The investigation of the role of real estate in a mixed-asset portfolio within the South African pension fund industry

Abstract

The objectives of this research are to assess the returns, risks and correlation of a mixed-asset portfolio, establish the role of real estate in a mixed-asset portfolio and suggest an appropriate real estate allocation in the South African pension fund industry. The issue of low real estate allocation has been a subject of interest to practitioners and academics, both locally and internationally, despite the diversification benefit that real estate provides in a mixed-asset portfolio.

A statistical approach was considered most the appropriate tool for analyzing returns. Solver optimizer in the excel spreadsheet package was used to generate efficient frontiers and the associated values of portfolios. Real estate provided a lower return of 1.25% and a lower standard deviation of 4.90% compared to equities with a return of 1.39% and the highest standard deviation of 6.23%, whilst bonds provided the best risk-return trade off, with a return of 1.42% and the lowest standard deviation of 2.64%. An equally -weighted portfolio consisting of bonds and stocks and a portfolio consisting bonds, stocks and real estate was simulated. The equally -weighted portfolio of bonds and stocks provides a return of 1.41% and a standard deviation of 3.76%. The minimum variance with bias to bonds provides a higher return of 1.42% at a lower level of risk of 2.62%. The equally -weighted portfolio consisting of bonds, stocks and real estate provides a return of 1.35%, with a lower risk of 3.49%. The minimum variance with bias to bonds provides almost the same return of 1.40% at a lower level of risk of 2.54% compared to the bond and share portfolio.

The Chi-Square statistical tool was used to test the diversification benefit of real estate. It can be concluded that the standard deviation of the portfolio with property is close enough to the standard deviation without property of 3.76% and cannot statistically say that it is different given the 5% level of significance. The Sharpe ratio was used to test the favourable risk adjusted returns offered by real estate. It concluded that property provides favourable risk adjusted returns and diversification benefits, as illustrated with the increasing portfolio

return from 7.44% to 8.66% on Sharpe ratio basis and standard deviation of the portfolio decreasing from 3.76% to 2.54%.

The literature review generally supported the view that real estate has a role in a mixed-asset portfolio. Research topics such as securitized versus unsecuritized real estate, real estate allocation and diversification, returns and risk, inflation hedging, modern portfolio theory and the efficient -frontier were analysed and related to the research report.

The empirical analysis supports the hypothesis that real estate provides diversification benefits. The property cycle is positive and it is supported by positive property fundamentals like (vacancies are at lowest levels, capitalisation rates are strengthening, the property cycle is turning positive and a stable interest rate environment). The positive property fundamentals will lead to earnings growth.

An allocation of between 10% based on the lower end of the minimum variance and 15% based on the lower end of the risk/return ratio is recommended for a mixed-asset portfolio.

1. Introduction

This study provides a review of the role of real estate in a mixed-portfolio and related issues. Topics specifically addressed in this research report include: securitised and unsecuritised real estate; real estate allocation and diversification; returns and risks; inflation hedging; modern portfolio theory (MPT) and the efficient frontier.

Real estate is examined from the existing literature from two perspectives namely; securitised and unsecuritised. Exhibit 1 includes a summary of the literature review; Chatrath, A. and Liang,Y. (1998), Gold, B.R. (1995) and Hoesli, M. et al (2003) agree that unsecuritised real estate seems to have a desirable low risk as measured by the standard deviation. Byrne and Lee, S. (1995) and Lee, S. (2001) and Lee, S. (2003), Mueller, A.G and Mueller, G.R. (2003) ,believe that securitised real estate returns, which require de-smoothing techniques because of appraisal bias also offer lower volatility relative to other asset classes. Norman, E.J. et al (1995, p.20), applies securitised real estate to ascertain the role of real estate in a mixed portfolio, an approach adopted in this research report.

A preview of the extensive existing literature reveals that actual real estate allocation is lower than theoretical allocation and that real estate provides diversification benefits in a mixed-portfolio. Exhibit 2; includes a summary of the literature by Byrne and Lee, S. (1995), Chun, G.H. and Shilling, J.D. (1998), Hoesli, M. et al. 2003, Hudson-Wilson, S. et al. (2003), Kuhle, J.L. 1987, Lee, S. (2001) and Lee, S. (2003), Norman, E.J. et al (1995), has argued for higher real estate inclusion in a mixed portfolio. Gold, B.R. (1995) argues against the MPT application, the basis of this research report. Lee, S. (2003) demonstrates that the traditional methods of portfolio analysis based on the long run correlation averages fails to identify in which periods real estate helps to reduce portfolio risk.

The majority of studies show that real estate returns of both securitised and unsecuritised real estate performed well over different time periods on a risk-

adjusted basis compared to bonds and stocks. Norman, E.J. et al (1995) and Hoesli, M. et al (2003) studies reveals that slightly more than half of the studies that provide direct comparison show a higher average return for stocks than for real estate and that stocks exhibit higher risk than real estate as shown in Exhibit 3. Mueller, A.G. and Mueller, G.R. (2003) found public and private real estate exhibited low quarterly correlation and the unrelated behaviour of these real estate assets makes a stronger case for both public and private real estate inclusion in a mixed-portfolio. Finally, Han, J. and Liang, Y (1995), found that REITs performance seem to be highly sensitive to the sample period studied, performance varied over time and that the use of the S&P 500 index, which contains large capitalisation stocks, has been used as a benchmark for comparing REITs, which are small market capitalisation stocks.

One of the objectives of investors holding investments is to protect wealth against inflation. Considerable work has been done examining the ability of both financial and real estate assets to act as hedges against inflation. Exhibit 4 provides a summary of inflation hedging capability of real estate. The arguments are divided into complete or partial hedge against inflation. Rubens, J. H. et al. (1989, p.50) found that only residential properties are a complete hedge against inflation, Chatrath, A and Liang, Y. (1998), Hudson-Wilson, S. (2003) and Yobaccio, E. et al (1995) found that REITs provide some hedging capability against inflation. Han, J. and Liang, Y (1995) argues that on a systematic risk-adjusted basis, REITs' performance was unstable over time. Finally the literature review focused on the application of the MPT and the efficient frontier. The MPT remains the standard tool for investigating the importance of an asset in a multi-asset portfolio. The efficient frontier was first defined by Harry Markowitz and explains that the basis for allocation is uncertainty and examined the relationship between risk and return for each asset class.

The theoretical literature and empirical research, while not offering universal support, generally suggests that institutional investors are under-invested in real estate and that real estate plays a diversification role in a mixed asset-portfolio.

Table 1, shows real estate ownership patterns of life insurance companies for 10 countries over the period 1986 – 1996 and together they account for about two thirds of invested assets of insurance companies worldwide. Chun, G.H. and Shilling, J.D. (1998), found that most institutional investors' world-wide have shifted out of real estate and into stocks and bonds over the last decade.

Table 1. International Real Estate Allocation

	Years	
	1996	**1986**
Country	**(%)**	**(%)**
US	8.15	2.59
UK	17.22	7.23
Sweden	0.00	4.81
Austria	14.37	9.86
Netherlands	7.20	5.00
Italy	0.00	14.57
France	6.02	12.32
Spain	28.81	16.58
Belgium	6.39	4.57
Australia	0.00	6.95
Mean	**8.71**	**4.69**

Source: Chun, G.H.and Shilling J.D. (1998, p.20).

US institutional investors have gone from holding approximately 8% of their portfolio in real estate in 1986 to 2.5% in 1996. UK investors held more than 16% of their assets in real estate, now hold approximately 7.23%. Germany investors have reduced their holdings from 7% to 5%. Austria, Belguim, Italy, Spain, and Sweden have significantly reduced their relative portfolio shares in real estate. On the contrary French institutional investors have gone from holding approximately 7% of their invested assets in property to over 12% of their investments in 1996 and Australian investors were not invested in real estate in 1988 and now hold 7%.

2. Objectives

The objectives of this research are to assess the returns, risks and correlation of a mixed-asset portfolio, and to establish the role of real estate in a mixed-asset portfolio. It also suggests an appropriate real estate allocation in the South African pension fund sector. The optimal allocation of institutional investors' capital in the various asset classes (often referred to as inter-asset or mixed-asset diversification) is of foremost importance. It has a crucial impact on portfolio performance, which in turn impacts on the amounts that have to be paid into a fund and/or those that will be distributed to beneficiaries. Strategic asset allocation as observed by Byrne and Lee, S. (1995, p. 77) and Lee, S. (2002, p.2) has shown to be the main determinant of portfolio returns, rather than stock selection.

3. Hypotheses.

The hypothesis being tested in this research report is that real estate provides diversification benefits in investment portfolios because it provides favourable risk adjusted returns.

4. Methodology

4.1. Introduction

The purpose of the study is to investigate the performance measures of a mixed-asset portfolio. See Annexure A and B for data compilation.

Due to the nature of the study, a statistical approach was considered the most appropriate. Solver optimizer in the Excel spreadsheet package was used to generate efficient frontiers and the associate of portfolios.

4.2. Compilation of data

Monthly data was retrieved for the ALSI total return index, money market total return index, bond total return index, and PUT total return index was used as a proxy for real estate index.

For each instrument the average monthly returns were calculated from 1986 – 2003 and standard deviations (risk).

Table 2:Returns and risk

	BONDS	ALSI	REAL ESTATE	MONEY MARKET
Mean return	1.42%	1.39%	1.25%	1.13%
Risk	2.64%	6.23%	4.90%	0.26%
Sharpe ratio	0.11	0.04	0.02	

The Sharpe Ratio, which is calculated as the difference between the expected return on the portfolio and the average return on the 3-month Negotiable Certificate of Deposit, and divide by the standard deviation of the portfolio (which will be calculated later) as shown in Table 2. The Sharpe ratio is the reward, in terms of excess return, for any additional unit of risk taken. Real estate has the lowest Sharpe ratio.

