \ldots (10)$$

where:

Δs_t, Δf_t = $s_t - s_{t-1}$ and $f_t - f_{t-1}$ for one week hedges, $s_t - s_{t-2}$ and $f_t - f_{t-2}$ for two week hedges, and $s_t - s_{t-4}$ and $f_t - f_{t-4}$ for four week hedges (s_t = cash price at time t and f_t = futures price at time t);
β_0, β_1 = regression parameters where HR* = β_1; and
e_t = residual term.

As noted before, the duration effect is affected by the fact that longer hedge durations are lifted closer to contract expiration. To eliminate this influence, the stability of HR* with respect to weeks remaining until contract expiration was analysed by running OLS simple regressions for the one, two and four week hedge durations separately. Therefore, one week duration hedges were divided into those that occur zero, one, two, . . . etc. weeks before contract expiration; two week duration hedges were divided into those that occur zero, two, four, . . . etc. weeks before expiration; and four week duration hedges were divided into those that occur zero and four weeks before expiration. This resulted in, for example, 40 observations in total for the four week hedges, because the four week hedges lifted 8 weeks from expiration were initiated 12 weeks from expiration, which just fell outside the period under consideration, and where thus left out.

Lindahl (1992) uses the following OLS multiple regression equation, which employs dummy variables to represent the different subsets of data (based on weeks to expiration):

$$\Delta s_t = \beta_0 + \beta_1 \Delta f_t D_1 + \beta_2 \Delta f D_2 + \beta_3 \Delta f_t D_3 + \ldots + \beta_{n+1} \Delta f_t D_{n+1} + e_t \quad \ldots (11)$$

where:

β_0, β_1, B_2, . . ., β_{n+1} = regression parameters where β_1, β_2, . . ., β_{n+1} are HR* estimates for hedges with zero, one, two, . . ., n weeks to expiration respectively;
D_1 = 1 for hedges with 0 weeks to expiration, and 0 otherwise;
D_2 = 1 for hedges with 1 week to expiration, and 0 otherwise;
$D_3 \ldots D_{n+1}$ = 1 for hedges with 2 . . ., n weeks to expiration, and 0 otherwise;
n = 11 (weeks); and
Δs_t, Δf_t and e_t are as defined in Eq. (10).

The reason for further analysis of the expiration effect by multiple regression is that in multiple regressions only one constant is estimated, opposed to one constant per subset of data in the simple regressions. The multiple regression, therefore, is statistically more powerful.

Since cash and futures must be at equilibrium at contract expiration and because the empirical results of the simple regressions showed that hedges with zero weeks to expiration have HR* values that are not significantly different from 1, except for those of the four week hedges, the multiple regression equation (Eq. (11)) was restricted. In this restricted least squares (RLS) multiple regression model, the coefficient for zero weeks to expiration was restricted to equal 1, and this is the so-called base case. The RLS regression is expressed as follows:

$$\Delta s_t = \beta_1 (\Delta s_t D_1 + \Delta f_t M_1) + \beta_2 \Delta F_t D_2 + \beta_3 \Delta f_t D_3 + \ldots + \beta_{n+1} \Delta f_t D_{n+1} + e_t \quad \ldots (12)$$

where:

β_1 = 1, by definition, for the base case (0 weeks to expiration);
$\beta_2, \ldots \beta_{n+1}$ = regression coefficients representing the differences from the base case;
M_1 = 0 for hedges with 0 weeks to expiration, and 1 otherwise, and
all other variables are as defined in Eqs. (10) and (11).

RLS estimates of HR* were obtained by adding the regression coefficients representing the differences to the base case of 1.

The regression coefficients representing the differences from the base case, obtained by using the RLS multiple regression model, were further analysed to ascertain a rate of convergence as the difference coefficients approach 0 and as HR* values approach the beta hedge ratio. To achieve this, the difference coefficients were added to the base case of 1, resulting in the RLS minimum variance hedge ratios. The linear trend analysis was done by regressing these HR*s (the dependent variable) against the number of weeks remaining until contract expiration (the independent variable). In equation form:

$$HR_i^* = \beta_0 + \beta_1 X_i + e_i \quad \ldots (13)$$

where:

X_i = weeks 0, 1, 2, 3, . . . n to expiration for one week duration hedges, and weeks 0, 2, 4, . . . n to expiration for two week duration hedges;
n = 11 and 10 for one and two week hedge durations respectively;
β_0, β_1 = regression parameters where β_1 indicates HR*'s rate of convergence per week towards the beta hedge ratio; and
i = i th observation; the number of observations are 12 and 6 for one and two week hedge durations respectively.

Again, other variables are as defined earlier.

5. EMPIRICAL RESULTS

5.1 The duration effect

Table 1 reports hedge ratio information for one, two and four week hedge durations for all hedges that are lifted within twelve weeks of contract expiration for the All Share, All Gold and Industrial Indices futures contracts. It shows that the minimum variance hedge ratios are significantly less than the beta hedge ratio, and that they increase as hedge duration increases from one to four weeks.

At this stage it must, however, be pointed out that HR* values calculated for this five year period on the local SIF market were, on average, approximately 10% lower than those on the US market over a similar period. This observation is attributed to the fact that, due to the much lower liquidity of the local market compared to that of the US market, the covariance between spot price changes and futures price changes on the SA market is lower relatively to that on the US market. Therefore, where Lindahl (1992) suggested using the 90% confidence level in determining the cutoff point for all "yes" and "no" decisions with respect to the hypotheses testing, this study used the 95% confidence level for such decisions.

Table 1 shows that HR* values ranged from 75,14% to 91,26% of the value of the cash portfolio position.

Thus, over the entire period investigated the classic one-to-one hedge would have been suboptimal in reducing the variance of the hedged position. In fact, the beta hedge ratio would have represented an overinvestment in futures with a consequent overpayment of margin and transaction costs. The value of HR* does not seem to be sensitive to the choice of the share index futures contract used. In this regard, HR*

values for the All Gold Index futures contract are slightly higher than those for the other two indices futures. This is ascribed to slightly greater basis change volatility between the All Gold Index futures contract and its underlying index compared to that of the other two market index contracts, due to volatility in the underlying parameters which normally affects sentiment in the cash market, namely the finrand, gold price and market sentiment in respect of the bullion price. This could all be contributing towards the slightly different behaviour of the HR* values for the All Gold Index futures contract.

TABLE 1
Minimum Variance vs. β Hedge Ratios: the Duration Effect

Share Index Futures Contract	Hedge Duration (weeks)	HR* Minimum Variance Hedge Ratio	Standard Errors	R^2 (hedging effectiveness)	No. of Observations	Is HR* significantly less than 1, the beta hedge ratio? (confidence level)
All Share	1	0,7961	0,0245	0,8263	224	yes (99%)
	2	0,8782	0,0299	0,8944	104	yes (99%)
	4	0,8719	0,0338	0,9406	44	yes (99%)
All Gold	1	0,8635	0,0222	0,8723	224	yes (99%)
	2	0,8918	0,0195	0,9534	104	yes (99%)
	4	0,9126	0,0235	0,9729	44	yes (99%)
Industrial	1	0,7514	0,0285	0,7582	224	yes (99%)
	2	0,8296	0,0388	0,8174	104	yes (99%)
	4	0,8370	0,0523	0,8591	44	yes (99%)

With reference to the effectiveness of the hedging strategy, the risk-minimising hedge, as could be expected, was quite effective in reducing the variance of hedged positions, with the four week duration hedge on the All Gold Index futures contract achieving an elimination as high as 97,29% of the spot price variability of the corresponding unhedged position. The R^2 values in Table 1 also show an increase with hedge duration increases. Since R^2 is a relative rather than an absolute measure of risk reduction efficiency, direct comparisons between R^2 values of the three different share index futures contracts are not feasible.

In conclusion, the alternative hypothesis, namely that HR* is less than the beta hedge ratio of 1, was accepted throughout. This study then confirms the findings of Lindahl (1992) with respect to share index futures, i.e. HR*s are significantly less than the beta hedge ratio, that they increase as hedge duration increases from one to four weeks and that R^2 values also increase as hedge duration increases. However, as emphasised by Lindahl (1992), the results in Table 1 are influenced by the fact that, on average, longer duration hedges are lifted closer to contract expiration. This influence will be examined in the next section.

TABLE 2
Minimum Variance vs. β Hedge Ratios: Expiration Effect: All Share Index Futures

Weeks to Expiration		HR*	Standard Errors	R^2	No. of Observations	Is HR* significantly less than 1, the beta hedge ratio? (confidence level)
1-week hedges	0	0,9347	0,0746	0,8972	20	no
	1	0,7366	0,0714	0,8553	20	yes (99%)
	2	0,5492	0,0831	0,7081	20	yes (99%)
	3	0,8677	0,0513	0,9406	20	yes (99%)
	4	0,7217	0,0751	0,8368	20	yes (99%)
	5	0,7810	0,0779	0,8482	20	yes (99%)
	6	0,7162	0,0764	0,8300	20	yes (99%)
	7	0,7322	0,0690	0,8622	20	yes (99%)
	8	0,9119	0,1458	0,6847	20	no
	9	0,9387	0,1098	0,8023	20	no
	10	0,8902	0,0985	0,8193	20	no
	0-10	0,7960	0,0247	0,8264	220	yes (99%)
2-week hedges	0	0,9410	0,0498	0,9519	20	no
	2	0,7474	0,0683	0,8693	20	yes (99%)
	4	0,8400	0,0638	0,9060	20	yes (99%)
	6	0,7800	0,0717	0,8681	20	yes (99%)
	8	1,0194	0,0780	0,9047	20	no
	0-8	0,8746	0,0309	0,8907	100	yes (99%)
4-week hedges	0	0,9011	0,0494	0,9487	20	yes (97,5%)
	4	0,8416	0,0569	0,9241	20	yes (99%)
	0 and 4	0,8775	0,0376	0,9348	40	yes (99%)

5.2 The expiration effect

Tables 2 to 4 report hedge ratio information for the three share index futures when the data were subdivided into number of weeks remaining until contract maturity and simple OLS regressions were run separately for each of the subperiods. Tables 5 to 10 show the results of the OLS and RLS multiple regressions, which generally reveal the same trends shown in the simple OLS regression results.

As proposed by the theory underlying the expiration effect, the results show that, in general, the HR* values increase, although only slightly, towards the naive model hedge ratio of 1 as hedges are lifted closer to contract expiration. In this regard, the null hypothesis, i.e. HR* = 1, was accepted for at least the hedges with 0 weeks to contract maturity for all three share index futures, except in the case of the four week duration hedges. The latter observation, i.e. rejection of the null hypothesis for the four week hedges, might be explained, as evidenced by a comparison of the respective results, by a slightly weaker expiration effect experienced on the local market compared to that on the American market. Explaining this in terms of fundamentals, this could be due to a possible higher futures price volatility as contract maturity is approached on the local market relatively to the US market. Also, the results of the four week hedges could be too sample sensitive to yield any definitive conclusions.

TABLE 3
Minimum Variance vs. β Hedge Ratios: Expiration Effect: All Gold Index Futures

Weeks to Expiration		HR*	Standard Errors	R^2	No. of Observations	Is HR* significantly less than 1, the beta hedge ratio? (confidence level)
1-week hedges	0	0,9768	0,0499	0,9551	20	no
	1	0,9293	0,0537	0,9433	20	no
	2	0,7735	0,0850	0,8215	20	yes (99%)
	3	0,9612	0,0472	0,9584	20	no
	4	0,8674	0,0615	0,9170	20	yes (97,5%)
	5	0,9042	0,0789	0,8795	20	no
	6	0,8360	0,0980	0,8017	20	yes (95%)
	7	0,7246	0,0878	0,7910	20	yes (99%)
	8	0,9433	0,0689	0,9125	20	no
	9	0,8715	0,0764	0,8785	20	yes (95%)
	10	0,9911	0,0932	0,8627	20	no
	0-10	0,8703	0,0222	0,8757	220	yes (99%)
2-week hedges	0	0,9684	0,0329	0,9796	20	no
	2	0,8476	0,0296	0,9785	20	yes (99%)
	4	0,9578	0,0647	0,9240	20	no
	6	0,9126	0,0362	0,9724	20	yes (99%)
	8	0,8107	0,0459	0,9454	20	yes (99%)
	0-8	0,8879	0,0196	0,9544	100	yes (99%)
4-week hedges	0	0,8868	0,0353	0,9723	20	yes (99%)
	4	0,9402	0,0373	0,9725	20	no
	0 and 4	0,9119	0,0254	0,9714	40	yes (99%)

TABLE 4
Minimum Variance vs. β Hedge Ratios: Expiration Effect: Industrial Index Futures

Weeks to Expiration		HR*	Standard Errors	R^2	No. of Observations	Is HR* significantly less than 1, the beta hedge ratio? (confidence level)
1-week hedges	0	1,0281	0,0734	0,9161	20	no
	1	0,8821	0,0778	0,8773	20	no
	2	0,6384	0,0574	0,8731	20	yes (99%)
	3	0,8689	0,0770	0,8762	20	yes (95%)
	4	0,7058	0,1040	0,7190	20	yes (99%)
	5	0,7250	0,0967	0,7575	20	yes (99%)
	6	0,6231	0,1127	0,6292	20	yes (99%)
	7	0,6433	0,0683	0,8315	20	yes (99%)
	8	0,6562	0,1104	0,6625	20	yes (99%)
	9	0,8606	0,1428	0,6687	20	no
	10	0,5834	0,0776	0,7586	20	yes (99%)
	0-10	0,7514	0,0287	0,7584	220	yes (99%)
2-week hedges	0	0,9782	0,0625	0,9316	20	no
	2	0,6837	0,0996	0,7235	20	yes (99%)
	4	0,7526	0,0982	0,7654	20	yes (99%)
	6	0,7173	0,0947	0,7614	20	yes (99%)
	8	0,9538	0,0809	0,8852	20	no
	0-8	0,8357	0,0399	0,8174	100	yes (99%)
4-week hedges	0	0,8907	0,0656	0,9111	20	yes (95%)
	4	0,8532	0,1009	0,7988	20	no
	0 and 4	0,8754	0,0604	0,8468	40	yes (97,5%)

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TABLE 5
Multiple Regression and the Expiration Effect: All Share Index Futures

Hedge Duration	Week before Expiration	Coefficient Estimates (HR*)	Standard Errors
1 week	0	0,9386	0,0892
	1	0,7489	0,0854
	2	0,5784	0,0802
	3	0,8850	0,0579
	4	0,7262	0,0735
	5	0,7852	0,0956
	6	0,7379	0,0785
	7	0,7093	0,0703
	8	0,9093	0,1051
	9	0,9303	0,0765
	10	0,8822	0,1021
	11	0,8509	0,4298
R^2 = 0,8338 No. of obs.: 224			
2 weeks	0	0,9444	0,0714
	2	0,7543	0,0639
	4	0,8507	0,0648
	6	0,8109	0,0688
	8	1,0187	0,0607
	10	0,9633	0,1539
R^2 = 0,9014 No. of obs.: 104			
4 weeks	0	0,9006	0,0529
	4	0,8710	0,0524
	8	0,8129	0,0959
R^2 = 0,9366 No. of obs.: 44			

TABLE 6
Multiple Regression and the Expiration Effect: All Gold Index Futures

Hedge Duration	Week before Expiration	Coefficient Estimates (HR*)	Standard Errors
1 week	0	0,9215	0,0770
	1	0,9290	0,0883
	2	0,7777	0,0815
	3	0,9536	0,0496
	4	0,8665	0,0645
	5	0,9095	0,1162
	6	0,8206	0,0679
	7	0,6680	0,0580
	8	0,9469	0,0905
	9	0,8717	0,0766
	10	0,9913	0,0899
	11	0,5002	0,1497
R^2 = 0,8774 No. of obs.: 224			
2 weeks	0	0,9379	0,0500
	2	0,8357	0,0380
	4	0,9546	0,0571
	6	0,9012	0,0455
	8	0,8106	0,0512
	10	0,9288	0,0853
R^2 = 0,9478 No. of obs.: 104			
4 weeks	0	0,8533	0,0422
	4	0,9311	0,0437
	8	0,8356	0,1050
R^2 = 0,9555 No. of obs.: 44			

TABLE 7
Multiple Regression and the Expiration Effect: Industrial Index Futures

Hedge Duration	Week before Expiration	Coefficient Estimates (HR*)	Standard Errors
1 week	0	1,0055	0,1352
	1	0,8608	0,0960
	2	0,6823	0,0939
	3	0,8904	0,0783
	4	0,7193	0,0867
	5	0,7422	0,1012
	6	0,6809	0,0899
	7	0,6372	0,0825
	8	0,6589	0,1035
	9	0,8624	0,0767
	10	0,5886	0,1149
	11	0,8094	0,5770
R^2 = 0,7688 No. of obs.: 224			
2 weeks	0	0,9379	0,0935
	2	0,6754	0,1070
	4	0,7774	0,0750
	6	0,7593	0,0982
	8	0,9563	0,0694
	10	0,6543	0,2340
R^2 = 0,8293 No. of obs.: 104			
4 weeks	0	0,8607	0,0766
	4	0,9004	0,0786
	8	0,6708	0,1294
R^2 = 0,8678 No. of obs.: 44			