In addition the correlation matrix and variance-covariance (input for portfolio standard deviation) are calculated.

Table 3: Correlation Matrix for Asset Classes

	BONDS	ALSI	MM	REAL ESTATE
BONDS	1			
ALSI	0.328879	1		
MM	0.114842	-0.00359	1	
REAL ESTATE	0.269392	0.356874	0.084206516	1

Table 3; presents the correlation matrix between the returns of the asset classes. The highest correlation was between the ALSI and Real Estate. However, the very low correlation between bonds and real estate is surprising, given the historic relationship that converged from 1994 as explained in Figure 5.

Table 4; presents the calculation covariance matrix, which will be used to calculate the standard deviation of the portfolio.

Table 4: COVARIANCE

	BONDS	ALSI	PROPERTY
BONDS	0.000368535	0.000145978	0.00002479
ALSI	0.000145978	0.00353201	0.001596924
PROPERTY	0.000024794	0.001596924	0.003708566

4.3. Limitations

The most important factor, which always plagues application of investment theory to real estate, is a reliable pricing series with which to measure returns. The Real Estate Index of the FTSE/JSE, combines both the PUT, PLS and Liberty International. Liberty International is the UK listed property equity company with 95% invested in retail and 5% in offices in the UK, could not be used because Liberty International constitute 51% of that index and it is considered to be a currency hedge. There is direct relationship between the movement of the Rand/Pound exchange rate and the local listed price (see Annexure E). Liberty International has been excluded for the purpose of this research because of different economic fundamentals that impact on this company.

The data analysis is limited to the listed property equity sector, and hence the PUT was used as proxy for property as explained in (Annexure A). Physical property comparatives could not be used due to the limited 10 yearly SAPIX data. SAPIX is generating physical property data, which will be useful for inclusion in future studies for comparison, once there is enough history or monthly data to generate sufficient data points. The property data series from I-NET had to be transposed (to construct a continuous index from 1986), because historical data uses different I-NET codes as explained by (Annexure B).

The JSE has proposed a construction of the Listed Property Index to remedy the above problems, and these will be launched in the second quarter of 2004. The SA Listed Property Index will consist of top 20 companies by market capitalisation in the real estate sector with a primary listing on the JSE. Liberty International will be excluded.

The research focus was limited to the pension fund sector and ignored the retail investor. Future studies should consider retail distribution as a holistic approach. Maritz and Miller (2004, p.9) say there are currently six unlisted property funds available in SA. These funds invest on average 72% in listed property securities, 9.5% in other securities, 15% in cash and the remainder in bonds and other assets.

International equity and bonds also play a role in a balanced portfolio. The international component was excluded on the basis of limited international data and exchange controls inhibiting South Africans from investing abroad, prior to 1997 and they are limited to invest only invest 15% of total assets offshore as per exchange controls regulations.

5. Literature Review

5.1. Introduction

The study provides a literature review of the empirical work and theory on the role of real estate in a mixed-asset portfolio. Key concepts that compose the research topic such as securitized versus unseciritised real estate, real estate allocation and diversification, returns and risk, inflation hedging, modern portfolio theory and the efficient -frontier were analysed and related to the research report.

5.2. Securitised versus unsecuritised real estate

The debate of the role of real estate is split into the literature review of direct real estate and public real estates assets. (Real Estate Investment Trusts – REITs and (Property Unit Trusts & Loans Stocks – PUT/PLS).

The debate of appraisal based data has been a subject of many studies in determining the role of real estate in a mixed-portfolio. Many investors believe that the appraisal based real estate data provides an inaccurate estimate of return volatility due to smoothing of returns. This tendency to recycle has the effect of incorporating previous prices in the current return. The evidence presented in Exhibit 1 confirms that smoothing bias causes the divergence between REITs and unsecuritised real estate. A difficulty related to both data quality and availability has received much attention. Gold, B.R. (1995, p.59) argues that these are perhaps overshadowed by the impact of uncertainty on the asset allocation process. Data limitations, as well as substantive issues regarding appraisal- based values, such as lumpiness; illiquidity and transaction costs make the application of modern portfolio theory (MPT) to real estate impossible.

While stocks are constantly marked to market, Gold, B.R. (1995, p.60) argues that future equity real estate returns are normally derived from a limited data set. Second, transaction times, while extremely short in the stock and bond markets, can be excruciatingly long for direct real estate. In a mixed portfolio, transaction times can have a significant impact on expected returns. Institutional investors need to be convinced that expected shifts in risks and returns are permanent, not transitory.

Chatrath et al. (1998, p.13) and Hoesli, M. et al (2003, p.3) agree that unsecuritised real estate seems to have a desirable low risk as measured by the standard deviation. Byrne and Lee, S. (1995, p.64) and Lee, S. (2002, p.1) and Mueller ,A.G. and Mueller, G.R. (2003, p.202) believe that securitised real estate returns, which requires de-smoothing techniques, because of appraisal bias also offer lower volatility relative to other asset classes. There are a number of methods that have been developed to de-smooth the appraised-based indices, but these can be broken down to two basic approaches; the models that assume market efficiency and those that do not. Norman, E.J. et al (1995, p.2) applies securitised real estate to ascertain the role of real estate in a mixed portfolio, an approach adopted in this research report. The approach was adopted because of limited direct data available from SAPIX and the responsiveness of listed property yields to broader economic fluctuations.

Geltner's approach assumes the de-smoothing technique, i.e. market efficiency, and the 'true' market returns are recovered from valuation based series by applying a autoregressive filter to the data set to derive a white noise in the process, which is then scaled by taking the relative risks of property and the equity market. The Geltner technique is the most commonly used technique throughout the research report. Byrne and Lee, S. (1995, p. 70), Lee, S. (2002, p. 2) Chatrah,A. and Liang,Y. , A. (1998, p. 312), Hoesli, M. et al (2003, p. 4) and Mueller, A.G and Mueller, G.R. (2003, p. 201) argue that the de-smoothing needs to capture the essence of the appraisal process and at the same time require relatively few data points. The simplest is the first auto-correlation. To bring indirect real estate in line with stocks and bonds, the effects of the auto-regressive must be removed. De-smoothed series is a simulated

return series after such inertia has been expunged from the original data. The valuation method best captures the appraisal behaviour of valuer's at disaggregated level on which index values are ultimately based.

Chatrah,A. and Liang,Y. (1998, p. 312) acknowledge that REITs have a substantial stock market component, and stock returns have tended to be negatively related to the rate of inflation. Mueller, A.G. and Mueller, G.R. (2003, p. 198) attributes the lagged relationship between public real estate and direct real estate due to the forward-looking nature of public securities pricing versus the backward looking nature of direct real estate. The correlation between the three assets and real estate are all zero and significantly lower than between bonds and stocks.

To avoid the problem of return smoothing due to the use of appraised values, some studies employ REITs and PUT for the purpose of this research report. Norman, E.J. et al (1995, p.16) argues that a problem normally arises when using REIT returns to measure real estate problems. During some time periods, REIT yields may vary from actual underlying property yields. In the early 1970s for example, REITs had low returns, while the returns on the underlying properties were high.

The differences may be the result from high inflation, which increases the tax shelter benefit of investor-owned properties. Other factors such as leverage and confidence on the ability of management to contribute to divergence of returns also explains the discrepancy. Several problems associated with using REIT returns can distort homogeneity of the portfolio because they usually have varying degrees of leverage.

5.2.1. Conclusion

Chatrah,A. and Liang,Y. ,A. and Liang,Y. (1998, p.311), Gold, B.R. (1995, p. 59) and Hoesli, M. et al. (2003, p. 11) agree that unsecuritised real estate seems to have a desirable low risk as measured by the standard deviation. Byrne and Lee, S. (1995, p.64), Lee, S. (2002, p. 4), Chatrah,A. and Liang,Y. (1998, p. 312), Hoesli, M. et al (2003, p. 4) and Mueller, A.G. and Mueller, G.R. (2003, p.

201) argue for securitised and direct real estate inclusion based on a de-smoothing technique of returns. De-smoothed series is a simulated return series after such inertia has been expunged from the original data. Geltner's approach assumes the market efficiency, and the 'true' market returns are recovered from valuation based series by applying an autoregressive filter to the data set to derive a white noise in the process, which is then scaled by taking the relative risks of property and the equity market. Real estate securities returns compared to de-smoothed direct real estate investments appear quite comparable. The research report focus on the securitised real estate returns an approach adopted by Norman, E.J. et al (1995, p.2) because of the insufficient direct property data, see limitations.

5.3. Real estate allocation and diversification

Diversification benefits of real estate and the allocation of real estate in an optimal mixed-asset portfolio are the subjects of studies presented in Exhibit 2. There appears to be a clear consensus that diversification with real estate provides enhanced returns. An interesting line of research is that of the impact of parameter uncertainty on optimal portfolio selection. It has been shown that the practical application of portfolio analysis is hampered by estimation error, Hoesli, M. et al. (2003, p. 6). Variances and co-variances are unknown over time. Given these results, it would seem appropriate to increase the reliability of the point of estimates for the optimal asset allocation.

One possibility for reducing estimation error is to constrain the allocation, thereby forcing a greater spread. While real estate is shown to be an important ingredient of an efficient frontier, optimal mixed-asset portfolio, the optimal amount allocated varies. Byrne and Lee, S. (1995, p.79) and Lee, S. (2002, p. 1) says that real estate has a place in a mixed-asset portfolio, although it is significantly less than in previous studies, using appraised data. The case for real estate can be made better by the application of representative constraints on asset weight and adjusting the property data series to compensate for appraisal bias. The choice of constraints is arbitrary however. Whether this is a reasonable is another question, however, equities were constrained to be

between 40 and 60 percent of the total, which is the range of holding average pension fund in the UK for the last 25 years. Along most of the frontier, the portfolio consists of only real estate and stocks, until bond replace stocks at the low risk end of the frontier.

Another possibility is to use the Bayes-Stein (BS) shrinkage approach. Hoesli, M. et al. (2003, p.3) found that when such an approach is used, the means are shrunk towards a common value. One intuitive interpretation of using BS estimates is that they should, when used within an asset class, improve estimates of expected long-term returns for specific asset classes by diminishing the effect of outlying observations. Optimal weight allocated to real estate, with unhedged returns, is in the 5%-15% allocation and inclusion of real estate leads to 5%-10% reduction in the portfolio standard deviation. Optimal allocation is constant across seven countries at approximately 15%.

Chun, G.H. and Shilling, J.D. (1998, p 41) believe that even with real estate imperfections such indivisibility the optimal allocation suggested for real estate in mixed-portfolio is 9% based on empirical evidence.

Hudson-Wilson, S. et al. (2003, p.10) uses a four quadrant weighted capitalisation performance return real estate index (comprising of REITs and private real estate, Private and Public Commercially Mortgage Backed Securities (CMBS). These four comprise the quadrants of the modern real estate investment class. The correlation between real estate and stocks of 0.065, real estate and bonds of 0.34, and real estate and cash of 0.259 suggest that real estate can play a significant role in a mixed-portfolio. Whenever two imperfectly related assets (correlation coefficient less than 1.0) are placed together in a portfolio, an opportunity exists to earn a greater return at each level of risk (or reduce the risk for a given level of return). In summary, when the return to an asset class is high enough, the risk is low enough, and/or the correlation reflects a sufficiently different pattern of returns, the asset class earns a place in the portfolio for at least a portion of return/risk premium-spectrum. Real estate meets these tests and is therefore a component of the well diversified mixed asset portfolios.

A large holding of real estate in the mixed portfolio may be justifiable on its compound return enhancing effect on the mixed-asset and not simply on its risk reducing ability as explained by Lee, S. (2002b, p 9). Real estate should be included in a mixed portfolio because of the effect of compound returns. To calculate compound returns, the market is broken into four possible outcomes, when both real estate and equity market is down and up, and real estate is up and equity market is down and when the real estate is down and equity market is up. Return due diversification is the difference between the compound return and the weighted- average returns, which is also called terminal wealth. By using a four-quadrant table for each asset class, it is possible to see to what extent the investor really gains from holding direct real estate, i.e. where losses in the asset class are offset by gains in direct real estate. Direct real estate reduces the upside potential of asset classes but compensates the investor by reducing the risk.

Kuhle, J.L. (1987, p2) compared the overall performance of five portfolio categories and ranked the returns according to the risk/return ratio. Within each category, a total of 600 portfolios were created containing various levels of assets. 50 random portfolios were created containing 12 assets of each and portfolios were equally weighted. The asset with the lowest relative comparisons would be a good candidate for risk reduction. The absolute magnitude of standard deviation for REITs is less than that of common stocks. In addition, the magnitude in risk reduction is greater for mixed-asset portfolios of common stock portfolio plus equity REITs than for mixed portfolio of common stock and mortgage REITs.

5.3.1. Conclusion

The literature review reaffirms of a case for real estate inclusion based on a more discriminating assessment of de-smoothing and MPT effects. Byrne and Lee, S. (1995, p.62) and Lee, S. (2003, p. 2) believes that one possibility reducing estimation error in the optimal portfolio is to constrain the allocation process based on historical averages. The study suggests a maximum real

estate allocation of 70.5% on the minimum risk end. Hoesli, M. et al. (2003, p. 20) suggested another possibility of reducing estimation error is to use BS shrinkage approach. The study suggested an allocation of between 15% - 25%. Other researchers like Lee, S. (2003, p. 3), Kuhle, J.L. (1987, p.1) and Hudson-Wilson, S. et al. (2003, p.40) focused their studies on risk-return attributes. Kuhle, J.L. (1987, p.7) found that the absolute magnitude of the standard deviation for REITs to be less than that of common stocks. Lee, S. (2002b, p. 9) found that real estate exhibits higher compound returns, which translates into higher terminal wealth. Hudson-Wilson, S. et al. (2003, p.16) argues for higher real estate inclusion based on the risk-return attributes.

5.4. Returns and risk

There is no consensus on the performance of real estate relative to other market investments. Hoesli, M. et al. (2003, p. 11) and Norman, E.J. et al (1995, p.20) Mueller, A.G. and Mueller, G.R. (2003, p. 196) provides evidence of returns and risk. Han, J. and Liang, Y. (1995, p.249) argues that performance of REITs varied over time, and REITs performed differently in different sub-periods under review, see Exhibit 3.

In the world of asset allocation, risk is divided into two components: Systematic and unsystematic risk. Systematic risk is the force to which all investments within a market are subject and which therefore must be borne by all investors. Unsystematic risk is confined to the peculiarities of an individual investment and may be diversified away. Market vacancy, production and inflation are all part of systematic risk, while location, building age, tenant mix, and timing of lease rollovers are all examples of unsystematic risk as explained by Gold, B.R. (1995, p.60).Muller AG et al. 2003, compared real estate returns (private and public) indexes representing various types of financial assets, including common stocks represented by S & P 500, small cap represented by Russell 2000, NASDAQ, bonds by Merril Lynch Mortgage Index and risk free rates. Data is measured quarterly as most fund managers are measured on a quarterly basis.

Equity REITs returns are either first or second in all time series, except the 20-year period. The S&P 500 is best over the 20-year period, while NASDAQ was the highest over the ten-year period. The standard deviation varied considerably for different time periods, with the NASDAQ showing the highest overall return in both 10 and 15year time periods, but the extremely high volatility made it less desirable in a mixed-asset portfolio. Real estate's return performance and relatively low volatility in both public and direct real has made the asset class a popular investment in poor economic conditions. Public and private real estate exhibited low quarterly correlation. The unrelated behaviour of these real estate assets makes a stronger case for both public and private real estate inclusion in a mixed-asset portfolio.

Data pertaining to stocks, bonds, direct real estate, real estate securities and cash from 1987-2001, for the US, UK, France, Netherlands, Sweden, Switzerland and Australia was compared by Hoesli, M. et al (2003, p.11), and found that real estate returns are poorly (positively or negatively) correlated to those of stocks, bonds and stocks constitute the highest return and risk asset class, while cash exhibits low return and risk parameters. Bonds appear to have a higher return and risk than cash. Real estate securities allocation varies quite substantially from different countries across.

In Sweden and the Netherlands, real estate stocks exhibit a lower return than cash, while their standard deviation is quite high. In France, the return on real estate stocks is only marginally higher than that on cash. In the US and UK, the return on real estate securities lies between that of stocks and bonds, but the standard deviation of securities real estate is higher than that of common stocks. Switzerland is the only country in which mean-variance efficiency is not violated, the standard deviation on real estate stocks lies between that of stocks and bonds, but the indirect real estate return is only marginally higher than that on bonds. In Australia the return and risk parameters of real estate securities are favourable, the return is higher than stocks, while standard deviation lies between that of bonds and stocks. UK and Netherlands exhibit lower return than bonds, but a higher return than cash.

A comprehensive review of literature conducted by Norman, E.J. et al (1995, p.1) found that slightly more than half of the studies that provide a direct comparison show a higher average return for stocks than for real estate. Some research demonstrated that real estate investments have outperformed debt and other fixed income securities, while other research finds that common stocks have outperformed real estate investments. On a risk-adjusted basis, most of the literature shows that real estate investments have a higher return per unit of risk than common stocks. When absolute risk of the investment is analyzed, the results are non-conclusive. A comparison shows that real estate has higher absolute returns than debt (such as bonds). The performance of real estate, in comparison to common stocks, is mixed.

Han, J. and Liang, Y. (1995, p. 245) evaluate the long term performance of REITs from 1970-1993, stability over time and the sensitivity of the Jensec index. Jensen is based on the Capital Asset Pricing Model (CAPM). It compares the performance of a security or a portfolio to the standard performance benchmark, the security market line. By assuming that the CAPM holds period by period, and that returns on securities generated by the market model, Jensen derived a linear expression between the realized returns on any security and its systematic risk, the realized returns on the market portfolio, the risk-free interest rate and random error. The Jensen index is used in performance studies because it measures performance based upon a simple and realistic benchmark, a passive managed portfolio that invests in savings accounts and the stock market portfolio. A positive and significant Jensen index indicates a superior performance of a REIT portfolio relative to this portfolio (REITs out-performs), while negative is vice versa.

According to the Jensen performance measure, in the long term, it should be expected that the REIT industry portfolio would perform similarly to the stock market portfolio adjusted for risk, if the market is efficient and the CAPM holds. REITs performed differently in different sub-periods. 1970-75, all equally weighted REIT portfolio earned a negative return, and the following 3 sub-periods the equally weighted portfolio had positive returns. All eight REIT portfolios had the highest mean returns in the 1976-1981 sub-period. T- test

results indicate that the mean returns are indeed significantly different between sub-periods 1970 -75, 1976 -81 for seven of the eight. Equally weighted portfolios equity REIT performed significantly worse in 1982-1987, than in 1976-1981. Jensen index suggests that there are substantial variations in the systematic risk-adjusted performance in the different sub-periods. Studies focus on short time periods and come to different conclusions.

5.4.1. Conclusion

Hoesli, M. et al (2003, p.11) M et al. 2003, Mueller, A.G. and Mueller, G.R. (2003, p. 196) and Norman, E.J. et al (1995, p21) find that stocks constitute the highest risk and that real estate show low volatility and lower correlation. Han, J. and Liang Y. (1995, p. 252) found the evidence to be inconclusive and that REIT performance varied over time. The S&P 500 is not an appropriate benchmark to use against the REITs index.