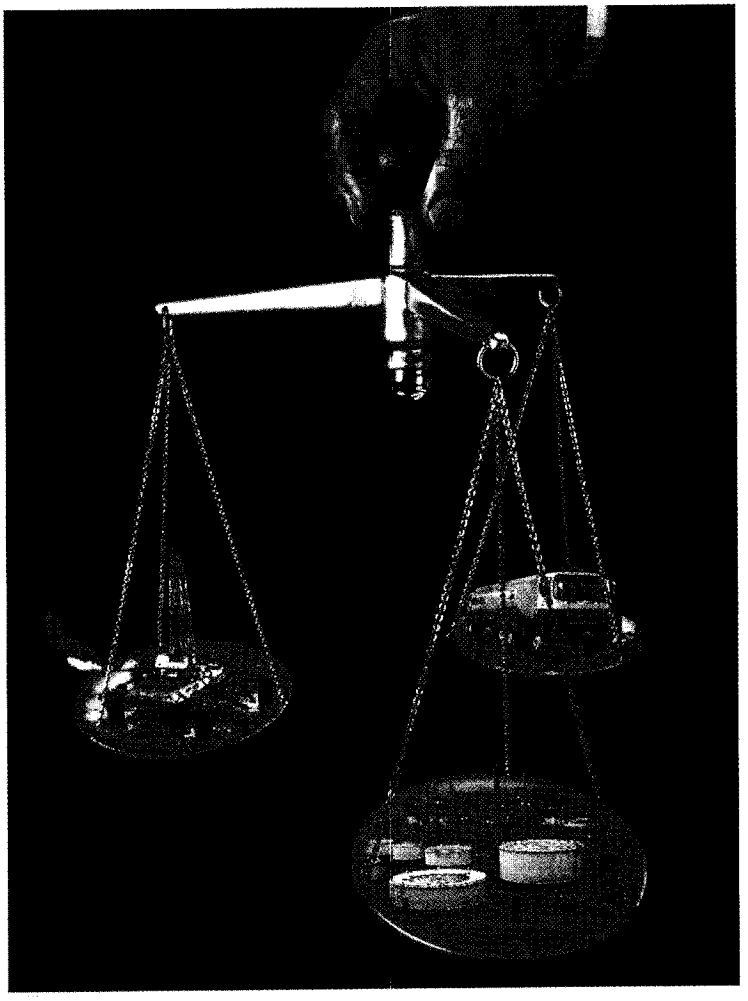

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TABLE 8
Multiple Regression and the Expiration Effect: All Share Index Futures

Hedge Duration	Week before Expiration	Coefficient Estimates	Standard Errors	t-value	P > t	HR*	Is coefficient estimate (β_2, ..., β_{n+1} in eq. (4.3)) significantly less than 0? (confidence level)
1 week	0	1	0,0872	11,4653	0	1	no (by restriction)
	1	-0,2511	0,1202	-2,0883	0,0380	0,7489	yes (97,5%)
	2	-0,4216	0,1168	-3,6084	0,0004	0,5784	yes (99%)
	3	-0,1150	0,1037	-1,1090	0,2687	0,8850	no
	4	-0,2738	0,1126	-2,4312	0,0159	0,7262	yes (99%)
	5	-0,2148	0,1272	-1,6881	0,0929	0,7852	yes (95%)
	6	-0,2621	0,1158	-2,2638	0,0246	0,7379	yes, (97,5%)
	7	-0,2907	0,1107	-2,6270	0,0092	0,7093	yes (99%)
	8	-0,0907	0,1341	-0,6762	0,4997	0,9093	no
	9	-0,0697	0,1145	-0,6084	0,5436	0,9303	no
	10	-0,1178	0,1319	-0,8927	0,3730	0,8822	no
	11	-0,1491	0,4257	-0,3503	0,7264	0,8509	no
	R^2 = 0,8438						
	No. of obs.: 224						
2 weeks	0	1	0,0708	14,1225	0	1	no (by restriction)
	2	-0,2457	0,0936	-2,6251	0,0101	0,7543	yes (99%)
	4	-0,1493	0,0942	-1,5859	0,1160	0,8507	no
	6	-0,1891	0,0967	-1,9558	0,0533	0,8109	yes (95%)
	8	0,0187	0,0916	0,2039	0,8389	1,0187	no
	10	-0,0367	0,1635	-0,2243	0,8230	0,9633	no
	R^2 = 0,9095						
	No. of obs.: 104						
4 weeks	0	1	0,0451	22,1796	0	1	no (by restriction)
	4	-0,1290	0,0611	-2,1105	0,0410	0,8710	yes (97,5%)
	8	-0,1871	0,0880	-2,1269	0,0395	0,8129	yes (97,5%)
	R^2 = 0,9607						
	No. of obs.: 44						

TABLE 9
Multiple Regression and the Expiration Effect: All Gold Index Futures

Hedge Duration	Week before Expiration	Coefficient Estimates	Standard Errors	t-value	P > t	HR*	Is coefficient estimate (β_2, ..., β_{n+1} in eq. (4.3)) significantly less than 0? (confidence level)
1 week	0	1	0,0773	12,9287	0	1	no (by restriction)
	1	-0,0710	0,1153	-0,6163	0,5384	0,9290	no
	2	-0,2223	0,1105	-2,0116	0,0455	0,7777	yes (97,5 %)
	3	-0,0464	0,0910	-0,5102	0,6104	0,9536	no
	4	-0,1335	0,0994	-1,3425	0,2809	0,8665	no
	5	-0,0905	0,1365	-0,6634	0,5078	0,9095	no
	6	-0,1794	0,1015	-1,7672	0,0786	0,8206	yes (95%)
	7	-0,3320	0,0956	-3,4732	0,0006	0,6680	yes (99%)
	8	-0,0531	0,1169	-0,4543	0,6501	0,9469	no
	9	-0,1283	0,1071	-1,1978	0,2323	0,8717	no
	10	-0,0087	0,1164	-0,0747	0,9405	0,9913	no
	11	-0,4998	0,1642	-3,0433	0,0026	0,5002	yes (99%)
	R^2 = 0,8852						
	No. of obs.: 224						
2 weeks	0	1	0,0469	21,3103	0	1	no (by restriction)
	2	-0,1643	0,0581	-2,8278	0,0057	0,8357	yes (99%)
	4	-0,0454	0,0697	-0,6520	0,5159	0,9546	no
	6	-0,0988	0,0624	-1,5838	0,1165	0,9012	no
	8	-0,1894	0,0659	-2,8741	0,0050	0,8106	yes (99%)
	10	-0,0712	0,0902	-0,7890	0,4320	0,9288	no
	R^2 = 0,9575						
	No. of obs.: 104						
4 weeks	0	1	0,0346	28,8871	0	1	no (by restriction)
	4	-0,0689	0,0467	-1,4773	0,1472	0,9311	no
	8	-0,1644	0,0828	-1,9866	0,0537	0,8356	yes (97,5%)
	R^2 = 0,9772						
	No. of obs.: 44						

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TABLE 10
Multiple Regression and the Expiration Effect: Industrial Index Futures

Hedge Duration	Week before Expiration	Coefficient Estimates	Standard Errors	t-value	P > t	HR*	Is coefficient estimate (β_2, ..., β_{n+1} in eq. (4.3)) significantly less than 0? (confidence level)
1 week	0	1	0,1273	7,8543	0	1	no (by restriction)
	1	-0,1392	0,1588	-0,8768	0,3816	0,8608	no
	2	-0,3177	0,1576	-2,0167	0,0450	0,6823	yes (97,5 %)
	3	-0,1096	0,1490	-0,7358	0,4626	0,8904	no
	4	-0,2807	0,1535	-1,8295	0,0687	0,7193	yes (95%)
	5	-0,2578	0,1619	-1,5924	0,1128	0,7422	no
	6	-0,3191	0,1552	-2,0552	0,0411	0,6809	yes (97,5%)
	7	-0,3628	0,1512	-2,3999	0,0173	0,6372	yes (99%)
	8	-0,3411	0,1633	-2,0883	0,0380	0,6589	yes (97,5%)
	9	-0,1376	0,1482	-0,9282	0,3544	0,8624	no
	10	-0,4114	0,1706	-2,4109	0,0168	0,5886	yes (99%)
	11	-0,1906	0,5843	-0,3262	0,7446	0,8094	no
	R^2 = 0,7742						
	No. of obs.: 224						
2 weeks	0	1	0,0925	10,8075	0	1	no (by restriction)
	2	-0,3246	0,1384	-2,3455	0,0210	0,6754	yes (99%)
	4	-0,2226	0,1173	-1,8971	0,0608	0,7774	yes (95%)
	6	-0,2407	0,1322	-1,8205	0,0717	0,7593	yes (95%)
	8	-0,0437	0,1141	-0,3829	0,7026	0,9563	no
	10	-0,3457	0,2433	-1,4206	0,1586	0,6543	no
	R^2 = 0,8421						
	No. of obs.: 104						
4 weeks	0	1	0,0704	14,2056	0	1	no (by restriction)
	4	-0,0996	0,0960	-1,0383	0,3052	0,9004	no
	8	-0,3292	0,1284	-2,5633	0,0141	0,6708	yes (99%)
	R^2 = 0,9090						
	No. of obs.: 44						

The R^2 values show, unlike the findings of Lindahl (1992), a basic trend of increasing as contract expiration is neared. This is consistent with what Chen, Sears and Tzang (1987) have experienced in their investigation of commodity futures. However, it must be stressed again that any summary statement involving R^2 values must be done carefully.

It is thus concluded that the simple and multiple regressions show that a general, albeit vague, pattern exists in which the further away the hedge is from contract expiration, the lower the minimum variance hedge ratio. Whereas a strong duration effect was identified on the local market, the same market showed only a slight presence of an expiration effect. Trying to explain this in terms of the theory of the expiration effect, which assumes that futures prices become less volatile as expiration is approached, it could be that this assumption does not hold for the SA market.

As far as the hypotheses testing in deriving the above conclusions are concerned, it can be said that the probability of making a type I error, i.e. rejecting the null hypothesis when it is indeed true, was low for the following reason: the probability of making a type I error is indicated by the confidence level, and in this study a confidence level of 95% was used as a cutoff point in making the relevant decisions. Furthermore, no assumptions such as independence within and among samples, which if not met, could lead to uncertainty about the size of type I and type II errors, were made. On the other hand, it must be emphasised that the acceptance of the null hypothesis does not mean it is true, but only indicates that the null hypothesis could not be rejected at the stated confidence level.

Table 11 shows the linear trend regression analysis results. As was expected from the results of the RLS multiple regressions, no clear conclusions regarding a rate of convergence could be made.

Residual plots, useful for the identification of conditions such

TABLE 11
Linear Trend Regression Results

Shares Index Futures Contract	Hedge Duration (weeks)	Constant	Standard Error (Constant)	Rate of Convergence Coefficient	Standard Error (Coefficient)	R^2	No. of Observations
All Share	1	0,7726	0,0656	0,0072	0,0101	0,0478	12
	2	0,8589	0,0849	0,0081	0,0140	0,0777	6
All Gold	1	0,9490	0,0750	-0,0175	0,0116	0,1861	12
	2	0,9398	0,0542	-0,0069	0,0089	0,1302	6
Industrial	1	0,8524	0,0612	-0,0166	0,0094	0,2368	12
	2	0,8683	0,1095	-0,0129	0,0181	0,1130	6

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as heteroscedasticity, autocorrelation and deviations from linearity in the regression model, were generated. No patterns characteristic of these problems were detected. The coefficients of correlation in the correlation matrices were, in general, not close to unity, indicating that no serious problems with respect to multicollinearity were encountered. Table 12 reports the Durbin-Watson statistics for the three SIF contracts. Since values near 2 indicate no first-order autocorrelation, again, in general, no serious problems were detected.

TABLE 12
Autocorrelation: Durbin-Watson statistic

Eq. (11), OLS			
SIF contract	Hedge duration		
	1 week	2 weeks	4 weeks
All Share	1,931	2,071	1,782
All Gold	1,676	1,530	1,261
Industrial	2,118	2,299	2,351
Eq. (12), RLS			
SIF contract	Hedge duration		
	1 week	2 weeks	4 weeks
All Share	1,942	2,062	1,866
All Gold	1,725	1,718	1,217
Industrial	2,122	2,286	2,443

6. CONCLUSIONS

The minimum variance hedge ratio is a popular decision rule in hedging literature. However, research done on the American share index futures market to compare the performance of HR* against that of the classic or beta hedge ratio yielded mixed results. On the South African market, however, no empirical work has been done with respect to using HR* as a hedging strategy.

Against this background an empirical analysis was undertaken to investigate the stability of HR* with respect to hedge duration and time to contract expiration. Hedge durations of one, two and four weeks were compared, and were further subdivided into the number of weeks remaining until contract maturation. The resulting HR* values were analysed for predictable trends, and were statistically compared with the naive or beta hedge ratio.

The results of this study have shown that the minimum variance hedge ratios for the All Share, All Gold and Industrial Index futures contracts are significantly less than the classic one-to-one hedge ratio, and that they increase as hedge duration increases from one to four weeks. However, this effect of hedge duration on HR* is influenced by the fact that, on average, longer hedge durations are lifted closer to contract expiration, the so-called expiration effect. As to the effectiveness of HR* as a hedging strategy, it was quite effective in reducing the variance of the unhedged position.

When the data were subdivided into weeks remaining to contract maturation the results have confirmed that HR* increases towards the beta hedge ratio as the contract expiration date is approached. In this regard, however, the trend is less distinctive and therefore, HR*'s estimated rates of convergence towards the beta hedge ratio have yielded indifferent results. The only logical explanation that could be offered in terms of fundamentals is that futures prices on the local market do not necessarily become less volatile as expiration is approached.

In the final instance, this study concludes that hedging an established cash portfolio with share index futures contracts should be an on-going adjusting process: contracts should be added to the hedged portfolio as hedge durations increase and approach the contract expiration date.

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Accounting rate of return revisited

ABSTRACT

Financial theory advocates the use of discounted cash flow techniques for purposes of making investment dicisions. Techniques such as Accounting Rate of Return (ARR) are rejected for a variety of reasons. Shareholders, however, cannot *know* that a company is making positive net present value investments they can only hope! Shareholders make use of information from the annual financial statements to calculate ratios such as Return on Assets (ROA) to evaluate managements' investment policies. Having briefly considered what companies appear to do in practice, the relationship between ARR and ROA, and ultimately Return on Equity and Earnings Yield is demonstrated, with the concluding proposal that, despite its faults, ARR has an important role to play in investment decision making.

ACCOUNTING RATE OF RETURN REVISITED

When making investment decisions a variety of techniques are available to the potential investor. These techniques include Payback, Accounting Rate of Return (ARR), Internal Rate of Return (IRR) and Net Present Value (NPV). For various reasons (some of which are discussed below) Payback and ARR are completely rejected as viable techniques while IRR is criticised as flawed. This leaves NPV as the most commonly recommended investment decision technique by current financial textbooks.

In view of the authority of the authors of financial textbooks together with the weight of academic opinion it would be reasonable to presume that all investors would only make use of discounted cash flow techniques (in other words the Net Present Value rule) to evaluate all investment decisions. This is not the case and a variety of research (refer Appendix I) in the United Kingdom, the United States and in South Africa has shown that, while there is a steady movement towards the use of discounted cash flow techniques, ARR is used in an average of 45% of investment decisions. (It should be noted that this percentage is high because the various surveys allow for multiple evaluation techniques.) The question arises as to why a technique which academics consider to have major flaws should be used at all.

The ARR technique uses accounting profits expected to arise from the investment over its expected life and determines the average annual return on the average investment. This is compared with a predetermined yardstick – usually the company's *required* after tax return on investment (ROI) or return on assets (ROA) and, if the investment's ARR is greater than or equal to this predetermined rate, the project is accepted. The ARR technique is criticised for a variety of reasons. Anthony and Reece state that "A method which does not consider the time value of money cannot produce an accurate result." (1989, p. 806). Furthermore, for the ARR method the timing of cash flows, so important for present value calculations, is not considered. Similarly the method is criticised for making use of an often arbitrary yardstick (although we shall see later that this is not necessarily the case). Finally the technique is criticised for relying on accounting numbers which are subject to a variety of accounting policies, interpretations and, dare it be said, manupulation.