5.5. Inflation hedging

The ability of real estate to serve as a hedge against inflation is an active research interest. Studies addressing this issue are shown in Exhibit 4, and provide evidence of real estate inclusion on the basis of complete or partial hedge against inflation in a mixed-portfolio. The research reveals that studies are divided into complete hedge against inflation Rubens, J.H. et al. (1986, p.50) and partial hedge against inflation Chatrath, A. and Liang, Y. (1998, p.322) Hudson-Wilson, S. et al. (2003, p. 20) and Yobaccio, E. et al. (1995, p.285) found that in low inflation periods, the hypothesis that REITs were a perfect hedge against unexpected inflation was rejected in all cases.

Rubens, J. H. et al (1986, p. 46) examines the inflation-hedging effectiveness of asset classes as inflation hedges, as individual assets and as portions of mean/variance efficient portfolios. Further, the returns will be divided into the appreciation and income components as expositional aid. Return measures will be regressed against actual, expected and unexpected inflation. The hedging effectiveness is better examined by dividing the two inflation components.

Portfolios are constructed consisting of real estate and government bonds to examine the benefits of including real estate in inflation hedging portfolios. The study extends this previous research by updating time. Furthermore the return components are separated into income and appreciation. The division of the return stream helps ascertain the portion of the total return that determines the hedging effectiveness of the asset. Finally mean-variance efficient portfolios are constructed to determine additional hedging benefit accrued from including real estate.

Only residential estate is a complete hedge against inflation. Treasury bills (TB's) are the only assets exhibiting at least some hedging effectiveness. All other financial and real assets have standard errors so large that their hedging effectiveness is in- determinant, Rubens, J.H. et al. (1986, p.50). When examined against expected inflation as measured by the Livingston Price Expectations index (LPE), there are few more positive hedges. Only TB's and business real estate provided a complete hedge against expected inflation. Rubens, J.H. et al. (1986, p. 47), find that farmland is a complete hedge against both expected and unexpected inflation.

Inflation impacts the capital value in two ways. Hudson-Wilson, S. et al. (2003, p. 19) found that first, it impacts current net operating income (NOI), which feeds through to value via capitalization rate. This feed is especially strong for retail assets. Conventional wisdom has held that real estate performs as an inflation hedge.

This means that if inflation is greater than expected, real estate returns will compensate for the surprise and will help offset the negative response of the other assets in the portfolio as real estate fell into disfavour through the 1980s crash, this rational was discredited and compounded by low inflation. Past inflation is partially embedded in rents set previously because every seller of rental space, wishes to keep price level rising in real terms. Thus NOI is partly a function of past inflation, rising if past inflation has been greater, and falling (or rising less) if past inflation has been tame. The speed, with which inflation

affects NOI, or the time lag necessary to capture inflations' impact on current NOI, depends on the structure of leases.

Yobaccio, E. et al. (1995, p.295) observed that REITs tend to mirror equity results against inflation and unexpected inflation. Hedging effectiveness was mixed for both inflation components, but performance was markedly worse against unexpected inflation. Secondly, in nearly all instances, REIT returns acted as a perverse hedge against unexpected inflation. Beta, which estimates the systematic risk relative to changes in the real market return, is positive and highly significant. The coefficients on expected inflation are positive and near 1, especially the case for mortgage REITs. This indicates that REITs offered some hedging potential against expected inflation. However, the coefficients of unexpected inflation are negative, and most significantly are different from 1.In the high inflation period,(1972-1981), the hypotheses that the coefficients of unexpected inflation were equal to 1 (indicating perfect hedging capability) could not be rejected for equity, mortgage, or hybrid REITs, primarily because of large standard errors. In low inflation period, the hypothesis that REITs were a perfect hedge against unexpected inflation was rejected in all cases. The consistent negative signs in both sub-periods indicate that real estate values fell as unexpected inflation increased.

Yobaccio, E. et al. (1995, p.281) uses the Fisher model to establish the inflation hedging-effectiveness of real estate. The nominal rate of interest is comprised of an appropriate equilibrium real interest rate and the expected inflation premium. Fama and others extended the Fisher relationship to risky assets. Implicit in the model is the notion that the real -return on the risk asset is independent of the level of expected inflation. During periods of high inflation or dis-inflation, investors may become more risk averse, and expect higher real returns on risk assets.

5.5.1. Conclusion

Inflation-hedging capability of real estate has been examined from a complete-hedge perspective, Rubens, J.H et al. (1989, p.50) and partial-hedge perspective supported by Chatrah,A. and Liang,Y. (1998, p. 317), Hudson-Wilson, S. et al (2003, p.20) and Yobaccio, E. et al (1995, p. 295)

Rubens, J.H. et al. (1989, p. 50) found that only residential is a complete hedge. Chatrah,A. and Liang,Y. (1998, p. 317) found that REITs act as perverse hedge, i.e. decrease in value as inflation increases and posses some ability to hedge against expected inflation. Yobaccio, E. (1995, p.295) found that equity and mortgage REITs and direct real estate provide at least partial hedges against unexpected inflation. Real estate should be considered in a mixed-portfolio based on the inflation-hedging empirical evidence.

5.6. Modern Portfolio Theory

Although it is not without its critics and theoretical difficulties, the Modern Portfolio Theory (MPT) remains the standard tool for investigating the importance of an asset in a multi-asset portfolio. It is used to determine the mixed portfolio of assets, which achieves the highest level of return given level of risk and is the methodology adopted for the research report.

Returns for a mixed portfolio are compiled, means and standard deviations are calculated to provide relative comparisons and correlation is then calculated. The asset with the lowest correlation would usually be a good candidate for risk reduction in portfolio through increased diversification.

Lee, S. (2002b, p. 1) agrees that most analysis considers the correlation between real estate and the alternative asset classes in examining the risk reducing benefits of adding property to increase diversification. The overall correlation coefficient is an average of a large number of concurrent asset movements in many economic and financial environments. The lower the covariance of an investment with a portfolio, the higher its contribution to reducing risk of the portfolio, and so the greater the attractiveness of the investment to the portfolio.

MPT takes advantage of the diversification effect provided by multiple and less than perfectly correlated assets, allowing minimisation of unsystematic risk and choice of exposure to systematic risk for any given level of return. Efficient market theories suggest that investors are not rewarded for bearing unsystematic risk and therefore should seek to minimise its presence.

Lee, S. (2002, p. 1) departs from MPT's traditional approach for creating singular combinations of assets for any given level of risk-adjusted returns and creates multiple ranges. This alternative helps quantify the impact of uncertainty by generating acceptable allocation ranges, rather than specific allocations, and it is difficult to obtain, point estimates.

5.6.1. Conclusions

The MPT remains the standard tool for investigating the importance of an asset in a mixed-asset portfolio despite critics.

Lowrey, C.F. (2002) contends that in theory, the efficient frontier is singularly delineated. In reality, however, due to the non-linear nature of mean-variance optimization, even slight changes in any one of the inputs (i.e. expected return, volatility, or correlation) have the potential to alter the output dramatically. As a result, the efficient frontier is quite fuzzy, such that any given point along the efficient frontier there exist a wide range of allocations that are statistically indistinguishable in terms of efficiency.

5.7. Efficient- frontier

The efficient frontier considers a universe of risky investments and explores what might be an optimal portfolio based upon those possible returns of investments.

Consider an interval of time. It starts today. It can be any length, but a one-year interval is typically assumed. Today's values for all the risky investments in the universe are known. Their accumulated values (reflecting price changes,

coupon payments, dividends, stock splits, etc.) at the end of the horizon are random. As random quantities, we may assign them expected returns and volatilities. We may also assign each pair a correlation for their returns. Generally, these quantities are based upon simple returns. We can use these inputs to calculate the expected return and volatility of any portfolio that can be constructed using the instruments that comprise the universe.

The notion of “optimal” portfolio can be defined in one of two ways: Firstly, for any given level of all the portfolios which have that volatility, and from among them all, select the one, which has the highest expected return. Secondly, for any expected return, consider all the portfolios, which have that expected, return and from among them all select the one which has the lowest volatility. Each definition produces a set of optimal portfolios. Definition (1) produces an optimal portfolio for each possible level of risk. Definition (2) produces an optimal portfolio for each expected return. Actually, the two definitions are equivalent. The set of optimal portfolios obtained using one definition is exactly the same set, which is obtained from the other. That set of optimal portfolios is called the efficient frontier.

Harry Markowitz first defined efficient frontier in his groundbreaking (1952 Journal of Finance) paper that launched portfolio theory. The basis for allocation is uncertainty. Uncertainty about future investment performance creates dynamic trade-off between risk and return that is fundamental to every investment decision. In the 1950s, Harry Markowitz expanded the two dimensional model of risk and return into three dimensional portfolio model that recognizes the relationship between “standalone” risk and return for each class and the “inter asset” risk, or covariance between assets, Lowrey, C.F.(2002) introducing uncertainty into the Markowitz, MPT framework helps to overcome the practical problem of balancing optimisation’s goals with real estates’ illiquidity, transaction costs and data problems, creating bundles of portfolios to which investors are indifferent.

Each of the portfolios along the efficient frontier provides the best-expected return for a given level of risk. The efficient frontier considers a universe of risky

investments and explores what might be an optimal portfolio based upon those possible investments. Lee, S. (2003, p. 4) agrees and says MPT provides investors with an infinite number of portfolios. Typically portfolios that comprise the efficient frontier are the ones that are most highly diversified.

5.7.1. Conclusions

Pearce S 1995 explains that portfolio theory, as its name infers, is concerned with the construction of investment portfolios. Essentially it is based on a statistical result: if several probability distributions are combined and their arithmetic mean and variances are known, together with the degree to which their returns co-vary, then the arithmetic mean and variance of the resulting combined probability distribution can be specified. Therefore if several different assets are combined into an investment portfolio and the expected returns, variances of returns and covariance's of returns are known for each asset, then the expected return and variance of the investment portfolio can be determined, an exercise performed in this research report.

5.8. Critique of the portfolio theory

Most investors agree that sound investment decision- making combines the science of quantitative analysis with the art of qualitative judgement and reason. While many factors have contributed to this trend, advancements in financial theory and the exponential growth of computing power have provided tools needed to turn asset allocation into a branch of science. Unfortunately, this view fails to recognise that asset allocation cannot, by definition, be a pure science as long as there is uncertainty, without which the whole exercise would be unnecessary.

Lowrey, C.F,. (2002), accepts that, conceptually, the idea of risk-return trade off is so straightforward that it is universally accepted – investors should be compensated for taking more risk. However, distilling that relationship into a single measure, like risk adjusted-return, is much more difficult, since doing so assumes that risk can be accurately quantified in a way that is meaningful for all

investments to all investors. Unfortunately, risk is not purely objective. Perceptions of risk typically reflect subjective factors based on the unique circumstances of each investor. So while the idea of risk is easy to understand on the surface, it is more complex than might appear at a deeper, subjective level, and much more difficult to measure.

There is also a deficiency in the methodology, which are not uncommon in mathematical models, which may contribute to MPT's false precision. Most investment professionals are familiar with the idea of the efficient frontier, or the set of portfolios that represent the highest expected return for different levels of risk.

Gold, B.R. (1995, p. 59) shows that the efficient frontier is not singular, but fuzzy. The study illustrates that numerous statistically dissimilar weighted-portfolios can be equally attractive for any given combination of expected risk and return and allocation ranges rather than specific targets.

5.9. Practitioners Literature

5.9.1. Local Returns

The South African listed property sector in 2003 (as explained in Annexure C), with a return of 41% more than doubled the 16.1% gain recorded by the ALSI (All share index) in 2003 and outperformed the 18.5% rewarded by bonds and 12.8% rewarded by money market. Property has outperformed all the other asset classes over the last 7 years with a return of 25.1% over the period under review. It is evident that property has outperformed bonds over the medium-term. The recent performance has created unprecedented demand for the sector from investors despite pension fund's lower real estate allocation. The attention has been focused on the defensive qualities, pre-tax income and interest-income investment. It has save - haven status, offering two types of returns – income yield and prospect of capital appreciation, i.e. real estate is considered a bond/equity hybrid.

Table 5. Asset class returns

	1 year	3 years	5 years	7 years	10 years	15 years	18 years	Geometric mean
PROPERTY	41.0%	24.5%	30.9%	25.1%	14.8%	16.0%	14.4%	14.40%
BONDS	18.5%	17.8%	20.5%	19.36%	15.85%	17.95%	18.2%	18.17%
ALSI	16.1%	11.3%	17.30%	9.66%	10.78%	15.02%	15.6%	15.63%
MM	12.78%	11.64%	12.30%	13.76%	13.86%	15.02%	14.4%	14.44%
	RELATIVE RISK PREMIUM TO PROPERTY							
BONDS	3.77%							
ALSI	1.23%							
MM	0.04%							

Source: Returns compiled from I-Net /FTSE JSE

Table 5 also presents risk premiums relative to property. In addition to returns, risk premium may have been calculated for each investment class relative to property. Bonds earned a risk premium of 3.77%, equities earned a risk premium of 1.23% and money market 0.04% over the period under review.

5.9.2. SA Pension Fund Asset Allocation

AFS CAFS reported that in 2002, the total market value of funds under administration was R145 billion. The median returns for total assets was –2.9%, -2.1% for Equities, 13.6% for Interest-sensitive instruments, 13.1% for Direct property and –30.2% from International. In 2001, the funds under administration was R169 billion, with median return for total assets of 21.6%, 18.7% for equities boasted by resources, 15% by interest-sensitive, 20.4% for property and 43.8% for international assets, because of the steep depreciation in the currency in that year. The asset allocation for the funds, during the period under review has been on average 56% in Equities, 28% in Interest Sensitive, 6% in Property and 10% in International markets for the fund survey 2002. According

to the Financial Services Board (FSB), the total assets of the retirement fund industry in SA increased by 21% to R836 billion in 2001. The self- administered funds increased from R329.12 billion to R369.97 billion, which makes the retirement industry sample fairly representative.

Pearce S 1995 contends that this low allocation within the SA context is a result of the portfolio manager's inability to accurately quantify the risk-return characteristics of real estate. Fund managers should consider real estate as a separate asset class. In terms of prudential investment guidelines applicable to retirement funds, a maximum limit of 25% is allowed for real estate, as shown in Annexure G. The research report will quantify the risk-return attributes of including real estate in a mixed portfolio.

The ALSI under-performed all the other classes other than in 1994,as a result of the steep decline in gold price and the Rand depreciation, (Annexure H) and other commodities as seen in Table 5. In 1998 the ALSI suffered as a result of high interest rates, and the 2001 and 2002 Dot-Com bubble, burst into the SA scene.

Table 6. Asset Class Allocation

Annual Asset Class Exposures (%) as at the 31 December											
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Interest Sensitive	36	33	28	31	29	31	37	29	29	27	31
Equities	55	59	65	62	62	58	46	56	54	51	55
Property	9	8	7	7	7	7	5	3	4	3	1
Foreign Assets					1	4	12	12	12	19	13

In June 2002, the listed property sector was reclassified into the financial sector on the FTSE JSE. Source: AF CAFS

The theoretical and empirical evidence presented in this research report, while not offering universal support, generally suggest that real estate have a role to play in a mixed-portfolio. Real estate provides favourable risk adjusted returns as explained in hypothesis testing, provides diversification and thus deserves a

higher allocation in a mixed portfolio as described in the efficient frontier. All the available data on ownership of real estate see Table 1 & 6, suggest that institutional investors are under-invested in real estate. The fund overall asset allocation needs to be in line with restrictions of the Pension Fund Act, Regulation 28, (Annexure G). Property as defined in Annexure G, has a maximum prudential limit of 25% of Total Fair of Assets and yet real estate allocation has been 6% on average and decreasing despite relatively good returns over the last 7 years.

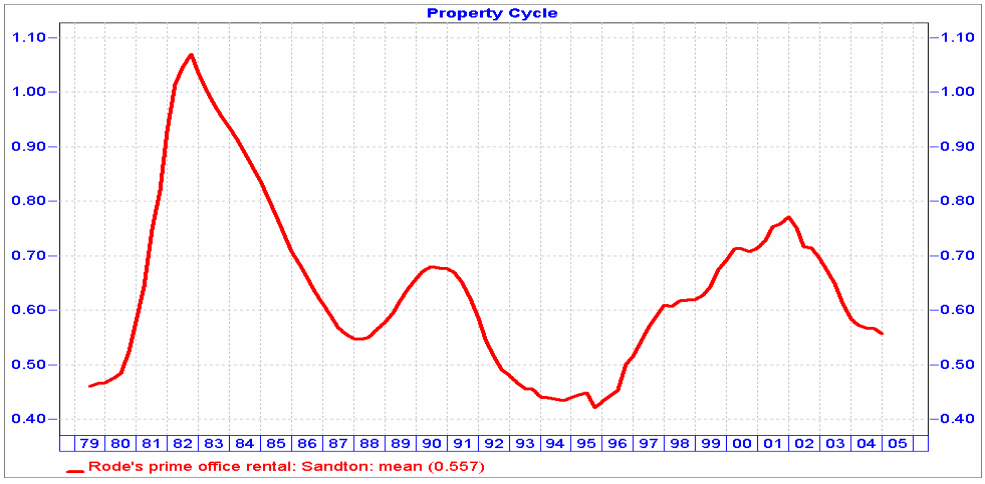
The research report will focus on a discussion of the property fundamentals (property cycle, vacancies, capitalisation rates (cap rates), bonds and interest rates) and real estate as an asset class.

5.10. Property fundamentals

5.10.1. Property Cycle

Property cycles are 'recurrent but irregular fluctuations' in the rate of all-property total return. There are several distinct factors that drive the property cycle namely; the occupier markets (rents), development industry (new supply), investment markets (yields and asset allocation) and rate of return.

Figurer 1: Property Cycle



Source I-NET & Rode rental series.

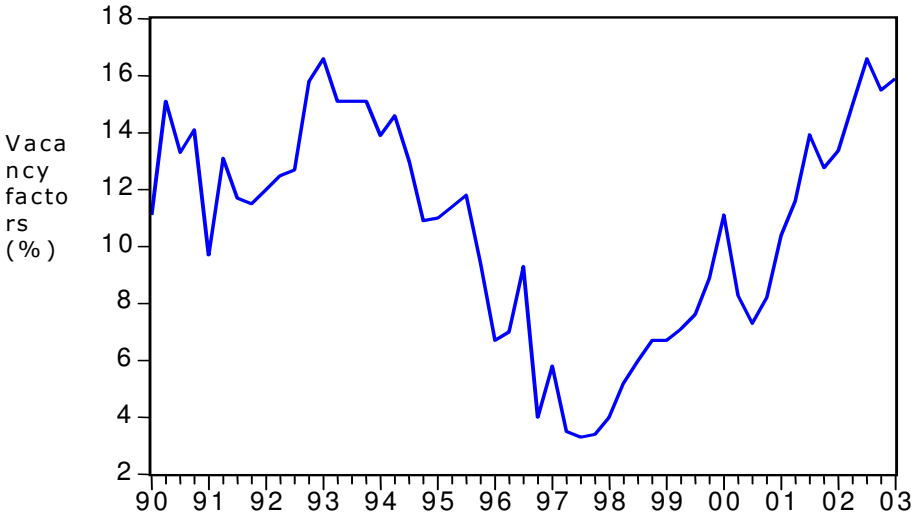
The graph above is the nominal rental growth of the Sandton office market (the moving average of rentals month-on-month and based to a 100), during the late 1980s and early 1990s; it was the Johannesburg CBD as the pioneer market and converted to Sandton CBD subsequently. It is used as a benchmark because it has the longest history and Sandton was hardest hit during the over-development era. The rental growth reached the trough in 2003, and given the favourable physical property as explained by vacancies, capitalisation rates and positive office take-up, rental growth will turn positive as explained in the up – tick in 2004.