There have been attempts to reconcile ARR with IRR as investment decision criteria. In their attempt to evaluate ARR, McIntyre and Icerman (1985) carried out an anourmous empirical exercise comparing ARR with IRR for 9 120 cash flows based on eight different cash flow scenarios from two to twenty years in duration. They demonstrated that rates of return produced by ARR calculations differed substantially from returns produced by IRR calculations for the projects. (The IRR being the inherent rate of return, on a discounted basis, generated by the investment.) While they report on the differences between returns produced however, they do not indicate whether the two methods would have led to different decisions. They further do not take into account the inherent problem with IRR and that is the assumption that cash flows from the project are reinvested at the IRR over the life of the project.

In any event, the problem is not whether ARR produces the same return as IRR. Logically this could not be expected as one (ARR) measures accounting returns while the other (IRR) measures the return on cash flows. The problem, at this stage, is not even whether both methods lead to the same decision. The problem is that shareholders should be considered when determining whether to invest or not. Financial textbooks predicate that the only way to make a "good" investment decision is to determine the cash flows arising out of the project, discount these at a suitable rate (usually the Weighted Average Cost of Capital, possibly adjusted for project specific risk) and then to accept the project if it produces a Net Present Value (NPV) greater than zero. In theory this may be correct.

If, however, textbooks dealing with financial analysis or the plethora of articles on the subject are consulted it is found that shareholders and analysts are extremely concerned about the Return on Assets (ROA), Return on Equity (ROE), Earnings per Share and Price Earnings ratios or Earnings Yields. All the above measurements of the profitability of a company and the efficiency of management are based on accounting profits – the same base as the ARR. If companies continuously invest in projects which yield positive NPV's this should be favourably reflected in the bottom line, the reported profits. However, shareholders do not know that companies are investing in projects with positive NPV's (they can only hope!). What shareholders do see are the accounting profits and it is on this basis that companies and their management are evaluated. Furthermore, all calculations of the cost of equity capital used in discounting are based to a greater or lesser extent on the company's returns which in turn are derived from the ARR. Management should therefore not ignore the ARR and, while not necessarily using it as a decision criterion, should ensure that, in the interests of shareholders, any project in which they invest also produces an ARR greater than or equal to the current after tax ROA. If there is concern as to the validity of this usage then consideration should be given to making use of a modified ARR as described below.

It is generally agreed that the investment and the financing decisions should be kept separate, although, by virtue of the fact that the Weighted Average Cost of Capital (WACC) is the most commonly recommended discount rate, the cost of financing is taken into account. When it comes to the calculation of ARR however, interest is not taken into account. Ross, Westerfield and Jaffe state that the ARR is "the average project earnings after taxes and depreciation, divided by the average book value of the investment during its life." (1988, p. 160). It would make far more sense to use a modified ARR (ARRmod) which would take interest into account. This can be done very easily, on the same basis as WACC is calculated, by either determining the company's proposed capital structure or using the existing structure and applying an interest charge based on the marginal cost of borrowing and the debt funded

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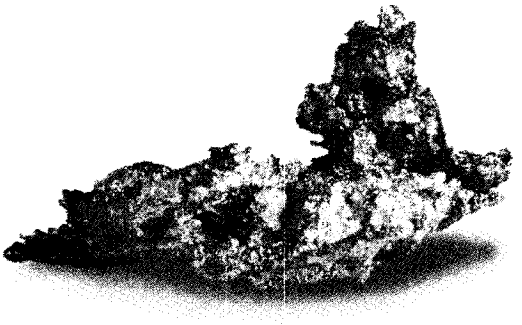

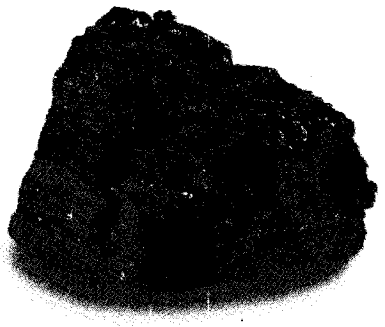

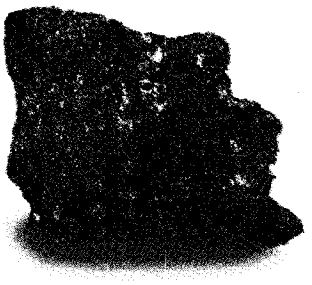

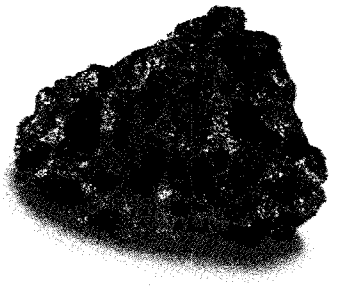

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portion of the investment, to the accounting profits and tax calculations. This would then produce ARR_{mod} which would be the basis of the reported earnings the project will generate.

In a single project company the ROA would vary for two reasons. Firstly the income could vary from year to year and secondly the asset base, being at book value, would reduce annually thus tending to produce higher ROA's towards the end of the project. However, if the company is operating on a continual, multi project basis where assets are being replaced regularly then the use of the book value of total assets will approximately equate with the average investment used in the ARR calculations. Similarly, if the company is involved in the same business continually, the income will tend to smooth out over time and annual income (profit) can be assumed to equate to average income for ARR purposes. While ROA generally refers to the entire company and ARR is project specific, the ROA is merely the sum of a number of ARR's. In the example below, for ease of calculation, it is assumed that the Average Total Assets used in the ROA calculation equates to Average Investment in the ARR calculation while Earnings before Interest and Tax (EBIT) used initially for ROA equates to Average Income before Tax as used in the ARR calculation. The following calculations aim to explain the impact of ROA (and ARR_{mod}) on the earnings yield.

While there is debate over the calculation of ROA (Correia et al., 1993, p 191), we can commence with a calculation on a pretax and pre interest basis.

ROA_{pit} = Return on Assets pre interest and taxation
= Earnings before interest and tax (EBIT)/Ave. total assets
= Average profit/Average investment
= $ARR_{pre\text{-}tax}$

ROA_{piat} = Return on Assets pre interest and after tax
= Earnings before interest & after tax (EBIAT)/Ave. total assets
= [Average profit x (1−Effective tax rate)]/Ave. investment
= ARR (as defined)

ROA_{ait} = Return on Assets after interest and tax
= Net operating profit after tax (NOPAT)/Ave. total assets
= [(Ave. profit −Interest) x (1−Eff. tax rate)]/Ave. investment
= ARR−[Interest x (1−Effective rax rate)/Ave. investment]
= **ARR_{mod}**

Now we can also show that

ARR_{mod} = ROA_{pit} x [1−Interest/EBIT] x [1−Effective tax rate]
= {EBIT x [1−Int./EBIT] x [1−Eff. tax rate]}/Total ave. assets
= Net Operating Profit after Tax (NOPAT)/Total average assets

ROE = Return on Equity
= Net operating profit after tax (NOPAT)/Average equity
= NOPAT/Total average assets x [Total average liabilities + Average equity]/Average equity
= ARR_{mod} x [(Total average liabilities/Average equity)+ 1]

Finally, Earnings Yield

EY = ROE x [Net Asset Value/Market Capitalisation]

Thus it can be seen from the above that the ARR_{mod} (and indirectly ARR as well) has a direct impact on the earnings yield and therefore, ultimately, on the company's share price. ARR_{mod} should therefore be taken into account in determining the acceptability of a project. Accordingly, while accepting that there are inherent and valid problems concerning the use of ARR, particularly with regard to the timing of cash flows, this is a measure which, due to its relationship to ROA and ROE, shareholders and analysts use constantly. The ARR or its modified form ARR_{mod}, should continue to be used by companies when making investment decisions as it does provide a market orientated benchmark against which projects should be measured. Possibly the high level of use by companies indicates a greater wisdom than academics often give them credit for.

APPENDIX 1
EVALUATION METHODS USED IN CAPITAL BUDGETING DECISIONS

RESEARCHER	YEAR	Payback	ARR	IRR	NPV
Kim et al.	1971	71%	55%	33%	27%
Pike	1975	73%	51%	44%	32%
Kim et al.	1977	49%	22%	13%	38%
Pike	1981	81%	49%	57%	39%
Taylor	1984	93%	56%	39%	63%
John	1985	77%	57%	74%	43%
Kim et al.	1985	64%	33%	31%	41%
Andrews & Butler	1986	69%	41%	60%	40%
Pike	1986	92%	56%	75%	68%
McIntyre & Icerman	1987	80%	33%	28%	36%
Parry & Firer**	1990	57%	65%	69%	51%
AVERAGE*		75%	45%	45%	43%

* The totals in all cases exceed 100% as questionnaires used by all researchers allowed for the use of more than one method by participating companies. In Kim's research (Kim et al., 1986), the percentage usage of each method is the sum of the primary and secondary methods used and therefore, as this excludes any further usage, the usage figures tend to be slightly understated.

** Parry and Firer (1990) refer to Return on Investment (ROI) in place of ARR. While ROI is not defined in the paper, it seems reasonable to assume that the two terms are synonymous.

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D Hodge, University of Bophuthatswana, School of Administration and Management*

Does the Weight of Funds support equity prices on the Johannesburg Stock Exchange?

ABSTRACT

This paper questions the belief that in South Africa large institutional cash flows, the weight of funds, support equity prices on the Johannesburg Stock Exchange. The paper suggests that this belief is conceptually flawed and that it conflicts with established portfolio and efficient asset market theory. An attempt was made to test possible implications of the weight of funds. However, the empirical evidence failed to support any of the suggested hypotheses. It was concluded that investors should disregard claims that the weight of funds supports equity prices on the JSE during either bull or bear market conditions.

1. INTRODUCTION

"There can be little debate that, under current circumstances where exchange control prevents institutional funds from being invested outside South Africa, the equity market is, to a very large extent, being driven higher by the vast institutional cash flows seeking a home, instead of being driven by its underlying investment merits."

From: Chairman's statement, annual report of the Guardbank Management Corporation Ltd for 1992.

The weight of funds, as suggested by the quote above (see also Finance Week, 22 January 1992), appears to be a peculiarity of the South African financial markets, given the nature of exchange control regulations which prohibit residents from investing abroad. The weight of funds argument is often espoused as an anodyne to reassure investors concerned that shares may be overvalued with regard to fundamentals. This belief has been accepted uncritically by most market commentators and in my view is fallacious. On both analytical and empirical grounds there are cogent reasons to disregard it.

Section two examines relevant conceptual and theoretical issues while the third section considers some selected empirical evidence. Section four draws the main conclusions from this investigation.

2. CONCEPTUAL AND THEORETICAL ISSUES

As suggested by the quote above, the weight of funds emphasizes the role played by institutional cash flows in supporting the equity market. However, it should be understood that the extent to which institutions dominate the financial markets does not determine the volume or weight of funds seeking an investment outlet. Financial institutions are simply intermediaries between savers and borrowers. As such they do not increase the volume or flow of desired saving but merely tap the collective saving of many individuals and firms. The desired flow of saving versus borrowing depends on factors such as: wealth; disposable income and retained earnings; the time preference of consumption; returns on investment; taxation of investment income and capital; and uncertainty (see Hirshleifer and Glazer 1990: 395-437).

These determinants are independent of the number or size of financial institutions. Without such institutions the money and capital markets would function less efficiently, but the desired flow of saving would not necessarily be any less. It is possible, through the development of innovative financial products and presuasive marketing, that the institutions may increase desired saving indirectly, by lengthening the time period of consumption. However, it is more plausible that competition for available saving, predetermined by the above mentioned variables, is increased. This may make some investment products more attractive than others but would not alter the total volume or desired flow of saving.

The insights of modern portfolio theory and efficient asset markets cast serious doubt on the weight of funds proposition. Investors, including investment fund managers, are usually not restricted to investment in a single class of domestic asset such as equities. They face a menu of investment opportunities from which an optimal portfolio of assets may be selected, including the risk free asset. The proportions in which assets of varying risk are selected depends upon their expected risk-adjusted returns. Profit maximizing investors and speculators determine the equilibrium prices of the various assets such that their expected risk adjusted returns are equal (see Brodie et al, 1989 and Cohen et al, 1987). The available research suggests that the JSE is a relatively efficient market as concluded, for example, by Gilbertson and Roux (1977 and 1978).

Given this perspective, an increase in the price of equities relative to other assets reflects their higher expected risk-adjusted returns rather than a lack of alternative investment outlets for the desired flow of saving. There is always the option of the risk free asset. As Raine (1987: 38) concludes: "The weight of funds is a catch-all explanation that is not analytically helpful in a dynamic environment. The interesting issue if share prices are rising is why shares are the preferred investment, not the tautology that their prices are rising because they are preferred."

In South Africa, JSE shares were the preferred investment for most of the 1980's, as reflected in their above average annual compound price increases. Raine argues that rising inflation over this period enhanced the attractiveness of claims on real assets relative to fixed income securities and other assets with fixed nominal value (1). She also suggests that declining business confidence led to low gross domestic investment which contributed to small increases in the supply of scrip for much of the 1980's. Although explanations of the relationship between fundamentals and share prices may differ, changes in such prices cannot be resolved by invoking an analytically empty concept like the weight of funds. To do so implies that investors consistently ignore fundamentals in deciding to buy or sell shares. The weight of funds thus contradicts established portfolio and efficient asset market theory without offering any alternative explanation of such apparently irrational behaviour.

Some researchers have attempted to explain speculation which drives share and other asset prices away from their fundamental values. However, as shall be made clear, these explanations should not be confused with a pseudo theory such as the weight of funds. It is possible that speculative bubbles may develop on the JSE equity market, as in stock and other asset markets abroad. Speculative bubbles in these markets are characterized by share prices which show large and persistent deviations from their present value prices (Flood and Garber 1980; Shiller 1981; Flood and Hodrick 1986). Such bubbles are classified as "intrinsic" if they can be explained by

* The author thanks Ivor Jones, Roy and Co. for providing most of the share price and index data analysed in this paper. Furthermore, I would like to thank Mr D.U.A. Galagadera, Acting Head: Department of Statistics, University of Bophuthatswana for his helpful comments and suggestions.

over-reaction to exogenous economic fundamentals affecting future earnings and dividend flows (Froot and Obstfeld 1991).

Alternatively, they may result from the actions of speculators who, at least partly, try to anticipate the behaviour of other market participants in forming their own expectations about share prices – expectations coloured by a kind of market narcissism. The formation of such expectations was discussed by Keynes where he used several entertaining metaphors, including the famous beauty contest analogy, to explain "This battle of wits to anticipate the basis of conventional valuation a few months hence, rather than the prospective yield of an investment over a long term of years . . ." (Keynes 1936: 155) and which he believed made "Investment based on genuine long-term expectation . . . so difficult today as to be scarcely practicable. He who attempts it must surely . . . run greater risks than he who tries to guess better than the crowd how the crowd will behave; and, given equal intelligence, he may make more disastrous mistakes" (Keynes 1936: 157). Under these circumstances a bubble may arise in that speculators, for a time, ignore fundamentals in the belief that they can profit more in the short-run by riding the prevailing mood or mass psychology of the market. Such speculation increases the volatility of asset prices and contrasts sharply with the view of Baumol (1957) and Friedman (1953) that speculation is stabilizing.

The weight of funds was an explanation used to justify the bull market in JSE equities which peaked in October 1987. However, the perspective given above suggests that this episode and the subsequent crash in the market may be explained better as a speculative bubble rather than the weight of funds blindly exerting upward pressure on share prices. Simply because funds are available for investment does not explain why such speculation should occur. An underlying theory of speculation is necessary, possibly along the lines of the two alternatives presented above. No such theory, or indeed any theory at all, is offered by the weight of funds.

An argument sometimes associated with the weight of funds concerns the "scarcity" of highly rated shares in the market. It is argued that fund managers are reluctant to sell such shares, which they may have purchased at a premium, because they may be difficult or more costly to acquire again later. This retention of "quality" shares is further believed to support equity prices even if fundamentals deteriorate or do not meet expectations. However, this view also contradicts asset market theory. If expectations are unidirectional then large percentage changes in share prices may be associated with very low trading volumes. For example, if new information results in predominantly bearish sentiment very little trade will take place at yesterday's prices because there would be few buyers of the stock offered at those prices. Share prices may be marked down in thin trade in line with the market's assessment of the new information. Only at the lower equilibrium prices, where expectations may again diverge, would we expect the volume of trade to increase, reflecting this divergence of opinion (see, for example, Runde and Torr 1985). An irresistable "weight of funds" is neither a necessary nor a sufficient condition for large adjustments in relative asset prices.

3. EMPIRICAL CONSIDERATIONS

Little or no empirical research has been conducted to test the weight of funds proposition. This may be due to the catch-all nature of the proposition which at first glance yields no easily testable predictions or implications. As noted above, the weight of funds is often expressed as a near tautology. However, some exploratory empirical results may possibly provide at least indirect evidence for the weight of funds, despite the conceptual and theoretical objections against it.

Monthly stock exchange data for the period February 1985 to February 1992 was selected for analysis in this regard. The sample period is noteworthy for the strong bull markets in equities on both the local and major foreign bourses which peaked in October 1987; the subsequent crash in share prices; and the recovery thereafter.