Rode and Associates in a recent publication (2003/Q4), reported a solid performance in the decentralised suburbs' office take –up in quarter 2003:4. Sadly enough, the higher demand for office space as of yet not materialised into a recovery in real decentralised office rentals. In the Johannesburg suburbs, take up of 217.000m/2 was seen in the twelve months to December 2003. Among the CBDs, both Cape Town and Pretoria have shown encouraging office take-up. Cape Town city centre has been constantly, since the beginning of 2003 with a cumulative take-up 25. 000 m/2 recorded over twelve months and Pretoria following with take-up of 23.000 m/2. In Johannesburg suburbs, take-up of 217.000 m/2 was seen in the twelve months to December 2003.

5.10.2. Vacancies

Figure 2, shows the Sandton CBD vacancies. Sandton office market experienced over-development in 1993/1994, and vacancies peaked at 16% followed by a healthy office take-up, which hit a trough of between 2% - 3% in 1997. Over-development and high interest rate and inflation environment in 1998 to 2000 lead to poor business confidence (bankruptcies, IT bubble 2000, high oil prices and a weak gold price), see local investment environment.

Figure 2:Sandton CBD Grades A and



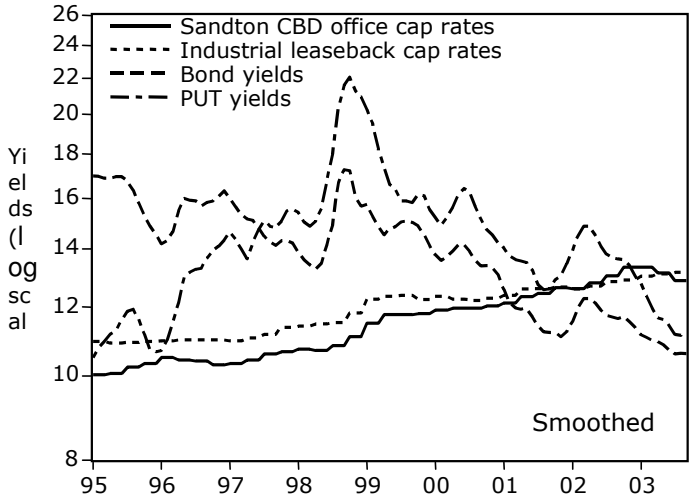
Source: Rode's Time Series; Sapoa

Vacancies have peaked in 2003 and are at their highest levels, and there are signs of healthy office take-up with little development activity, which bodes well for rental growth.

5.10.3. Capitalisation rates

Rode and Associates in a recent publication (2003/Q3) say the latest analysis of capitalisation rates shows an about turn from the rising trend that has been in existence since 1996. However, the strengthening has only been noticed in retail and office property, and not the industrial property market. Figure 4 shows that industrial leaseback capitalisation rates are still rising, (but word from the market is that industrial vacancies have peaked and industrial rentals are firming. This early signs have been confirmed by Martprop reporting a 2.1% distribution growth for the year ended 31 January 2004 and Metprop reporting a 6.8% for the interim period ended 30 September 2003). In Sandton, the cap rates of A-grade offices space is coming down as demonstrated in Figure 3.

Figure3 National industrial leaseback & Sandton CBD grade-A office cap rates vs long-bond yields and PUT yields

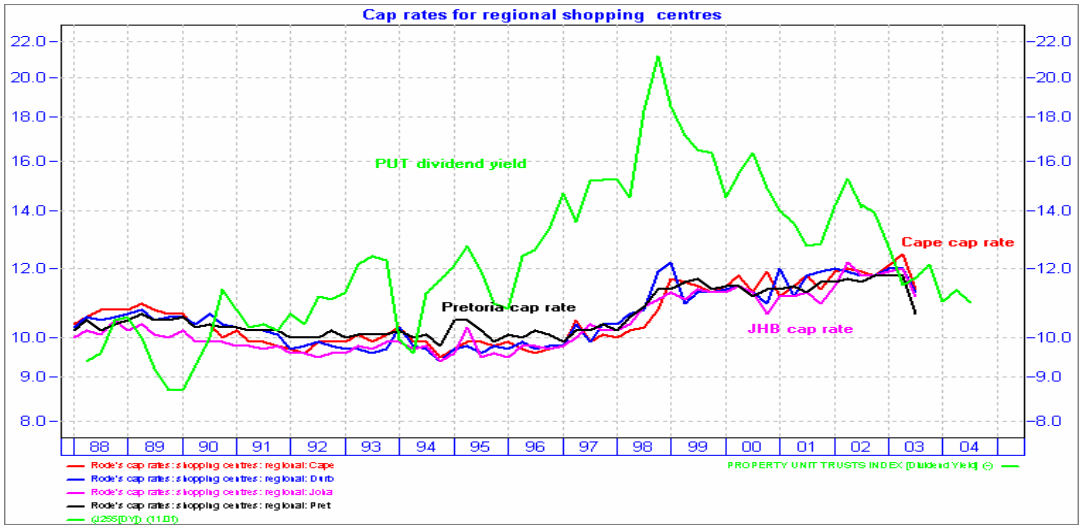


Source of data: Rode's Time Series; JSE; Bond Exchange of SA

Rode and Associates says furthermore, Figure 4 shows how Property Unit Trust (PUT) income yields have declined from late 1998, tracking bond yields. Since late 2002 PUT income have dipped below cap rates, which implies superficially that PUTs have traded at premium a relative to directly held property since then.

However, there is an interpretation trap here because the level of an individual property's cap rate cannot be compared directly with the income and only a third of the total portfolio is valued, meaning the total portfolio is re-valued every three years.

Figure 4: PUT dividend yield and Shopping centres capitalisation rates



Source: I-NET & Rode and associates.

Figure 4 shows that the cap rates of regional, community and neighbourhood shopping centres in all the major cities declined (strengthened). Shopping centre cap rates are also benefiting from the continued good performance of retail sales, which in turn will further benefit from the declining trend in interest rates and strengthening of the Rand.

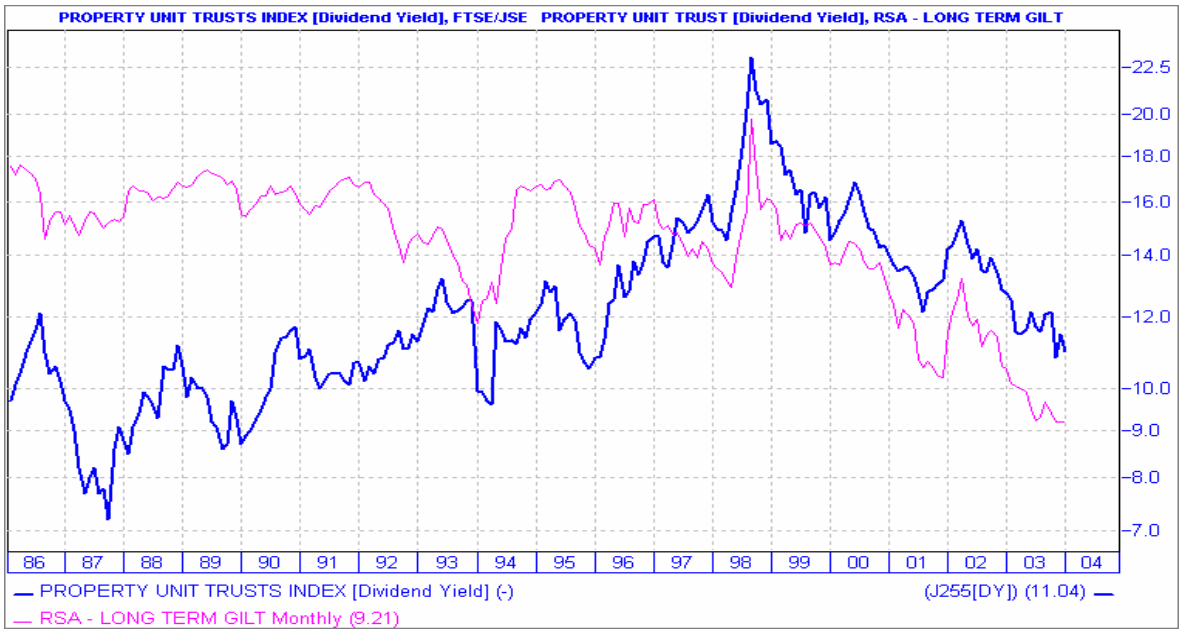
The cap rates for both retail and office sectors have been strengthening, whilst the industrial sector's cap rates experienced a lagged effect, though confirmation of earnings growth is evident in counters with a high industrial exposure.

5.10.4. Bonds and property yields

Interest rates are used by the Reserve Bank as a primary monetary policy instrument. This is why it is critical to watch the inflation signals and carefully monitor sentiment regarding its potential impact on interest rates. Pearce S (1995) explains that the expected level of inflation and real interest rates affect real estate values. Figure 5 demonstrates the relationship between the listed property dividend yield and the long bond rate. Yields on listed property follow long bonds yield in the longer term as illustrated in Figure 5, with property yields usually higher than long bond yields as evidenced by the risk premium of 3.77% over the period under review. The correlation of the bond yields and property

yields is more evident from the 1990s, and a decline in interest rates is likely to be followed by a re-rating of the real estate sectors and an increase followed by a de-rating of the real estate sectors.

Figure 5: PUT Dividend Yield and Long Bond Yield



Source: I-NET/ FTSE JSE

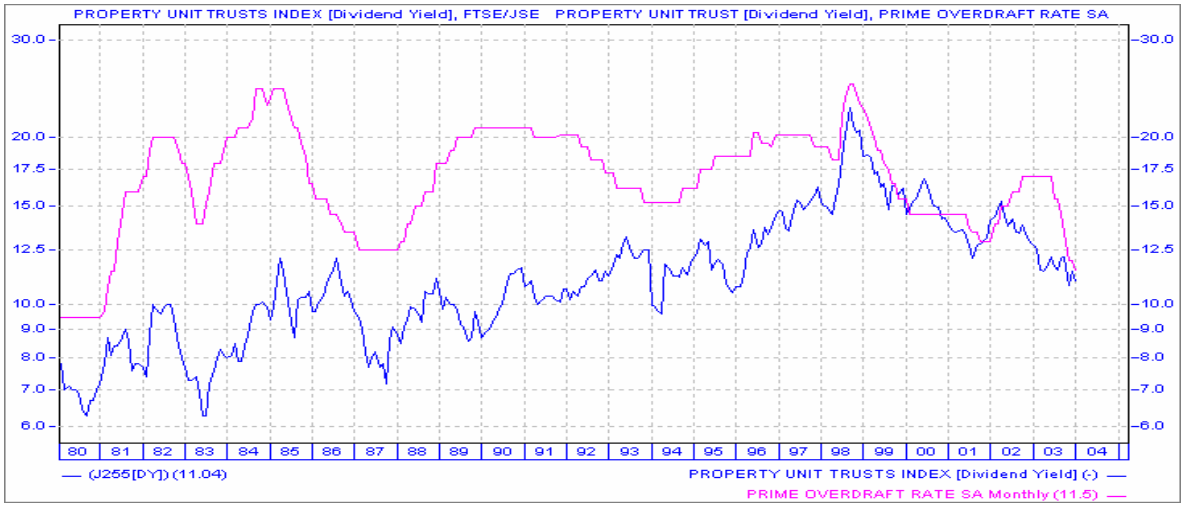
Historically, the only times when property yields have been either lower than, or equal to, long bond yields have been prior to periods of good earnings growth from listed property. In 1994, earnings were at the bottom of the growth cycle, and subsequently, physical property fundamentals improved and are now similar to the current property cycle. Bond yields are expected to strengthen further, and property yields are also expected to follow suit.

5.10.5.1. Interest rates and property yields

History teaches that property values have the ability to foresee changes in the interest rate environment. Property shares have had a propensity to move higher several months before interest rate declines (inverse relationship).

Figure 6, shows that prime bottomed at 12.5% in 1986, and remained steady throughout 1987 despite the 1987 market crash, the ALSI, Annexure H fell by 56% from peak in 1987(2704 points) to trough in 1988(1724 points). In 1988 rates were increased by 550 basis points from 12.5% to 18% in response to the 1987 market crash caused by the Asian crisis. The rates remained steady, until 1991 when they started to gradually fall and bottomed at 15,5% in 1994. From 1995 prime rates were gradually increased and peaked at 20% in 1997. In 1997, the Japanese market steeply declined and in response, prime rate was increased by 475 basis points and peaked at 25,50% in 1998. The rates were progressively decreased and reached a trough in 2001 (12.75%). In 2001 rates were increased by 400 basis points from 2001 (12.75%) to 2002 (16.75%) and has since been reduced by 525 basis points to the end of 2003 (11.5%).

Figure 6: Prime interest rates and PUT dividend yields.

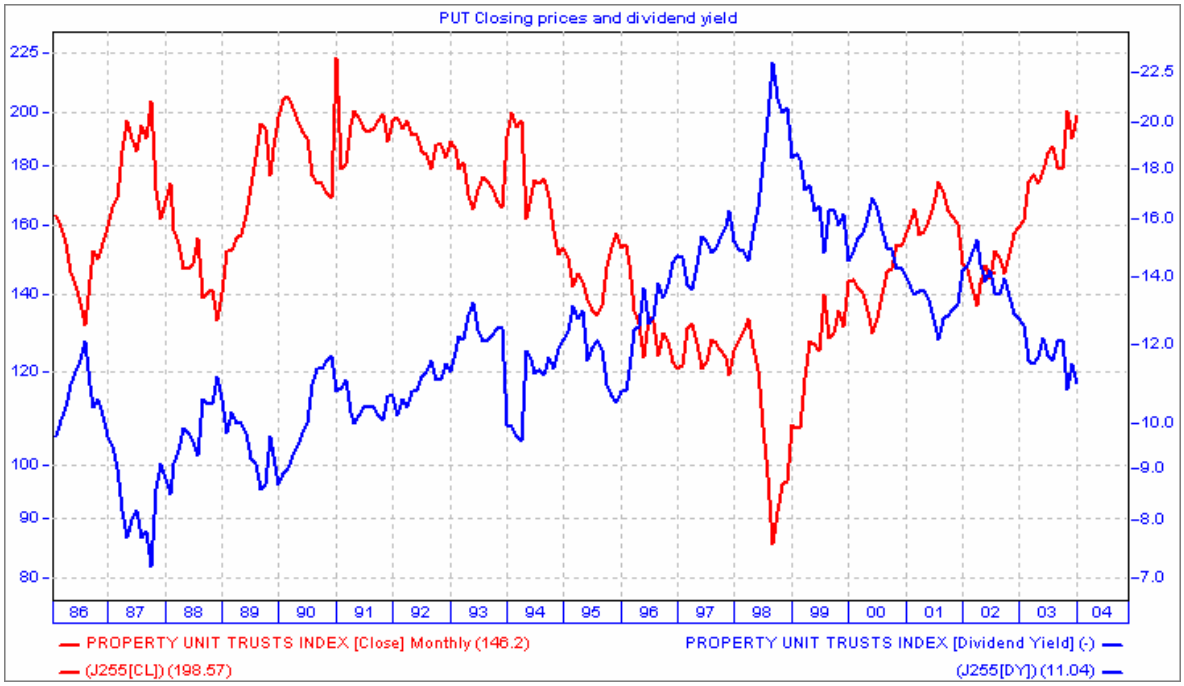


Source: I –NET/JSE FTSE

The PUT index lost 33% and PLS 47% from peak in 1991 to trough in 1998 see Figure 7, and PUT dividend yield peaked at 21.20% and PLS yield at 21.69% in 1998 as a result of high interest. The indices have since recovered and gained

25% and 45% respectively, from 1999 to 2001. In 2001, prime rate was increased by 400 basis points and the PUT followed by losing 25% from 172 points in 2001 to 142 points in 2002. The rates have since been reduced by 550 basis points and the PUT responded by appreciating by 35% to end 2003 and are expected to remain stable.

Figure 7: PUT Closing prices and dividend yield

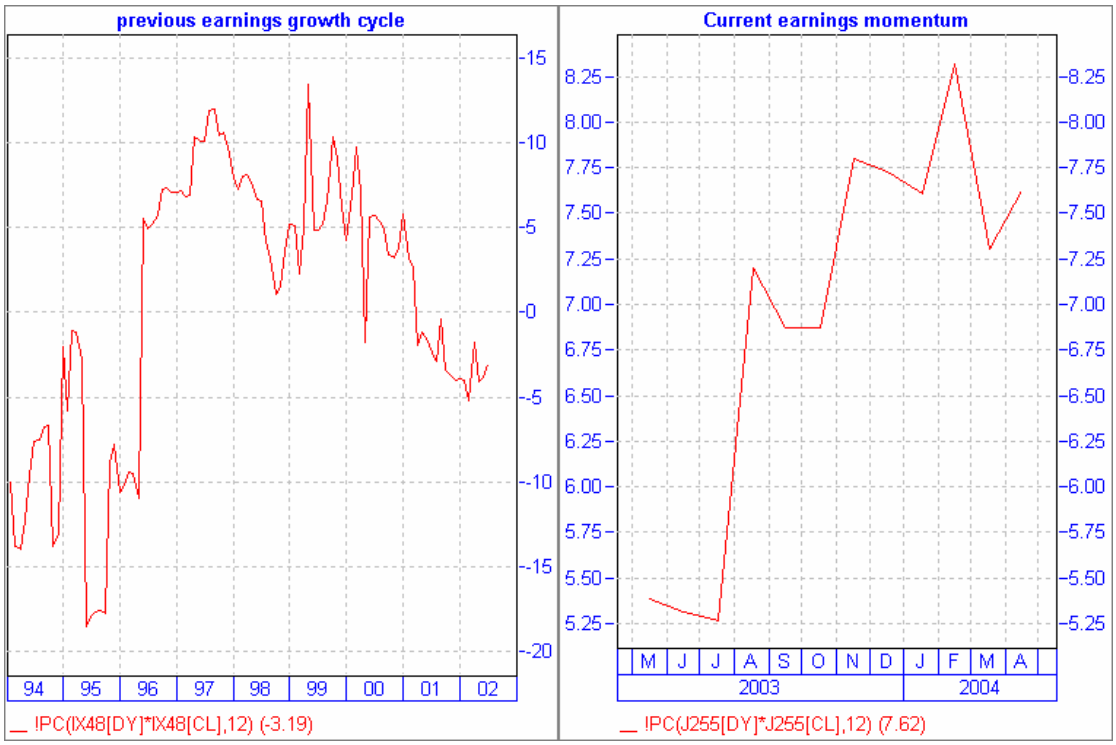


Source: I –NET/JSE FTSE

The positive property fundamentals (vacancies are at lowest levels, cap rates are strengthening, the property cycle positive and a stable interest rate environment) will lead to earnings growth and the extent of earnings growth will determine whether listed property yields trade at a discount to bond yields. During times of very high -expected growth, like the current property cycle, the projected total rate of return justifies a lower historic yield from listed relative to bonds.