A notable feature during this period was the collapse of share prices on the JSE between October 1987 and February 1988. The JSE All Share Index and the Industrial Index fell by 44% and 35% respectively over this interval. Clearly, the weight of funds was conspicuous by its absence during this severe correction in the market. Even if the institutions were not major sellers at this time it did not appear to prevent or cushion the fall in the market. Table 1 compares the decline of the JSE indices against that of nine foreign stock market indices between August 1987 and February 1988. The figures in parentheses give the percentage change in the indices from the peak to the trough in each market as these do not always coincide exactly.

TABLE 1
A Comparison of the Percentage Change in JSE and Foreign Stock Market Indices Between August 1987 and February 1988.

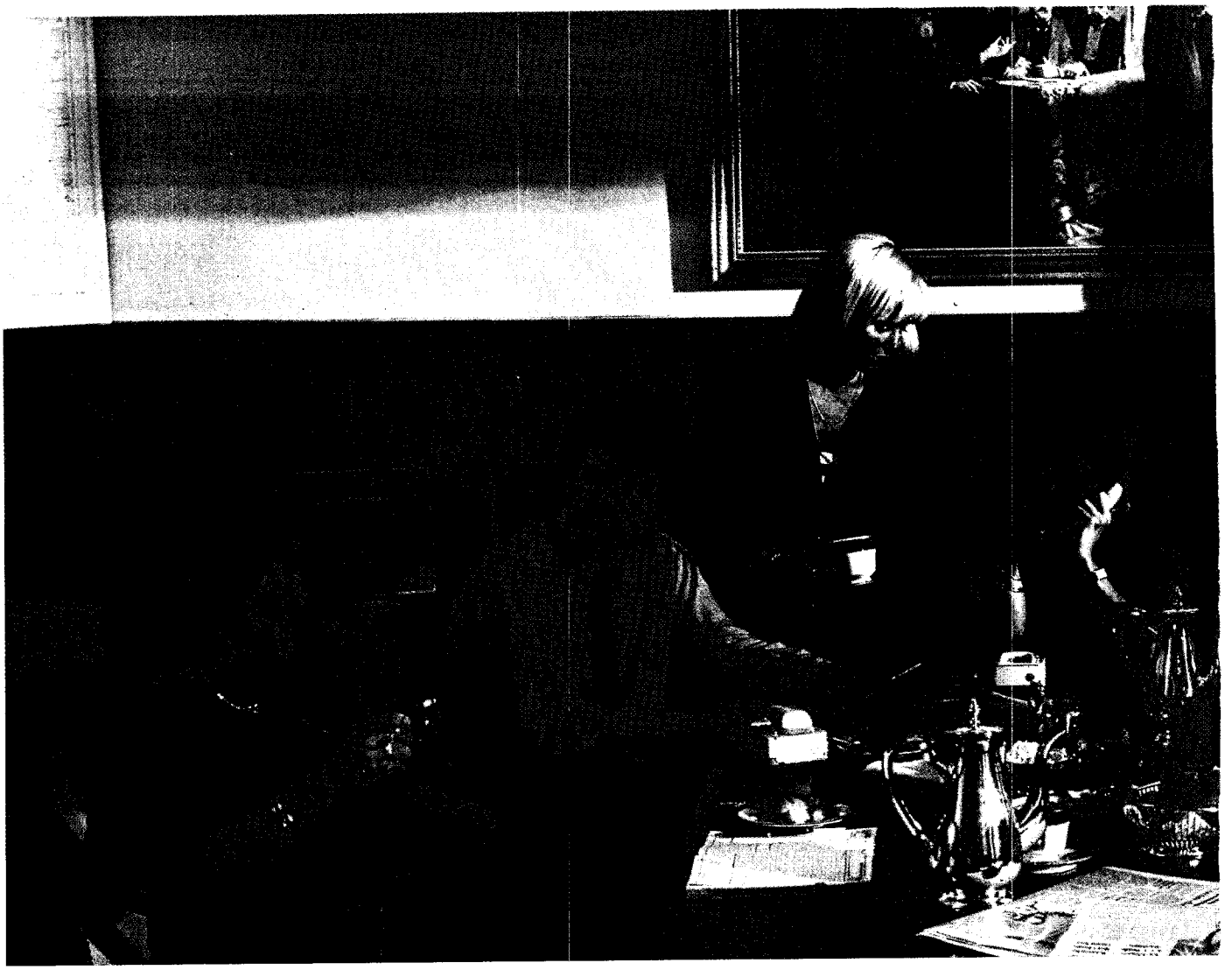
INDEX	PERCENTAGE CHANGE 08/87-02/88
JSE All Share	**-44**
JSE Industrial	**-35**
Standard and Poor 400 Industrial	-21 (-28)
Dow Jones Industrial	-22 (-31)
Financial Times 500	-22 (-31)
FT-SE 100	-21 (-33)
Tokyo Nikkei	- 3 (-17)
Commerzbank Shares	-31 (-40)
Banca Commerciale Italiana	-21 (-39)
Hong Kong Hang Seng	-33 (-46)
Financial Times Actuaries World Index	-10 (-21)

The information in Table 1 suggests that the weight of funds failed to support JSE share prices during the bear market of 1987-88. Only the Hong Kong Hang Seng Index fell further than the JSE All Share Index while, in addition, only the Commerzbank and Banca Commerciale Italiana indices declined more than the JSE Industrial Index. The decline in the JSE indices was roughly double that of the world average, as measured by the FT Actuaries World Index.

Adherents to the weight of funds view may object that the behaviour of the JSE and other stock markets cannot be assessed adequately with reference to a single bear market of a few months. This objection was met as follows: if the weight of funds supported share prices on the JSE we would expect the variability and average monthly percentage changes in the JSE indices to be greater during bull markets than in bear markets. The weight of funds implies that during bullish periods the market tends to over-react to positive new information while, conversely, it under-reacts to negative news during bear markets. This implication was tested by comparing the standard deviations and the averages of the monthly percentage changes in the JSE All Share and Industrial indices for bull and bear markets during the sample period February 1985 through February 1992.

It is crucial for this purpose to have satisfactory definitions of what constitutes a bull or bear market. Following Fabozzi and Francis (1977: 1094-95) three different definitions were used:

1) Up and Down (UD) markets: Months in which the percentage change in the index (r_i) was positive are classified as "up" months and together constitute a bull market. Negative monthly percentage changes in the index are classified as "down" months and constitute a bear market. As noted by



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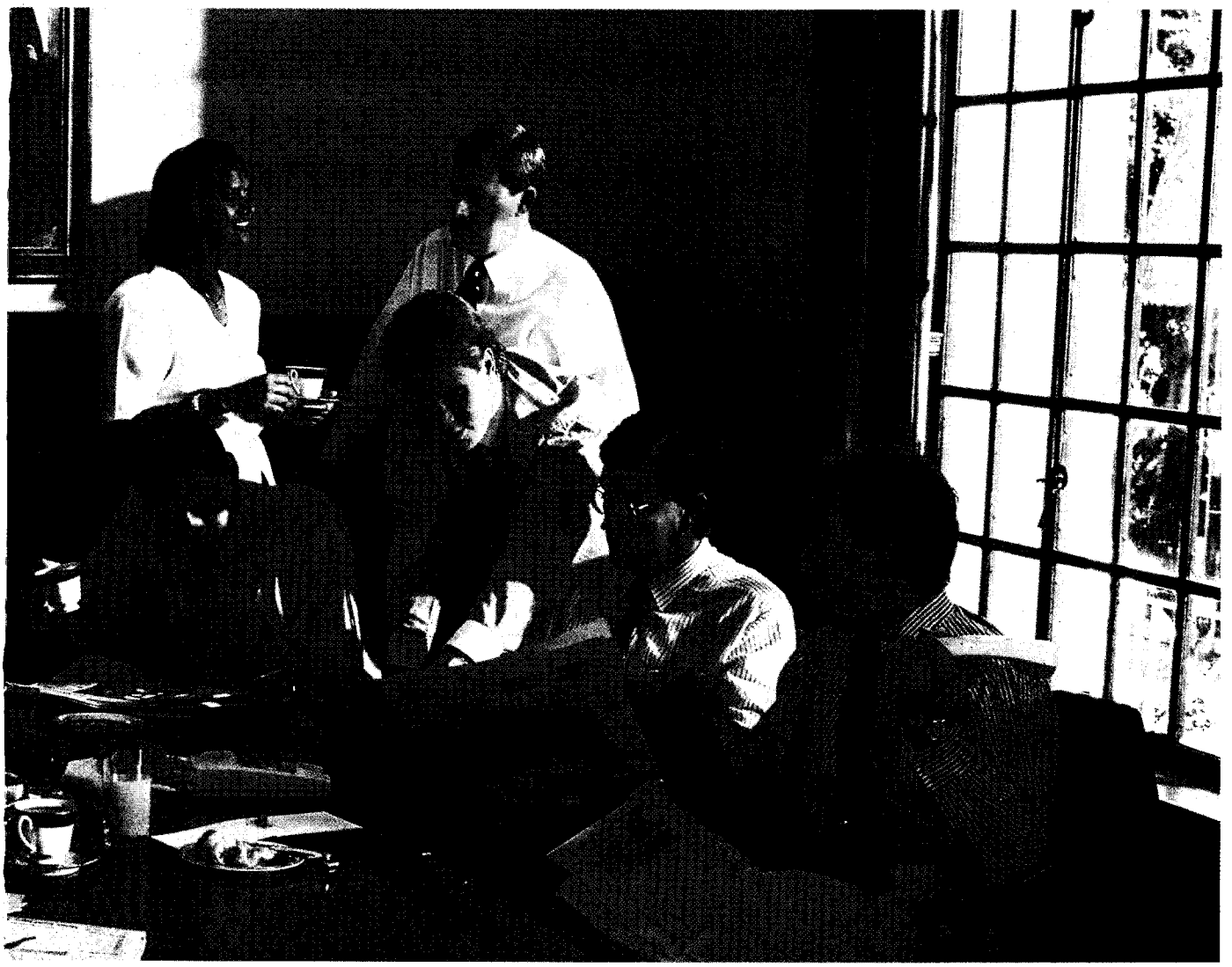

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Fabozzi and Francis this procedure divides the sample into two mutually exclusive and exhaustive subsets. However, it ignores market trends and treats each month independently.

2) Bull and Bear (BB) markets: Fabozzi and Francis categorized months as in (1) except that months where the index rose between adjacent bear months were regarded as a continuation of a bearish trend and thus part of the bear market category. It was felt necessary to alter this procedure slightly to prevent a bias favouring bear market trends and to account for contrary bullish or bearish months where the percentage changes were relatively small. Accordingly, a contrary month(s) between adjacent bullish or bearish months was regarded as a continuation of a trend if the cumulative percentage change was less than that of the two adjacent months.

For example, from April to July 1987 the consecutive monthly percentage changes in the JSE All Share Index were 8,65; -0,77; -0,04 and 12,87. The two negative months are classified as a continuation of a bullish trend as they sum to less than the adjacent positive monthly percentage changes. By contrast, in March 1988 the index rose 10,67% compared to declines of 3,19% and 4,46% in February and April respectively. Since the rise in March was greater than the sum of the negative adjacent monthly changes it was regarded as a break in a bearish trend and thus part of the bull market category. The procedure captures market trends rather than treating all months independently as in (1) above.

3) Substantial Up and Down (SUD) markets: This procedure divides the sample into three subsets (a) Bull market months in which the market rises substantially (b) Bear market months in which the market declines substantially and (c) Months in which the market is directionless – these months are ignored according to the SUD criterion. Under the SUD procedure substantial up or down movements in the indices are arbitrarily defined as those months in which the absolute value of r_t exceeds one half the standard deviation of the market's monthly returns for the entire sample period.

A comparison of the means and standard deviations of the monthly percentage changes in the JSE indices for bull and bear market categories are shown in Table 2 below.

TABLE 2
A Comparison of the Mean and Standard Deviation of Monthly Percentage Changes in the JSE All Share and Industrial Indices for Different Bull and Bear Market Classifications.

JSE INDEX	TYPE	BULL		BEAR	
		Mean	SD	Mean	SD
All Share	UD	5,4	3,3	-4,4	4,6
	SUD	6,5	2,9	-6,7	4,9
	BB	3,1	4,8	-6,0	6,8
Industrial	UD	4,8	2,9	-4,8	5,4
	SUD	6,3	2,2	-7,4	5,6
	BB	3,7	4,1	-4,5	6,8

Generally, the information in Table 2 does not support the weight of funds. For all the classifications examined the standard deviations were higher in bear markets than in bull markets. This is the opposite of what we would expect if the weight of funds supported or cushioned share prices in bear markets and blindly pushed up prices in bull markets, regardless of fundamentals. Moreover, the absolute value of the mean is generally higher under bear market rather than bull market conditions. Only for the JSE All Share Index under the UD bull market category is the mean higher than for the bear market. To summarize, JSE bear markets tend to be more volatile than bull markets and share prices do not appear to be supported by a weight of funds.

It may yet be objected that the comparisons made in Tables 1 and 2 are unsatisfactory because they fail to account for the longer duration of bull markets. It may be argued that the weight of funds, dependent upon regular institutional cash flows, sustains share price increases in bull markets for relatively longer periods and, although not preventing bearish corrections in the market, ensures that they are of short duration. This objection was met by comparing changes in the JSE stock market indices against a broad world index.

An approach similar to that adopted by Fabozzi and Francis was used. Fabozzi and Francis (1977) tested the stability of individual NYSE stocks' alphas and betas over bull and bear markets, as defined above (2). Instead of testing for individual shares, however, the approach here was amended by regressing monthly percentage changes in the JSE All Share and Industrial indices against the Financial Times Actuaries World Index for the sample period February 1986 – February 1992 (3). The JSE indices are correlated with the FT index due to common economic fundamentals affecting all world stock markets, although not very strongly over the sample period.

If there is a significant weight of funds effect on the JSE we would expect the alphas and betas of the JSE indices to be greater over bull markets than for bear markets. This hypothesis was tested, under the bull and bear market definitions above, by a one tailed test of the modified single index market model (SIMM) used by Fabozzi and Francis (1977: 1094):

$$JSE_t = A_1 + A_2 d_t + B_1 W_t + B_2 d_t W_t + u_t \qquad \text{where } E(u_t) = 0$$

As explained by Fabozzi and Francis, the advantage of this modified SIMM equation is that it allows the alphas and betas to be estimated simultaneously over bull and bear markets. The d_t variable is a binary variable equal to unity in bull markets, and zero in bear markets, or vice versa. The coefficients A_1 and B_1 measure the alpha and beta of the JSE indices against the FT Actuaries World Index (W_t) over both bull and bear market conditions. The A_2 and B_2 coefficients on the binary variable measure the **differential** effect of bull and bear markets on A_1 and B_1. If the alpha and beta of the JSE indices under bull market conditions are higher than their average for the whole sample, then A_2 and B_2 will be significantly greater than zero. Conversely, if the alphas and betas in bear markets are lower than the sample average, then A_2 and B_2 will be significantly less than zero. The results are summarized in Table 3.

TABLE 3
The Differential Effect of Bull and Bear Market Conditions on the Alphas and Betas of the JSE All Share and Industrial Indices for the Period February 1986 to February 1992, Using Three Different Market Classifications

BULL MARKETS								
JSE Index	Coeff.	Market Classification						
		UD			SUD		BB	
		Sign	$t_{0,05}$	$t_{0,10}$	Sign	$t_{0,05}$ $t_{0,10}$	Sign	$t_{0,05}$ $t_{0,10}$
All Share	A_2	–	No	No	–	Yes Yes	+	No No
	B_2	–	Yes	Yes	–	Yes Yes	–	No No
Industrial	A_2	–	No	Yes	–	Yes Yes	+	No No
	B_2	–	Yes	Yes	–	Yes Yes	–	Yes Yes
BEAR MARKETS								
All Share	A_2	+	No	No	+	Yes Yes	+	No No
	B_2	+	Yes	Yes	+	Yes Yes	+	Yes Yes
Industrial	A_2	+	No	Yes	+	Yes Yes	+	No Yes
	B_2	+	Yes	Yes	+	Yes Yes	+	No Yes

The results cast further doubt on any weight of funds effect on JSE share prices. In examining the differential effect of bull market conditions, for 10 of the 12 test results the coefficients concerned had negative signs and, of these, 7 test coefficients (2 alphas and 5 betas) were significant at the 5% level of statistical significance. This means that the alphas and betas of the JSE All Share and Industrial indices against the world index tend, if anything, to be **lower** in bull markets. Only the alpha (A_2) coefficients in the trend (BB) market classification had the hypothesized positive sign, but were rejected at both the 5% and 10% levels of significance.

The differential effect of bear markets was positive in all 12 cases – none of the coefficients in the table had the hypothesized negative sign for bear markets. Moreover, 7 of these test coefficients (2 alphas and 5 betas) were acceptable at the 5% level of significance. This means that, contrary to what we would expect if the weight of funds were true, the alphas and betas of the JSE indices estimated for bear markets tend to be **higher** than the average.

4. CONCLUSIONS

The weight of funds explanation of share price behaviour on the JSE is a pseudo theory empty of any analytical content. On close examination it virtually amounts to a tautology. However, an attempt was made to subject possible implications of the weight of funds to empirical tests. The test results failed to support any of the proposed hypotheses. Moreover, some of the results suggest the opposite of the weight of funds. JSE equity bear markets are mostly deeper and more volatile than bull markets and, when compared to a broad world stock market index, the JSE indices under-react in bull markets and over-react in bear markets. The results suggest that investors are not protected by the weight of funds and should disregard advice that claims otherwise.

Notes

1) See, however, Fuller and Petry (1981) for a contrary interpretation of the link between inflation and stock prices in the USA.

2) The rationale for the research undertaken by Fabozzi and Francis was to see whether the calculation of separate alphas and betas for bull and bear markets was justified. They concluded that neither the alpha nor the beta coefficients of the stocks sampled appeared to be significantly affected by the alternating forces of bull and bear market conditions, and that some investment analysts had "fallen into the trap of misapplying econometric models and, as a result, are purveying erroneous information" (Fabozzi and Francis 1977:1098).

Similar research has been conducted by Bradfield et al (1982) for 48 industrial stocks on the JSE for the period March 1968 to June 1976. The findings of their research concurred with that of Fabozzi and Francis even where they used the risk free rate of return as the dividing line between bull and bear markets, as suggested by Lindahl-Stevens (1980).

3) The Financial Times Actuaries Wolrd Index was introduced in January 1986, hence the sample period is 12 months shorter than for the previous sample.

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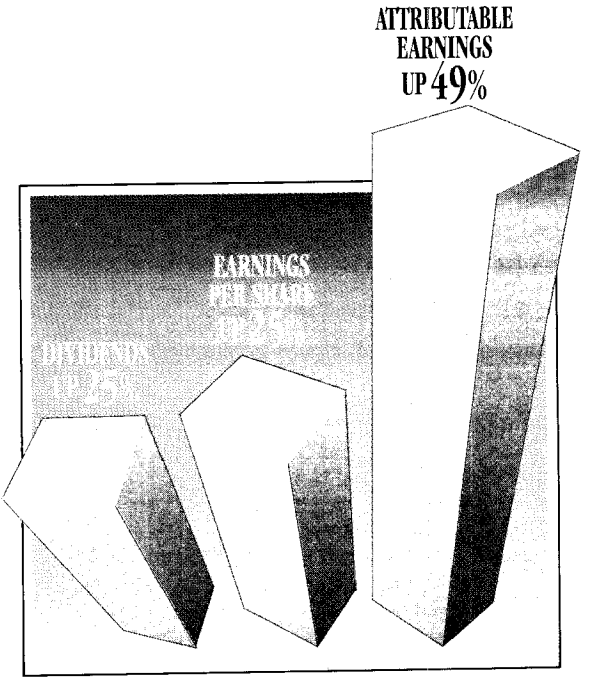

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Share price anomalies and the efficiency of the JSE

ABSTRACT

Share price anomalies of a magnitude larger than the direct transaction costs of switching from one share to another were detected in 56 out of 60 pairs of closely related shares. Non-isolated anomalies were detected for 49 of these pairs. The extent of these anomalies indicates inefficiency of the JSE.

Three factors were identified that contribute significantly to the extent and magnitude of the anomalies. A discriminant function of these factors correctly classified nine out of ten pairs of shares for which no non-isolated anomalies were detected and 45 out of 47 pairs that had non-isolated anomalies.

INTRODUCTION

Is the JSE efficient? The efficient market hypothesis (EMH) states that if a market is efficient then prices at any time fully reflect all available information. Thus it is not possible to **consistently** obtain an abnormal return ("beat the market") i.e. a return higher than required by the risk of the investment. While unexpected events may lead to abnormal returns if the investor is lucky, the **expected** return should not be abnormal in an efficient market.

A share price anomaly occurs where there is a significant deviation from the exact theoretical relationship between two related shares. The related shares may be two different types of share in the same company, such as ordinary shares and "S" ordinaries, "A" (non-voting) ordinaries or convertibles. Alternatively, the related shares may be of two companies in a pyramid relationship. In this case the pyramid company's predominant or only asset would be shares in the other company. The extent and magnitude of these share price anomalies have been used in this study as a powerful test of market efficiency.

PRIOR RESEARCH

Several research studies have tested the efficiency of the JSE. Some examples of studies supporting the EMH in the semi-strong form include those of Wanckel (1979), Taylor (1977), Gilbertson and Roux (1977) and Husselman (1988). Those rejecting the semi-strong form of the EMH include Knight and Affleck-Graves (1983), Bhana (1987), Bhana (1989) and Jacobson (1988). The research by Kelly (1983) appeared to support the semi-strong form EMH, but after correction of an error in the statistical analysis of his data, it can be seen (Philpott, 1993, p8) that this research actually strongly supports the evidence of inefficiency on the JSE. Since none of the research supporting the EMH proved that the JSE is efficient, but rather merely failed to detect inefficiencies, it may be concluded that the JSE is not efficient in the semi-strong form. However, none of the prior research indicates if the inefficiencies are limited to shares with particular characteristics (eg low volume shares).

There appears to be no published research on share price anomalies on the JSE, although press reports on the subject have appeared, eg John Spira (1982) on the South Roodepoort anomaly. Only two unpublished studies were found, by Little and Teeuwisse (1987) and Weir and Ormiston (1989), both of which looked at pyramid relationships. However, the latter study only looked at the extent of correlation of the share prices of the related shares, without considering the theoretical relationships between the shares. Little and Teeuwisse (1987) did compute the theoretical share price ratios of pyramid to operating company and compared these to the actual price ratios, but this was only a pilot study and only four pyramid pairs in a single market sector were studied.

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RESEARCH HYPOTHESES

The following two hypotheses were tested:
Hypothesis 1: The JSE is efficient in the semi-strong form for all listed shares. Thus significant share price anomalies, larger than the trading costs of switching, would be extremely rare and would not persist for more than a day.
Hypothesis 2: The JSE is efficient in the semi-strong form for many, but not all of the listed shares. Thus significant share price anomalies (larger than the trading costs of switching) that persist for more than a day would not occur for all (or almost all) related securities.

As expected, the data analysis detected non-isolated price anomalies for many but not all of the pairs of shares, thus rejecting hypothesis 1 and providing evidence in support of hypothesis 2. The results of this stage of the research allowed it to continue towards the next objective, which was to identify the types of factors distinguishing the efficient from the inefficient shares.

It is assumed that a pyramid paying out all the dividends received from the listed bottom company will continue to do so, and will not do anything to change the share value ratio or the ratio of dividends per share. Secondly that the discount factor used to calculate the present value of expected future dividends is identical for the pyramid and the operating company. A third assumption is that in an efficient market the only deviation in share price from the intrinsic value is that attributable to a control premium.

RESEARCH METHODOLOGY

Sample Selection

A list of companies with convertible securities was compiled using information from the December 1991 JSE Monthly Bulletin. The nature of convertible securities results in these usually being listed for only a few years, so the list of convertibles was extended to include securities delisted over the past few years. Convertible debentures were usually excluded as they pay taxable interest, not dividends.

The final sample contained sixteen companies with convertibles, including one with deferred shares (Venterspost), six with preferred ordinaries, eight with convertible pref's and two with two types of convertible debentures. One of the companies with the convertible debentures (Tradegro) also had convertible pref's, while another company, SA Breweries, had two types of convertible pref's, so that there were eighteen pairs of shares from these sixteen companies.

Companies with more than one class of ordinary share in issue, e.g. voting and non-voting shares, were identified from the share price data published in the press and confirmed from the information given for the relevant companies under "**Capital**" or "**Share Capital**" in the JSE Handbook, February 1992. All five companies with two types of ordinary shares differing in voting rights were accepted in the final sample. However, only one company that had "S" Ordinary shares, namely South Roodepoort, was retained in the sample, due to unavailability of share price data.

A list of 78 pyramid companies was compiled by checking through the information on every listed company from the JSE

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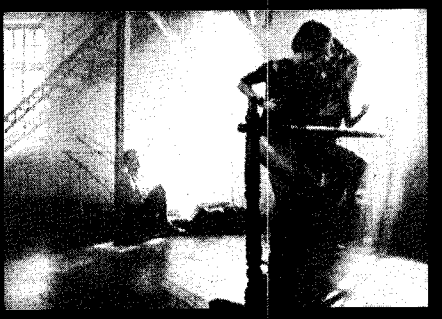

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Handbook, February 1992. From this initial list, 36 pyramid pairs were eliminated, mainly due to the pyramid not being pure enough, leaving 42 pyramid pairs in the final sample.

A pure pyramid's only assets would be ordinary shares and possibly convertibles in the bottom company and it should have no other source of income. There should be no significant liabilities or expenses, except those paid by the bottom company. There may obviously be current assets and liabilities of dividends receivable and payable.

Computation of Analytical Parameters

All the convertibles selected for the sample had a conversion ratio of one, so the share value ratio must equal one. The share value ratio for the companies with two classes of ordinary shares is also one. However, this share value ratio only defines the exact value of the "S" ordinaries relative to the ordinary shares. The share value ratio for the preferred ordinary or convertible preference shares provides only a lower limit for their value relative to the ordinary shares, while for the deferred shares or the shares with no or restricted voting rights, it is an upper limit.

The share value ratios for the pyramids were computed as the ratio of the number of shares of the bottom company held by the pyramid to the number of issued shares of the pyramid. Where applicable, the fully diluted ratio was used. Where a second or third tier pyramid had shares in more than one of the companies below it, then the formula used is slightly more complex (see Philpott, 1993, p25).

If an impure pyramid had net other income or expenses, then this was capitalised, unless it was directly related to the other assets or liabilities. Since expenses may be expected to increase with inflation, an appropriate capitalization rate would be the real return on a reasonably low risk investment. A rate of 5% was chosen for capitalization of normal (increasing) expenses (or income), which is very close to the mean dividend yield of the general equity unit trusts in October, 1992. Since the pyramids retained in the sample were almost pure, the exact capitalization rate chosen is not too critical.

The direct transaction costs consist of the stockbroker's fee, payable on both purchases and sales, consisting of a basic charge plus brokerage, and a Marketable Securities Tax (MST), payable only on purchases. The transaction costs have changed a few times since 1985.

TABLE 1
Transaction costs for switching

	Deal Size				Share
Date	R1 000	R5 000	R10 000	R100 000	Price
01-Apr-91	9,40%	4,60%	3,65%	2,62%	
01-Dec-90	9,90%	5,10%	4,15%	3,12%	
01-Apr-86	8,90%	4,90%	4,05%	3,11%	R0,40
01-Apr-86	4,90%	4,90%	4,05%	3,11%	R2,00
01-Apr-86	4,40%	4,40%	4,05%	3,11%	R4,00

It was decided to use deal sizes predominantly in the range R1 000 to R100 000 for transaction cost purposes. The appropriate transaction costs are shown in Table 1. These are the total costs for switching from one share to another i.e. they include the broker's fees for both the buying and selling legs of the deal as well as the MST on the purchase. The costs for the period before April 1986 would be exactly 0,5% less than the costs tabulated for the period from April 1986.

The bid-ask spread is the gap between the bid (buyer's) price i.e. the highest price that buyers are offering and the ask (seller's) price i.e. the lowest price that the sellers are offering. This bid-ask spread is generally regarded as an indirect transaction cost, which is incurred by dealers wanting to make a quick deal.

Where a dealer wishes to switch from one share to another to take advantage of a share price anomaly, it is unnecessary for him to incur the indirect costs of the bid-ask spread for the first leg of the deal. Between the two legs of the deal, however, he is exposed to unfavourable share price movements. He would therefore need to conclude the second leg of the deal as quickly as possible, thus incurring the bid-ask spread costs. These costs may be minimized by buying or selling the share with the larger bid-ask spread first.

Unfortunately bid and ask prices are not readily available on electronic databases. They are published in certain morning newspapers, but getting this information directly from the press was undesirable since the sample contained 121 shares, grouped into 66 pairs and covering a period of over seven years. An attempt was therefore made to estimate the bid-ask spreads using the serial covariance technique of Richard Roll (1984), but this was unsuccessful.

Acquisition and Analysis of Data

Daily and weekly share price data were downloaded from the I-Net Database. The weekly data was used for the initial analysis (screening) in order to select a period for the daily data where the chances of finding price anomalies would be maximized.

Both Little & Teeuwisse (1987) and Weir & Ormiston (1989) used closing prices for their analyses. Bookstaber (1981) discusses the problem with using closing prices to detect mispricing of options relative to the underlying shares, when there may be a large difference in the time of day between the last trade in the option and the last trade in the share. In order to avoid this problem of differences in time of last trade and minimize the chances of detecting apparent rather than real anomalies in the share price relationships, the daily or weekly high and low rather than closing prices were used.

For each pair of shares, it was determined whether either a discount or premium to the implied value (or neither) could be justified. For example, in the case of pyramids, a control premium was assumed to always be justified, unless either the pyramid held less than 30% of the shares or it had given an undertaking to extend any takeover offer to the minorities in the bottom company. Where appropriate, premiums or discounts could also be justified by differences in dividends (convertibles) or in voting rights.

Lotus 123 Spreadsheet models were used for the analysis of the share price data. Anomalies were detected where the minimum premium or discount of share 2 relative to share 1 exceeded a threshold, and this premium or discount could not be justified. For the initial analysis a threshold of 4% (on either premium or discount or both was used to detect share price anomalies. As may be seen from Table 1, this is approximately the level of direct transaction costs for switching from one share to the other for a deal size at the R10 000 level, between April 1986 and March 1991.

Sequences of anomalies occuring on two or more days in succession were also detected, because, even in a market regarded as being efficient for all practical purposes, it may be possible for prices to be pushed out of line for a single deal. Secondly, although the use of highs and lows minimized the detection of apparent anomalies that are not real, they were not eliminated where both shares rarely trade. However, the chance of false anomalies being detected for two periods in succession is extremely remote.

An anomaly was regarded as occurring on two days in suc-

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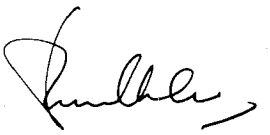

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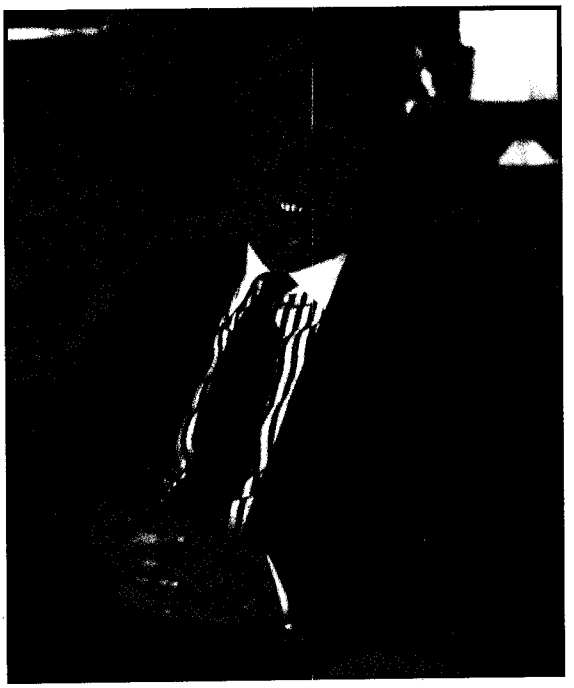

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cession even if there were trading days in between the two anomaly days, provided that:

1. Both anomalies were of the same type, eg share 2 traded at a premium relative to share 1 of more than the threshold on both days.
2. There were no days in between on which both shares traded.
3. On any days in between where share 2 traded, it traded at a premium (discount), larger than the threshold, relative to the maximum (minimum) price for share 1 over the period from the first to the second anomaly day.
4. Equivalently, on any days in between where share 1 traded, it traded at a discount (premium), above the threshold, relative to the minimum (maximum) price for share 2.

The convertible preference shares and preferred ordinary shares selected had rights and conditions attached to them such that their annual dividends could not be less than the annual dividends on the ordinary shares. However, the preference portion of the annual dividend on the convertibles is normally divided equally between the interim and final dividends, whereas the interim dividend on the ordinary shares is typically much smaller than the final dividend. Thus, the final dividend on the ordinary share may be larger than the final dividend on the convertible to make up for the much smaller interim dividend on the ordinary share. In addition, certain convertible preference shares, e.g. CMI or SA Breweries "A" convertible pref's, pay their dividends before the dividends on the ordinary shares. Consequently, the value of the ordinary share may be slightly higher than the value of the convertible at certain times.

Adjustments were made to the spreadsheets for the relevant periods where the value of the convertible could exceed that of the ordinary share. The maximum possible excess value of the convertible was used for this adjustment. For example, the maximum excess value between declaration and last day to register (LDR) for the final dividend would be the difference in final dividends (assuming the ordinary dividend is higher), if dividends on both securities were paid simultaneously, or the actual final ordinary dividend if the convertible had already gone ex-dividend.

In order to ensure that the 4% threshold used was adequate to cover trading costs of switching, the mean daily valumes and values traded were computed. The mean daily traded volume was adjusted for the percentage of days traded to obtain the mean volume on days traded. The frequency distributions of volume traded on each traded day for the different shares are highly skewed distributions. Consequently, the mean values of the volume on days traded are often pushed much higher by one or a few days when trading volumes were abnormally high, so that the mean is not a good estimate of a normal day's trading. The geometric means of the volume and value traded on non-zero volume days were therefore used.

All the pairs of shares, where the minimum between the two shares of the geometric means of the daily value traded was less then R10 000, were considered for reanalysis using a higher threshold. It is possible that the volume and value traded on anomaly days could be significantly less than average for certain shares. Consequently, the minima between the two shares of the average value traded on anomaly days were also computed and checked that they were above R10 000.

There was no purpose in reanalysing the pairs where no non-isolated anomalies had been detected in the original analysis. As may be seen from Table 1, for the period before December 1990 (when the R30 basic charge was introduced), the total direct switching costs remain near 4% even if the deal size goes down to R1 000, provided the share prices are high enough. Thus it was only necessary to reanalyse those low traded value pairs where a significant part of the period analyse was after 1 Dec. 1990 or where the mean share price was well under seven Rand.

Construction of an Anomaly Index

Analysis of the daily share price data revealed that 82% of the pairs had non-isolated share price anomalies, if those trading on less than 3% of the days are excluded. However, the extent of these share price anomalies varied considerably, so it was decided to compare the extent of share price anomalies between the pairs of companies, instead of simply dividing them into two groups according to whether or not non-isolated anomalies were detected.

Three measures of the market efficiency, as indicated by the extent and magnitude of share price anomalies, were used in the analysis of the daily share price data. These were the percentage of anomaly days (relative to the days both shares traded, using a 4% threshold for the premium or discount of share 2 relative to share 1), the percentage of non-isolated anomaly days and the maximum premium or discount.

Where the data was tested for discounts of share 2 to its implied value from the share 1 price (because a premium could be justified), then the maximum discount would be a measure of the magnitude of price anomalies. Conversely, where the data was tested for premiums of share 2 relative to share 1, then the maximum premium would be the appropriate measure. In the cases where neither premium nor discount could be justified, the larger of maximum premium and maximum discount was used.

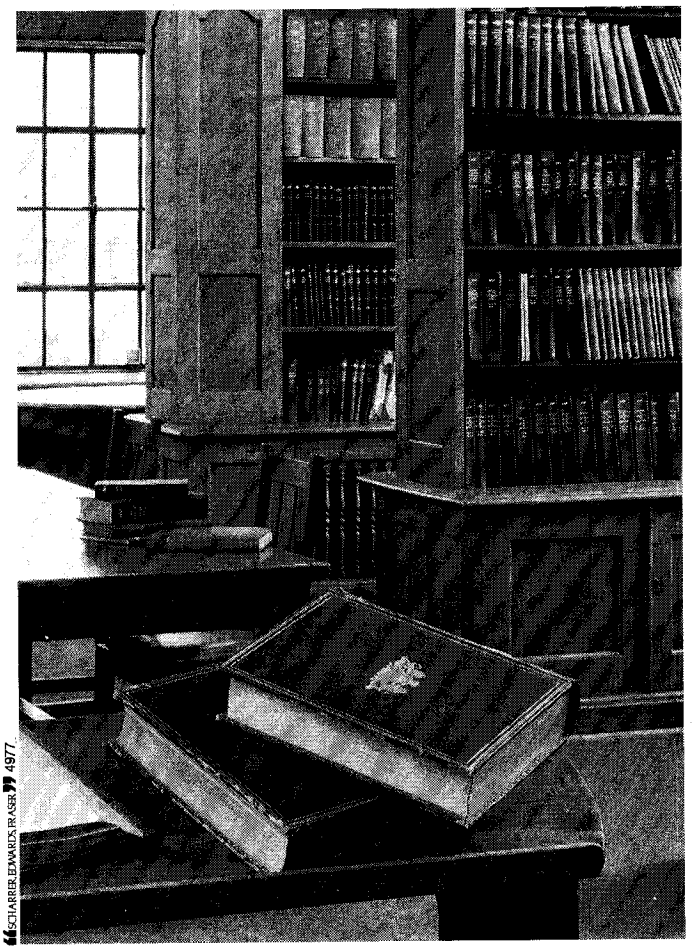
The maximum discount must always be less than 100%, but in theory there is no limit on the maximum premium. If for example share 1 trades at a discount relative to 2 of 75%, then this would imply that share 2 trades at a premium of 300% relative to share 1. Thus in order for the maximum discount or premium to be equivalent measures of the magnitude of the share price anomalies, it is necessary to transform the maximum premium according to $y=1-(1+x)^{-1}$ where x is the maximum premium of share 2 relative to share 1 and y is the transformed variable. In fact y is equal to the maximum discount of share 1 relative to share 2.

The percentage of anomaly days from the daily data has a selection bias due to the fact that the period examined was not chosen at random. Since this period was selected from the weekly data in order to maximize the chances of detecting anomalies, one can expect to find a higher percentage of anomaly days for those companies where the period examined using weekly data was longer. In order to reduce this bias it was decided to include the percentage of anomaly weeks from the weekly data in the index.

The anomaly index was constructed by a linear combination of the four anomaly measures i.e. the total percentage of anomaly days the percentage of non-isolated anomaly days, the maximum discount or transformed maximum premium and the total percentage of anomaly weeks (weekly data). Principle components analysis was used to obtain the linear combination of these measures that would account for the maximum variability in the data. The first principle component accounted for over 90% of this variability. The coefficients of the four measures in this first principle component were suitably scaled so that the resulting anomaly index would have a possible range from 0% to 100%.

Regression and Discriminant Analysis

Data was collected on several factors considered likely to influence the extent of share price anomalies. These factors included volume and value traded and percentage of days traded



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for which data was already available. Other factors considered included the number of shareholders, the percentage of shares held by the minority shareholders and whether or not the company had made a loss in the last five years. Market capitalization was also considered in case the size of the company had some influence on market efficiency.

The anomaly index (dependent variable) was regressed against the influencing factors (independent variables), using Stepwise Multiple Regression for variable selection. Logarithmic transformations were generally performed on the variables with highly skewed distributions and no upper bounds e.g. daily volume or value traded or number of shareholders. An estimate of the mean number of deals per day was obtained from the percentage of days traded using the appropriate formula (Philpott, 1993, p28-29).

One of the factors considered was whether or not the share value ratio was a round number. This binary (true/false) variable, the Value Ratio Code, allowed a maximum deviation of 2% from a round number (eg 2; 3; or 0,75). For the pyramids, the capitalized expenses plus liabilities per share were not permitted to exceed 2% of the share price.

Finally, the pairs of shares that traded on more than 3% of the days were divided into two groups, according to whether or not any non-isolated anomalies were detected. A discriminant analysis was performed using the three variables from the regression model, to see how well these variables could distinguish between the two groups.

The shares in the small group, where no non-isolated anomalies were detected, were all tested only for either discounts or premiums above the threshold, but not both. Thus, it was probable that this group included shares where the share price relationship was out of line in the opposite direction to that which was tested. For example, where a convertible preference share trades at a premium to the ordinary share, then this is justifiable, but if the premium is excessive, i.e. considerably more than the present value of the expected difference in dividends before conversion (plus a reasonable risk premium), then this may also be regarded as a price anomaly. However, this type of anomaly would be far more difficult to detect than the type tested for (where the convertible pref. trades at a discount), since it requires forecasting the dividends on the ordinary shares.

The pairs of shares in the efficient group (no-non-isolated anomalies detected) with a high probability of having price anomalies in the opposite direction to that tested for, were excluded from the initial discriminant analysis. However, the discriminant function obtained was used to classify these pairs into one of the two groups. Those of the originally excluded pairs that were classified into the efficient group were included in the next round of the discriminant analysis and the process repeated.

RESULTS

The results of the preliminary analysis on the weekly data are not presented here as the main purpose was merely to select a period for the daily data. Table 2 shows the results of the analysis of the daily share price data. The seven pairs of shares that traded on less than 3% of the trading days have been excluded because the chance of detecting share price anomalies for at least two successive days is rather small for shares trading so infrequently. Nevertheless, non-isolated anomalies were still detected for two of these seven pairs. Results for indirect (second or third tier) pyramids are also excluded.

The results in Table 2 are presented in descending order of the percentage of non-isolated trading days. No anomalies were detected in only four of the sixty pairs. Only isolated anomalies were observed for another seven pairs. Thus, share price anomalies were observed for at least two days in succession for the other 49 pairs, with nineteen of the pairs providing anomalous price differences for more than half the days that both shares traded. In some cases the price anomalies were quite persistent, up to 103 days in succession for Fregold & Ofsil or 98 successive days for SA Brew & Bevcon, indicating that the anomalies may last for several months. An indication of how consistently the two shares prices were out of line is provided by the Mean P/D (Premium/Discount) values.

The sixty pairs of shares in Table 2 include 26 where the geometric mean of the daily traded value (on days traded) of the lesser traded share is under R10 000 and non-isolated anomalies had been detected for 22 of these pairs. The periods analysed (before December 1990) and the share prices for five of these pairs were such that the direct switching costs would not have increased significantly above 4% even for small deals. The other seventeen pairs were reanalysed using the appropriate higher thresholds ranging from 4,4% for FS Group (ordinary and preferred ordinary) to 8,5% for Valard/Valhold. This reanalysis made no difference to the results of five of the pairs. The percentage of total and/or non-isolated anomaly days was slightly reduced for the other twelve pairs, but non-isolated anomalies were still detected.

Rough estimates of the expected levels of the bid-ask spreads were made from measures of share liquidity (frequency of deals) and price volatility, ranging from less than 1% for highly traded low volatility shares eg Pick 'n Pay to approximately 20% for the seldom traded Valard or highly volatile South Roodepoort. The maximum premium or discount from Table 2 was compared to the estimated total switching costs, including the indirect cost of the bid-ask spread (equal to half the bid-ask spread of the share with the lower spread) and direct costs of either 4% or the appropriate higher value for the low traded value shares (less than R10 000 per day). Of the 49 pairs (Table 2) where non-isolated anomalies were detected, the price anomalies were large enough to cover the total switching costs for 38 pairs, even allowing for an absolute error of up to 3,5% in the total costs.

Regression and Discriminant Analysis

The coefficients of the first principal component of the four anomaly measures were scaled and used to obtain the following anomaly index:

Index = 0,2708 TA+0,2704 NA+0,2174 MD+0,2415 WA

where TA is Total Anomalies, NA is Non-isolated Anomalies, MD is maximum. Discount/Premium (transformed) and WA is Weekly Anomalies.

The best regression model obtained from the factors considered was:

Index=81,0%−0,451 LR−0,206 VRC−0,568 SA

with an R^2 value of 43%, an adjusted R^2 of 40% and t values for the coefficients ranging from 2,4 to 5,0. Index is the anomaly index defined above, LR is the Liquidity Ratio, VRC is the Value Ratio Code and SA is the minimum between the two shares of the Shareholder Activity, defined as the estimated number of deals per shareholder per annum. The number of deals per day was estimated from the percentage of days that the share traded and converted to deals per annum using 250 trading days per annum.

The Liquidity Ratio is the ratio of the number of days that the one share traded to the number of days that the other share traded, with a maximum of 1. Share 2 was the numerator of this ratio if the pair was tested only for discounts of share 2 relative to share 1 (i.e. most of the pyramids and all of the convertible pref.'s and preferred ordinaries), or if both premiums and discounts were tested for but the maximum discount was larger than the maximum premium. In the other cases (e.g.

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TABLE 2
Analysis of daily share price data

Share 1	Share 2	Start Date	End Date	Days Traded[1]	Anom.[2] Tot.	Days Seq.	Max Seq.[3]	Maximum Prem.	Maximum Disc.	Mean P/D[4]
RANDCOL	AT COL	02-May-91	18-Aug-92	10,1%	100,0%	100,0%B	29	0,0%	29,3%	18,3%D
TRADGRO	TGRO-CP	27-Mar-90	27-Jun-91	7,3%	100,0%	100,0%D	23	0,0%	43,3%	28,2%D
FREGOLD	OFSIL	03-Jun-91	18-Sep-92	82,7%	98,5%	98,5%D	103	0,0%	18,8%	13,6%D
STH RDPT	S RDPTS	09-Nov-89	19-Feb-91	33,0%	97,2%	97,2%B	41	0,0%	56,3%	35,5%D
FOODCRP	FOOD 7CP	10-Aug-89	19-Nov-90	8,1%	96,2%	96,2%D	13	0,0%	21,6%	13,7%D
FRASERS	FRASCON	02-Sep-88	20-Dec-89	10,7%	94,3%	88,6%D	15	0,0%	37,4%	22,9%D
SA BREW	BEVCON	03-Jun-91	25-Sep-92	63,5%	87,7%	86,8%D	98	0,0%	24,1%	15,0%D
GROUP 5	G5HOLD	01-Mar-90	28-Jun-91	34,4%	87,1%	85,3%D	45	0,0%	18,3%	11,1%D
M&R HLD	M&R INV	07-Dec-90	20-Mar-92	30,7%	86,9%	84,8%D	43	0,5%	22,6%	8,7%D
SA BIAS	SABVEST	05-Jun-91	18-Sep-92	4,3%	85,7%	78,6%D	8	11,1%	18,4%	10,1%D
GENCOR	GENBEHER	02-Oct-87	18-Jan-89	80,7%	78,3%	76,4%D	36	4,3%	12,2%	7,5%D
EVERITE	EVHOLD	01-Oct-87	31-Jan-89	12,8%	72,1%	72,1%D	10	0,3%	30,2%	14,2%D
PEPKOR	PEPGRO	04-Jul-91	16-Oct-92	19,3%	73,0%	69,8%D	16	2,9%	14,8%	7,2%D
HLH	HUNTCOR	03-Jun-91	18-Sep-92	49,8%	70,1%	64,6%D	34	2,0%	15,1%	5,9%D
SEARDEL	SEARCON	10-Jan-89	20-Apr-90	15,6%	70,0%	62,0%D	12	14,3%	21,9%	7,7%D
W&A	WAICOR	03-Jun-91	18-Sep-92	64,7%	61,5%	56,3%B	62	9,5%	27,2%	8,2%D
SCOCLIK	HI-SCORE	02-Oct-89	18-Jan-91	43,9%	55,2%	55,2%D	18	15,7%	20,0%	4,5%D
SA BREW	SAB A-CP	04-Jun-90	01-Oct-91	6,2%	52,4%	52,4%D	8	9,1%	24,0%	11,4%D
FOSCHINI	LEFIC	08-Apr-91	17-Jul-92	13,7%	52,3%	47,7%D	8	4,0%	18,7%	4,9%D
MALBAK	MALHOLD	02-Nov-87	17-Feb-89	83,2%	46,0%	44,1%D	47	5,0%	22,2%	6,6%D
MARLIN	MLNHOLD	29-Apr-91	17-Jul-92	13,4%	56,1%	43,9%B	6	12,8%	16,3%	5,9%D
USKO	USKO CP	05-Jan-90	19-Apr-91	25,9%	44,0%	39,3%D	12	10,5%	22,2%	5,5%D
FSI	FS GROUP	07-Mar-91	18-Jun-92	23,3%	46,6%	35,6%B	9	9,1%	23,1%	2,9%D
SPECLTY	STORECO	08-Jul-91	16-Oct-92	8,3%	40,7%	33,3%D	4	0,9%	9,1%	3,0%D
REMB BEH	TEGKOR	01-Feb-89	22-May-90	65,2%	35,4%	31,1%D	20	3,5%	12,4%	4,3%D
FS GROUP	FSG PO	02-Nov-89	19-Feb-91	10,1%	33,3%	30,3%D	3	36,4%	12,6%	3,6%D
VALARD	VALHOLD	08-Jan-91	13-Mar-92	5,7%	35,3%	29,4%D	5	17,0%	19,0%	3,8%D
MARSHAL	MARCONS	12-Apr-88	20-Jul-89	4,4%	42,9%	28,6%D	2	0,0%	18,9%	12,2%D
W AREAS	ELSBURG	01-Nov-90	19-Feb-92	94,8%	31,1%	28,5%D	17	6,5%	12,1%	3,9%D
G5HOLD	GOLDSTN	01-Jun-90	30-Sep-91	28,9%	32,3%	27,3%D	6	3,9%	20,4%	8,7%D
PICKNPAY	PIKWIK	02-Dec-88	21-Mar-90	74,2%	30,2%	25,2%B	15	3,3%	11,4%	2,8%D
NEIAFR	NEIHOLD	04-Jan-90	19-Apr-91	19,7%	21,9%	18,8%D	7	7,7%	9,6%	2,3%D
PLATE GL	PLACOR	02-Apr-90	19-Jul-91	45,5%	18,2%	17,6%D	26	35,0%	10,0%	4,5%P
IMPHOLD	IMPERIAL	04-Mar-91	18-Jun-92	15,8%	19,6%	15,7%D	3	9,9%	17,7%	0,8%D
HARTIES	ZANDPAN	01-Dec-86	18-Mar-88	100,0%	18,1%	15,6%B	16	12,9%	5,8%	1,9%P
UNIHOLD	U-CON	20-Nov-90	19-Feb-92	10,2%	28,1%	12,5%D	2	7,9%	18,5%	2,6%D
FIRSTBK	FIRST PO	06-Jun-90	19-Sep-91	41,5%	15,4%	12,5%D	3	5,7%	9,5%	2,1%D
CLICKS	CLICKDIN	07-May-87	30-May-88	42,2%	16,8%	12,4%D	7	10,8%	13,3%	1,7%D
REMGRO	REMB BEH	02-May-91	18-Aug-92	98,8%	16,1%	12,1%D	6	5,3%	6,4%	3,1%D
GFSA	GFSA CP	01-Jun-89	19-Sep-90	17,9%	13,6%	11,9%D	3	11,5%	11,9%	1,3%D
OFSIL	WELKOM	03-Jun-91	18-Sep-92	59,3%	12,8%	11,3%D	8	7,4%	13,5%	1,6%D
SUNCRSH	DALYS	01-Dec-88	30-Mar-90	8,1%	14,8%	11,1%D	3	12,6%	5,1%	2,7%P
TEGKOR	TIB	01-Aug-90	19-Nov-91	37,6%	15,3%	10,5%D	9	5,7%	9,8%	1,5%D
ELCENTR	ELGRO	04-Sep-90	20-Dec-91	49,8%	12,2%	8,5%D	6	6,5%	9,1%	0,5%D
FSI	FSI PO	02-Feb-89	22-May-90	27,8%	6,7%	6,7%D	2	14,3%	7,7%	0,7%P
SBIC	SBIC PO	01-Nov-88	19-Feb-90	78,6%	7,0%	6,2%D	16	3,3%	10,9%	2,0%D
CMI	CMI CP	02-Aug-91	17-Jul-92	22,1%	9,4%	5,7%D	3	11,1%	6,0%	0,6%P
SUNPAK	SUNVEST	03-Nov-88	19-Feb-90	42,2%	5,1%	3,6%D	3	11,0%	9,4%	1,6%D
WALTONS	WALHOLD	02-Oct-87	18-Jan-89	73,0%	3,8%	3,4%D	6	12,9%	6,2%	2,3%P
TRIMTRD	TRIMHLD	06-Dec-90	20-Mar-92	4,6%	6,7%	0,0%D	1	56,9%	9,6%	34,4%P
AF & OVR	AF&OVR-A	14-Apr-86	20-Jul-87	7,5%	4,2%	0,0%P	1	7,7%	4,3%	0,5%P
GENTYR-A	GENTYR-B	17-Jan-90	19-Apr-91	12,0%	2,6%	0,0%P	1	6,3%	6,1%	0,2%D
SA BREW	SAB B-CP	24-Apr-92	25-Sep-92	38,7%	2,3%	0,0%D	1	7,8%	4,4%	1,5%P
ANGVAAL	AVAAL-N	02-Feb-89	20-Apr-90	31,3%	2,1%	0,0%P	1	11,1%	19,4%	3,4%D
ROYAL	ROYHOLD	03-Jan-91	16-Apr-92	33,6%	0,9%	0,0%D	1	7,7%	5,0%	0,5%P
KELGRAN	KEELEY	07-Jun-91	18-Sep-92	51,4%	0,6%	0,0%D	1	12,6%	12,5%	1,8%P
URQHART	URQ PO	16-Sep-91	30-Nov-92	5,9%	0,0%	0,0%D	0	59,1%	0,0%	40,2%P
VENTERS	VENT DEF	02-Jan-91	16-Apr-92	74,2%	0,0%	0,0%P	0	0,0%	40,0%	22,1%D
WOOLTRU	WOOLTR-A	02-Jun-87	16-Sep-88	66,6%	0,0%	0,0%P	0	1,9%	8,8%	2,3%D
VALAUTO	VALCAR	24-Oct-90	17-Jan-92	3,2%	0,0%	0,0%D	0	23,4%	0,0%	23,4%P

1. The percentage of days that both shares traded.
2. Anomaly days as a percentage of the number of days that both shares traded. Anomaly days are the days where share 2 traded at a premium ("P") or discount ("D") of more than 4% to the implied value from the share 1 price. A "B" indicates that both premiums and discounts above the 4% threshold were included. The Tot. (Total) column includes all anomaly days, while the Seq. (Sequence) column excludes isolated anomaly days i.e. only sequences of at least two anomaly days in succession are included.
3. The largest unbroken sequence of successive anomaly days.
4. The premium ("P") or discount ("D") of the mean closing price of share 2 to be implied value from the mean closing share 1 price. To prevent distortions, only the days when both shares traded were used for the computations of the mean closing prices.

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the non-voting shares) share 1 was the numerator. If the numerator exceeded the denominator, then the ratio was set equal to 1. Similar results were obtained if the definition of the Liquidity Ratio was changed to simply the ratio of the minimum to the maximum number of days traded. The Value Ratio Code was 1 if the share value ratio was a round number, as previously defined.

The three factors from the regression analysis were used for the discriminant analysis of the data. The sample contained eleven pairs of shares in the efficient group (no non-isolated anomalies detected) and 47 in the anomaly group. Four of the pairs in the efficient group were suspected of having price anomalies in the opposite direction to that tested for and were thus omitted from the first stage of the discriminant analysis, leaving seven pairs in the efficient group. As soon as any of these four pairs were classified into the efficient group they were included in the next stage so that by the third and final stage there were ten pairs in the efficient group, with only Valauto/Valcar still excluded. The final discriminant function was:–
DF=3,6796 LR+2,1514 VRC+2,0977 SA–4,2737

Nine of the ten pairs from the efficient group, excluding only Royal/Royhold, were correctly classified, using a cut off value of DF=1,5. Valauto/Valcar was still classified well inside the anomaly group, while SBIC and Imphold/Imperial (DF=1,64 for both) were the only two of the 47 pairs in the anomaly group incorrectly classified.

The alternative definition of the liquidity ratio i.e. minimum days traded divided by maximum days traded for the two shares would be much simpler to use in practice. Using this alternative liquidity ratio results in some adjustments to the coefficients of the discriminant function so that:–
DF=3,4880 LR+2,0385 VRC+3,2908 SA–4,1770

Valauto/Valcar and Trimtex were excluded from the analysis and were classified into the anomaly group, using a cutoff for DF of 1,5. Two of the remaining nine pairs in the efficient group were incorrectly classified, namely Royal/Royhold (DF=1,149) and Kelgran/Keeley (DF=1,239). Imphold/Imperial and SBIC remained the only incorrectly classified pairs from the anomaly group.

DISCUSSION

Where price anomalies exceed the switching costs then holders of the relatively overpriced share may benefit and take a risk free profit by switching, which is in conflict with the EMH. However, there is at least one group that could benefit from even smaller anomalies. This is the group of investors that have already decided to buy one of the shares. This group may benefit by simply choosing the relatively underpriced share of the pair to buy, without incurring any extra transaction charges. If any sellers of the shares happen to hold both shares, then they could similarly benefit from even small anomalies.

If the magnitude of the price anomaly is large enough then even arbitrageurs with no interest in the shares may benefit, by buying the underpriced share and selling the overpriced one short. However, the restrictions on short sales make the costs of such an exercise very high.

Share Price Lags

Share price anomalies may occur in two possible ways, or in a combination of the two. The first would be where one of the shares consistently trades at a significant unjustified premium or discount to the other. The best example of this would be South Roodepoort, where the mean discount of the "S" ordinaries to the ordinary shares was 35,5% (Table 2). The second way would be where the ratio of the prices of the two shares is very close to the share value ratio on average, but fluctuates significantly above and below this ratio. Part of the fluctuations in the share price ratios may be caused by lags i.e. one of the shares taking longer than the other to react to price sensitive information.

If short (bear) sales are ignored, then the potential sellers must be the shareholders. However, the group of shareholders that are considering selling (or who have placed selling orders on the market) would normally be much smaller than the total number of shareholders. Thus, unless the information is so dramatic and negative as to cause the shareholders who had not previously considered selling to suddenly decide to do so, the potential sellers would effectively be limited to this smaller group.

If certain information takes time to be distributed or interpreted, then some people would obviously be able to react more quickly than others to such information. It could then be expected that sometimes the sellers of share 1 would react more quickly, causing the price of share 2 to lag share 1. On other occasions the share 2 sellers would react faster, causing share 1 to lag, while often there would be no lag because the sellers of both shares reacted immediately (or equally promptly). In addition, where for example share 2 lags share 1 then this lag could sometimes be only a day, while on other occasions it may take several days to catch up.

In order for share 2 to consistently lag share 1 by a constant amount (e.g. one day) so that a high value for the lagged correlation coefficient is obtained, the sellers of share 2 would need to consistently receive any price sensitive information exactly one day after the share 1 sellers. This is obviously absurd and would never happen in practice.

The above argument could be looked at from the buyers' rather than the sellers' point of view. However, arguing from the sellers' point of view is more valid for two reasons. Firstly, the number of potential buyers is likely to be far greater than the number of potential sellers (not restricted to the shareholders). Secondly, the buyers have no restrictions on which of the two shares they buy, whereas the sellers do, unless they hold both shares or sell short.

Do Anomalies Imply Inefficiency?

The results of this research conclusively prove that the occurrence of share price anomalies between related shares on the JSE is widespread. However, the question remains whether this necessarily implies inefficiency in the market, or an alternative explanation is feasible.

Under the assumptions previously mentioned, particularly the second and third assumptions, share price anomalies must imply inefficiency in the market. However, the validity of these two assumptions may be questioned.

The most common justification for anomalies where a pyramid (or convertible) trades at a discount to the bottom company (or ordinary share) is in terms of liquidity. It is common for the traded value of the pyramid to be significantly less than that of the bottom company. Little and Teeuwisse (1987, p5) discuss this aspect in terms of marketability of the shares. They found that the traded values of three of the pyramids were only half the traded values of the corresponding bottom companies, while the traded value of the fourth pyramid, Pikwik, was only a third of that of Pick 'n Pay.

In terms of the Capital Asset Pricing Model (CAPM) or the more recent Arbitrage Pricing Theory (APT), the market does not reward for diversifiable risk. The liquidity risk inherent in a share that trades infrequently must be specific to that particular share and therefore may be regarded as diversifiable. Thus, if the CAPM or the APT are valid than a liquidity premium may not be used to justify share price anomalies.

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Ibbotson, Diermeier and Siegel (1984) claim that the systematic risk characteristics of the CAPM or the APT are not the only factors influencing the prices of investment assets. They have developed an alternative theory, the New Equilibrium Theory (NET), which appears to conform far better to reality. According to the NET, the required rate of return of an asset needs to be adjusted for marketability costs. Low liquidity of an investment should push up the marketability costs, so that a liquidity discount on the price of seldom traded shares may be justified. However, the research of James and Edmister (1983) on the small firm effect indicates that liquidity premiums are usually of negligible significance.

A liquidity premium cannot justify all the anomalies detected in this research, because for several of the pairs the pyramid traded at a discount in spite of trading more frequently than the bottom company. Even where a liquidity premium is justified, it seems unlikely to be of sufficient magnitude in an efficient market to explain the larger magnitude anomalies e.g. the 56% maximum discount of the South Roodepoort "S" shares to the ordinaries (Table 2).

CONCLUSIONS

The results of this study prove conclusively that share price anomalies on the JSE are common, often of a large magnitude and frequently persist for a long periods. If the assumptions previously mentioned are accepted, then this proves that the JSE is not an efficient market, although there may well be "pockets of efficiency", since no price anomalies were found for certain pairs of shares. Previous researchers such as Strebel (1977) have suggested that market efficiency on the JSE is likely to be limited to the actively traded shares i.e. those where trading volume is high. However, share price anomalies were detected in both high volume (e.g. Fregold/Ofsil) and low volume shares. These results further indicate that a liquidity premium for the more actively traded shares may explain some, but not all of the price anomalies.

Three factors likely to influence market efficiency as measured by the extent of share price anomalies were identified. The first factor, the liquidity ratio, may be associated with a liquidity premium for the more actively traded shares. The magnitude of this liquidity premium, however, appears to be frequently too large to be justified in an efficient market, considering the share liquidity is a diversifiable risk.

The importance of the second factor, the value ratio code, indicates an inability of many investors in the market to interpret or remember information, unless it is extremely straightforward. After all, even the slight complexity caused by a share value ratio that is not a round number, is sufficient to significantly increase the extent of share price anomalies. The significance of the third factor, the shareholder activity, indicates that a more efficient market may be expected in shares that do not have passive shareholders.

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Revision of Index performance calculations

ABSTRACT

Relative performance measurement and incentive fees increase the need for accurate performance benchmarks. This paper identifies a significant bias and error in the current performance calculations for the Actuaries All Bond Index. A single correction to the traditional formula takes into account the actual income payment frequency of assets is proposed to eliminate this bias.

INTRODUCTION

In this paper we apply principles of mathematics of finance to the calculation of the performance of the JSE indices in pursuit of an acceptably accurate method of performance evaluation.

BACKGROUND

With the increasing importance of benchmarks in portfolio management due to

a) increased performance monitoring sophistication
b) use of relative performance based fees

the need for exact methods of performance calculation has become critical, i.e. the performance of the benchmark must reflect as accurately as possible the performance of an actual portfolio with the same constituents as that benchmark.

However, in the recent past it has come to the attention of fund managers that performance of fixed interest portfolios with a similar structure to the most widely used fixed interest benchmark, viz the JSE Actuaries All Bond Index, consistently underperform that index by approximately 0,5% annually.

Hence, the purpose of this paper is to:

1. quantify the underperformance by analysing the current performance calculations and from this state possible reasons for this underperformance;
2. suggest possible alternatives to performance evaluation, short of monitoring the actual portfolio consisting of the index constituents and its cashflows.

CURRENT PERFORMANCE INDICES

Traditionally the following calculations have been used to measure total performance of the bond indices.

$$Yc = \frac{WP - VO - (K - J)}{Vo + .5*(K-J)} *100$$

where Yc is the return of the index (in percent
K is the net new money invested during the period, calculated as the all in price paid for purchases (after all costs) less the all-in realization proceeds of sales.
Vo is the all in value of the portfolio at time *0.*
Wp is the value of the portfolio at the end of the period if the amount available at the start of the period and the cash flow halfway through the period had been invested in the index.

$$WP=(\frac{Ip}{Io} * Vo)+(\frac{Ip}{I_{½}\,p} * K)$$

Where Io is the clean Price Index at time o
Ip is the clean Price Index at time p
$I½p$ is the clean Price Index at time $½p$

J is the interest that would have been earned over the period, using the Interest Yield,

$$J=(Vo+.5*K)*t*G_{½}P$$

Where t is the period in years from o to p;
$G_{½}\,p$ is the Nominal Annual Income Yield at time $½\,p$

These returns are then linked using

$$Ya=100*[((1+\frac{Y_1}{100})*(1+\frac{Y_2}{100})...(1+\frac{Y_i}{100}))-1]$$

Ya is the return for the whole period under observation (e.g. one year)
Yi is the return over the ith sub-period (e.g. month)

We have applied this method to the bond index where we use a month as a sub-period. This is compared to the actual performance of a portfolio consisting of the index constituents (results in Appendix I), the methodology of calculations outlined below.

The following table summarises the performance results for the two years involved:

Portfolio	1991	1992
All bond (traditional)	14,38	27,77
All bond (actual)	13,92	26,90
Difference	0,46	0,87

Given that the Trustees may evaluate a fund manager's performance and determine the level of his fees on the basis of these figures and that the incremental value added by a portfolio manager is of the order of 2% pa, this kind of error becomes unacceptable.

ACTUAL PORTFOLIO PERFORMANCE METHODOLOGY

To track the performance of an actual portfolio consisting of the index constituents and weightings, two systems were used viz:

(i) A Lotus spreadsheet
(ii) The I-Net Portfolio tracking system with performance calculations being done using Carsons Portfolio Performance option.

Both systems calculated the same performance results.

At the start of the investigation the portfolio was constructed using the weightings as given by the JSE. At the beginning of each subsequent quarter, when the index weightings changed, it was assumed that the portfolio switched into the new weightings with no cost involved.

To ensure that the nominal weightings of the various stocks in the index remained constant during a specific quarter, all income received from the portfolio was treated as a client withdrawal and drawn down from the portfolio. All income and withdrawals were assumed to occur midway through the month in which they arose.

The portfolio was valued at each month end using the official JSE All-in market value obtained from I-Net and monthly per-

formance was calculated using the following formula:

$$R_i = \frac{V_{1i} - V_{0i} - C_i}{V_{0i} + \frac{1}{2} C_i}$$

Where R_i = rate of return in month i
V_{1i} = All-in market value at end of month i
V_{0i} = All-in market value at beginning of month i
C_i = net investment in month i
= $P_i - S_i - I_i$

Where P_i = Purchases for month i
S_i = Sales for month i
I_i = Income for month i

These monthly returns were then linked for longer periods using the following formula:

$$R = \prod_{i=1}^{n}(1+R_i) - 1$$

All accounting of the portfolio was done on an accrual basis, i.e., income is accounted for in the month it is earned rather than when it is received for performance purposes. This is consistent with the accounting practices of most major portfolio managers and is also the practice consulting actuaries recommend be adopted.

PERFORMANCE CALCULATION ASSUMPTIONS

In order to explain this difference it is necessary to look at the assumptions implicit in the performance calculations.

1. Using

$$J = (Vo + .5 * K) * t * G_{1/2}\, p$$

where p refers to a month, compounding using *Ya* assumes that coupons are received on a monthly basis i.e. that all the bonds in the index pay coupons monthly. However we know that only two coupons are paid yearly by each bond. The current performance measurement formula therefore generates results which are significantly biased because of an excessive compounding effect.

2. Receipt of coupons is assumed to be uniform over the period. However in reality, by inspection of LDR dates of bonds in the All Bond Index, coupons are usually received at the end of a particular month, and furthermore, receipts over the year are clustered in certain months. The implicit timing difference of the reinvestment of income can obviously lead to higher or lower returns depending on interest rate moves. They should however cancel out over a long period. These problems will be addressed in a later paper, and therefore are beyond the scope of this paper.

ALTERNATIVE PERFORMANCE CALCULATIONS

As the interest yield is, in practice, compounded half yearly, a better approximation of the return for a period of length *t* is obtained by replacing the effective periodic rate of interest.

$$t * G_{1/2}\, p$$

in the current formula with

$$[(1 + \frac{G_{1/2}\, p}{2})^{2t} - 1]$$

giving a revised interest, *J*, of

$$(Vo + 0.5 * K) * [(1 + \frac{G_{1/2}\, p}{2})^{2t} - 1]$$

This method has been used in Appendix II.

APPENDIX I
ACTUAL PERFORMANCE VERSUS 'TRADITIONAL METHOD' PERFORMANCE

	ALL BOND PRICE INDEX	ALL BOND YILED INDEX	ACTUAL PERFORMANCE MONTH	ACTUAL PERFORMANCE QUARTER	ACTUAL PERFORMANCE ANNUAL	'TRADITIONAL' METHOD PERFORMANCE MONTH	'TRADITIONAL' METHOD PERFORMANCE QUARTER	'TRADITIONAL' METHOD PERFORMANCE ANNUAL	DIFFERENCE
31-Dec-90	114,73								
31-Jan-91	115,72	14,97%	2,06%			2,12%			
28-Feb-91	116,84	14,47%	2,03%			2,19%			
31-Mar-91	115,34	14,59%	-0,02%	4,10%		-0,08%	4,27%		
30-Apr-91	115,81	14,70%	1,59%			1,64%			
31-May-91	114,50	14,73%	0,11%			0,08%			
30-Jun-91	112,93	14,99%	-0,14%	1,55%		-0,14%	1,58%		
31-Jul-91	112,42	14,97%	0,79%			0,79%			
31-Aug-91	111,00	15,27%	0,02%			-0,01%			
30-Sep-91	110,61	15,31%	0,88%	1,69%		0,92%	1,71%		
31-Oct-91	110,83	15,51%	1,45%			1,49%			
30-Nov-91	112,56	15,12%	2,74%			2,84%			
31-Dec-91	113,08	15,08%	1,66%	5,96%	13,92%	1,72%	6,18%	14,38%	0,46%
31-Jan-92	113,06	14,99%	1,24%			1,23%			
29-Feb-92	112,82	15,06%	0,95%			1,04%			
31-Mar-92	115,10	14,97%	3,23%	5,51%		3,29%	5,65%		
30-Apr-92	116,19	14,73%	2,11%			2,19%			
31-May-92	117,94	14,37%	2,66%			2,72%			
30-Jun-92	120,04	14,49%	2,89%	7,86%		3,01%	8,13%		
31-Jul-92	125,93	13,76%	5,90%			6,11%			
31-Aug-92	129,13	13,06%	3,59%			3,66%			
30-Sep-92	132,68	13,02%	3,73%	13,80%		3,86%	14,24%		
31-Oct-92	128,62	12,96%	-1,89%			-2,01%			
30-Nov-92	126,88	13,45%	-0,28%			-0,25%			
31-Dec-92	125,64	13,83%	0,17%	-2,01%	26,90%	0,16%	-2,09%	27,77%	0,87%

Some of our biggest reasons for believing in big business are some of our smallest.

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And that is really what a healthy economy is all about, a mix of big, medium and small businesses operating internationally and internally off a strong, competitive base.

Big business and the South African economy. Inseparable if the new South Africa is to have an economy worthy of generations to come.

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APPENDIX II
ACTUAL PERFORMANCE VERSUS 'ADJUSTED METHOD' PERFORMANCE

	ALL BOND PRICE INDEX	ALL BOND YILED INDEX	ACTUAL PERFORMANCE MONTH	ACTUAL PERFORMANCE QUARTER	ACTUAL PERFORMANCE ANNUAL	'ADJUSTED' METHOD PERFORMANCE MONTH	'ADJUSTED' METHOD PERFORMANCE QUARTER	'ADJUSTED' METHOD PERFORMANCE ANNUAL	DIFFERENCE
31-Dec-90	114,73								
31-Jan-91	115,72	14,97%	2,06%			2,08%			
28-Feb-91	116,84	14,47%	2,03%			2,15%			
31-Mar-91	115,34	14,59%	-0,02%	4,10%		-0,12%	4,16%		
30-Apr-91	115,81	14,70%	1,59%			1,60%			
31-May-91	114,50	14,73%	0,11%			0,05%			
30-Jun-91	112,93	14,99%	-0,14%	1,55%		-0,18%	1,47%		
31-Jul-91	112,42	14,97%	0,79%			0,75%			
31-Aug-91	111,00	15,27%	0,02%			-0,04%			
30-Sep-91	110,61	15,31%	0,88%	1,69%		0,88%	1,60%		
31-Oct-91	110,83	15,51%	1,45%			1,45%			
30-Nov-91	112,56	15,12%	2,74%			2,80%			
31-Dec-91	113,08	15,08%	1,66%	5,96%	13,92%	1,69%	6,06%	13,87%	-0,05%
31-Jan-92	113,06	14,99%	1,24%			1,19%			
29-Feb-92	112,82	15,06%	0,95%			1,00%			
31-Mar-92	115,10	14,97%	3,23%	5,51%		3,26%	5,54%		
30-Apr-92	116,19	14,73%	2,11%			2,15%			
31-May-92	117,94	14,37%	2,66%			2,69%			
30-Jun-92	120,04	14,49%	2,89%	7,86%		2,97%	8,01%		
31-Jul-92	125,93	13,76%	5,90%			6,08%			
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30-Sep-92	132,68	13,02%	3,73%	13,80%		3,83%	14,14%		
31-Oct-92	128,62	12,96%	-1,89%			-2,04%			
30-Nov-92	126,88	13,45%	-0,28%			-0,28%			
31-Dec-92	125,64	13,83%	0,17%	-2,01%	26,90%	0,13%	-2,18%	27,27%	0,37%

Summarised results are as follows:

Portfolio	1991	1992
All bond (adjusted)	13,87	27,27
All bond (actual)	13,92	26,90
Difference	-0,05	0,37

The traditional method is an adequate approximation where interest received is a small component of total returns, as compounding effects are less noticeable. However, with the high interest yields on bonds at present, the adjusted method is a better approximation to actual performance of the index.

As with bonds, dividends on equity are received semi-annually. The dividend yields however, are far smaller, currently, than interest yields resulting in a smaller compounding effect than with bonds. Dividend yields fluctuate over time, so for

1. future prudence and;
2. performance consistency across asset indices

the above logic should also be applied to equity indices.

CONCLUSION

Using the traditional performance calculation leads to the performance of the indices exceeding the performance on the actual portfolio with the same constituents as that index. The reason for this is that dividends or coupons are assumed to be reinvested in the index monthly instead of semi-annually.

This inconsistency can be partly corrected by adjusting the assumed monthly interest in the traditional calculations to reflect this semi-annual payment. At current market levels this represents the eliminations of a bias of about 0,5% p.a.

We recommend that the revised interest be used in calculating performance, making the index performance an achievable and realistic benchmark for portfolio performance measurement and comparisons.

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"Performance system EVA™ takes off in SA", announced a headline recently in Business Day. What is EVA, how does it relate to the growth ethic prevalent in the corporate world, and why does it lead to increasing value for shareholders?

Growth, whether internally or externally generated, does not always add value to the firm. If new investments produce returns that are lower than their cost of capital, shareholder value will fall.

The measurement of a business's progress towards creating value for its shareholders lies at the heart of today's hottest financial idea – economic value added or EVA. Investors, it is now recognised, reward businesses for quality rather than mere size.

In essence EVA is a way of measuring the real profitability of a business after the total cost of its capital – both debt and equity – has been taken into account. Traditional measures only account for the cost of debt capital. In EVA, the often considerable cost of equity capital is also included.

Historically the approach to corporate performance measurement was based on return on equity (ROE) or return on assets (ROA). Firms' performance targets as well as management compensation have, in the past, been based largely on these accounting rates of return.

These ratios are attractive because they are single numbers which reflect both operating performance and asset management. They facilitate comparison amongst various business units and are generated directly from the firm's accounting system.

Major inadequacies inherent in the use of these ratios include flaws in the accounting system and the potential for manipulation, together with the fact that historical returns do not capture the very significant re-investment activity critical to creating or maintaining value.

The key principle of this "new idea" in corporate finance is that value is created when an investment exceeds a cost of capital that correctly reflects its investment risk.

All businesses have in common the three elements upon which value rests, namely:

- The amount of capital invested in the business;
- The cost of capital;
- The return on capital.

The total capital invested in a business is the sum of its debt and equity finance. The book value of the capital reflected in the annual financial statements should be increased by adding back to capital such items as the deferred tax reserve, LIFO inventory reserves and the capitalized value of R&D expenditures. This converts book value into economic book value which, it has been argued, is a truer measure of the cash which investors have put at risk, and upon which they expect their returns to accrue.

The cost of capital may be defined as the return required by the providers of capital. The cost of debt is measured by the after tax interest payments made by the firm. The cost of equity is not represented by an explicit payment by the firm, but is rather an opportunity cost. It is the return required by shareholders and is equal to the return available to them by investing in other, comparably risky companies. The cost of equity comprises both dividend payments and an expectation of capital gains (ie an increase in the value of the firm's shares). These capital costs are weighted in the proportions in which debt and equity are used by the firm, yielding a weighted cost of capital.

The net operating profit of the firm, expressed on an after-tax basis (NOPAT), is the cash flow stream that is available to compensate the suppliers of both debt and equity capital. The firm's overall return can thus be calculated by dividing NOPAT by the economic capital employed. Value is created if a business generates returns that are in excess of its cost of capital. Such firms could be expected to trade at a premium to the amount of capital they employ. The opposite will apply if the returns generated fall below the cost of capital.

In order to add value for its shareholders, a firm has three options open to it. It will either have to generate long-term sustainable returns in excess of the cost of capital on its existing business portfolio, undertake new ventures such that the returns they provide are greater than the cost of capital required to finance the ventures, and/or ensure that those parts of the business where the return being achieved is less than the cost of capital, are divested. Thus it may be appropriate to reduce the size of the firm in order to generate shareholder value.

The attached figure shows diagrammatically how the building blocks of capital, the returns generated by the firm (R) and the cost of capital (C) interact to generate value.

EVA is simply the economic capital used multiplied by the spread between R and C. EVA expected to be generated in the future is discounted to present value using the firm's cost of capital, thus recognising the time preference for money and the riskiness of the investment generating the EVA. The sum of the present values of these future EVA's gives the market's expected value to be added to the firm. The sum of the market value added (MVA) plus the economic capital invested in the firm gives an estimate of the total market value of the firm. The equity value may be determined by subtracting the market value of debt from the total value which emerges from the model.

In practice estimating cash flows for the expected life of the business requires setting up a series of discrete estimates of performance for the short term (say the next 5 to 8 years) and a single estimate of the average performance for the longer term. The focus in the entire analysis is on cash flows in order to avoid the inadequacies of accounting systems, as reflected in measures such as ROE.

In operationalising the EVA model, the following key determinants of cash flow must be estimated:

1) Operating profits before interest and tax
2) The tax rate
3) Growth in revenues
4) The required investment in working capital
5) The fixed capital investment
6) The life of the projected strategy

The determinants of the discount rate (or cost of capital) are:
1) The cost of equity capital
2) The cost of debt
3) Leverage

These factors, barring perhaps the cost of equity, are hardly more complex than the determinants of ROE as presented in

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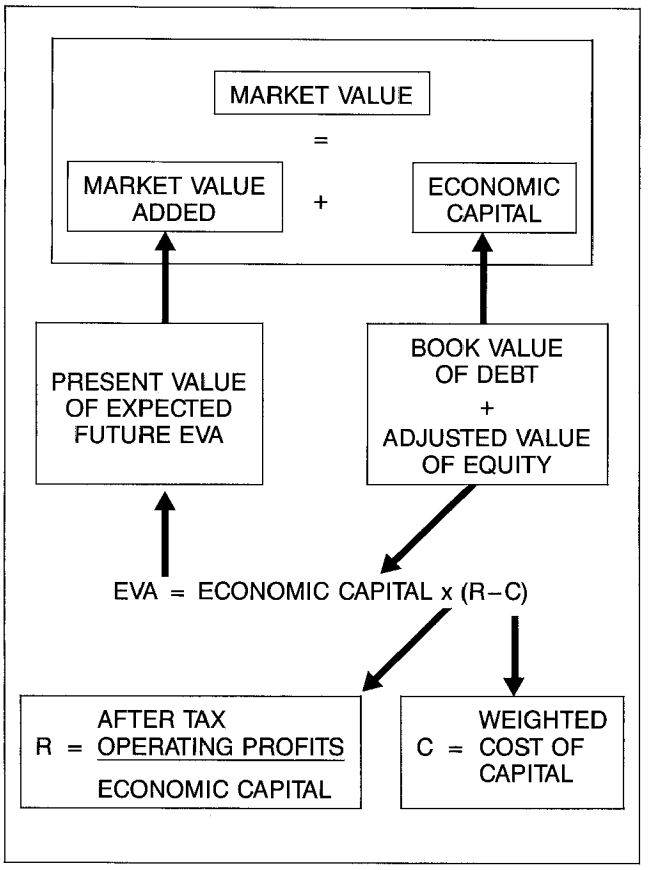
the well known du Pont model, but they relate directly to shareholders value. EVA captures the dynamics of risk, operating efficiency, capital productivity, growth and time as they jointly affect shareholder value.

To be successfully implemented, the method of performance measurement in the firm must change so that the economic value added concept can be used as a guideline by management in both tactical and strategic decision making.



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1. Articles should normally not exceed 6 500 words.
2. They should be submitted in duplicate and in final form for consideration by the Editorial Committee.
3. Where they contain graphs, separate copies of the graphs, suitable for use by the Journal's printers, should also be submitted.
4. An attempt should be made to limit the number of graphs included in any article.
5. Tables of statistical data should be kept as clear and brief as possible.
6. A distinction should be made between footnotes and references.
7. Footnotes, elaborations or explanations of the main text, should be numbered and should appear at the end of the article not at the bottom of the page to which they relate.
8. References should be listed at the end of the article in alphabetical order according to family names of first mentioned authors and should take the forms illustrated below:–

   Smith, John (1986). An Inquiry into Market Efficiency. **Journal of Finance,** Vol 29, No 2, p 19.

   Jones, P F and De Kock, P J S (1975). **Financial Analysis.** Oxford University Press.

   (Note a) Full stops should not be placed after the initials of authors.
   b) The year of publication should be given only after the names of the author(s).
   c) Where the publication referred to is a journal, the jounal's name should be underlined or appear in italics.
   d) Where the publication referred to is a book, the title of the book, not the name of the publisher, should be underlined or appear in italics).
9. When a particular work is referred to in the main text, the form adopted should accord with the following example:-
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