The analysis indicates that property will continue to outperform both cash and bonds because of strong earnings growth cycle currently at 7.6% because of expected strong capital growth to match the earnings as illustrated in Figure 8.

Figure 8: Listed property earnings growth



Source: I-NET/JSE FTSE

5.11. Real Estate as an Asset Class

The low real estate allocation could perhaps be explained by the inability of fund managers to understand that “real estate is a unique asset class” and DeLisle J.R. (2002, p.6) outline the reasons below:

Real asset base: real estate is comprised of land and improvements, and while bricks and mortar are a wasting asset, the land typically has enduring value which may be independent of current usage.

Partially derived asset value: the value of the underlying land is a function of externalities, of which are not controllable by owners. Real estate values are subject to windfall and wipeouts associated with governments. Production function: unlike other intangible assets which, can be created by paperwork, commercial real estate can be produced through a long, capital intensive process. The process requires co-ordination of regulators through to technicians.

Risk characteristics: Investors face a range of micro risks associated with analysis of a local market and tenant exposures, and macro risks associated with an array of business and economic pressures.
Durable product: Real estate assets cannot be recycled, in addition to requiring on-going maintenance and insurance.

Real estate returns are also difficult to measure real estate returns accurately according Lowrey, C.F. (2002) because of the following reasons:

- Real estate is traded infrequently
- Real estate is a heterogeneous commodity
- Prices are not reported to a centralised market
- Lack of information on capital improvement may lead to miscalculation of return
- The problem with appraisal data

The research report will focus on the listed market because of the responsiveness of the listed property yields to the broader market and the convenience of having to manage physical property. It should also be noted that the physical data available from IPD/SAPIX, is yearly data and only limited to a 5 years of history.

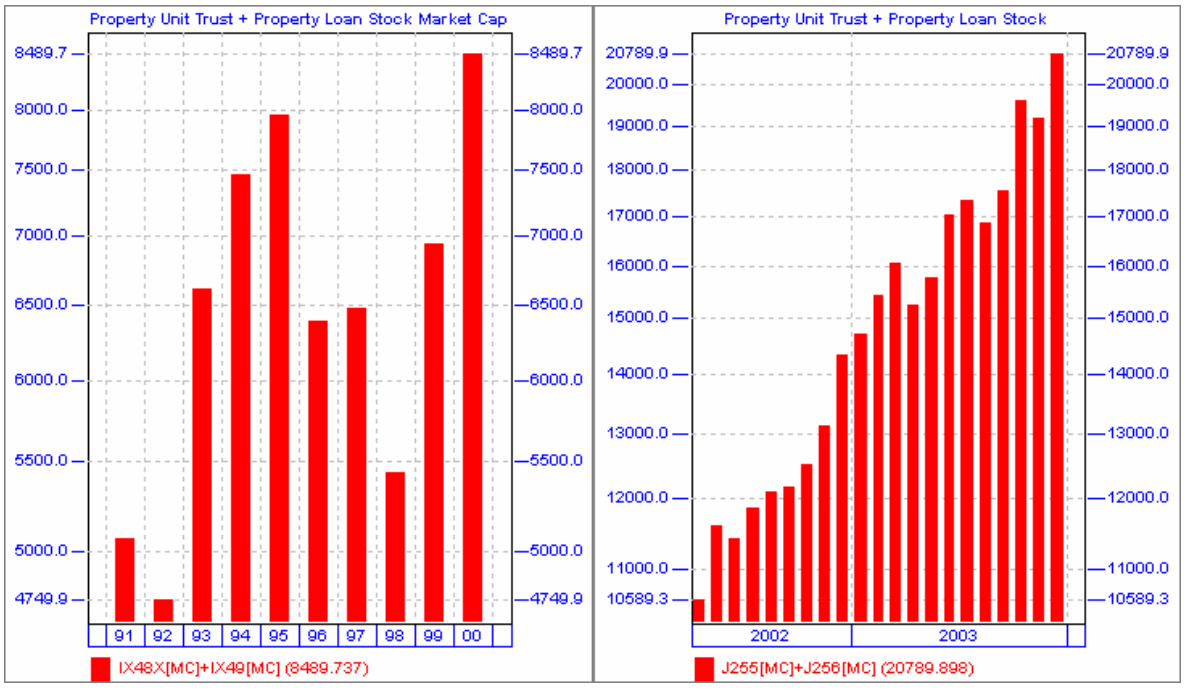
The one issue the fund managers consider is the size of the listed property sector in South Africa (SA). The PUT and PLS sectors combined comprise 1.2% of the total market capitalisation of the Johannesburg Stock Exchange (JSE). This compares favourably with the well -established and securitised US market. The Bloomberg Real Estate Investment Trust Index, which excludes mortgage related REITs, has a total market capitalisation of $214.1bn. The Russell 3000 index composes of 3000 US companies, and represents approximately 98% of the investable US equity market and has a market capitalisation of $12.99 trillion, and that make the US REIT market about 1.65% (Source: Bloomberg December 2003).

The property sector is growing and there have been consolidations through mergers (like Growthpoint and Primegro creating a PLS with a market capitalisation of R3,5 billion) and acquisitions (ApexHi purchase of Shops for Africa for R415 million). The physical market has also been responsive to listings conditions as illustrated by Rode below, creating new supply for bulking existing portfolios, thus growing the sector.

The property sector of the JSE, have grown the market capitalisation from R5.06 billion in 1991 to R20.8billion as indicated by Figure 9. There is renewed interest in the sector, evidenced by new listings (iFour, Acucap, Resilient, Emira, Ambit and MCCP, and planned listing of Vukile Properties, sponsored by Sanlam), and further consolidation. Market capitalisation is expected to reach R30billion in 2005.

Figure 9: PUT and PLS Market Capitalisation

Yearly data Monthly data

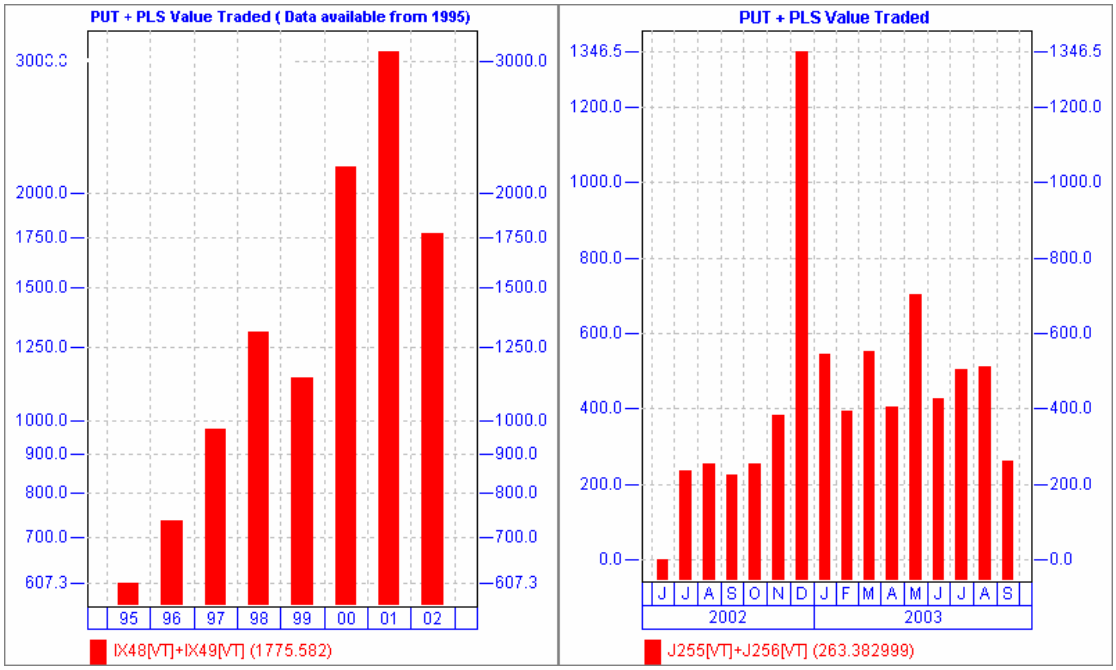


Source: I –NET

The other issue is one of the most important practical aspects of portfolio management, liquidity. Fund managers are clearly concerned about the liquidity because it impacts their ability to time the markets.

In 1995 the combined volumes for the PUT & PLS sector, Figure 10 was just above a R1 billion and has vastly improved to R22.7 billion over the period under review

Figure 10: PUT & PLS Value Traded



Source: I –NET

The problem of low real estate allocation can be partially attributed to liquidity, but there is a clear understanding within the listed property players to bulk up their existing portfolios. The combined sector is expected to reach R30 billion by 2004.

Real estate as an asset class will remain a building block in a balanced portfolio. The fundamentals support a higher allocation into real estate. The listed property sector, has evidenced structural changes in terms of corporate governance from the late 1980s, and has been revived by competent property

asset managers, who are extracting value by active asset management of property portfolios, and thus maximising shareholder returns.

6. Empirical Analysis

6.1. Introduction

An equally weighted portfolio of bonds, shares and real estate returns is calculated using the expected returns of the different asset-classes and multiplied by the assigned weight. Standard deviation of the portfolio is then calculated, in the cell next to the calculated expected return, using the covariance matrix of the returns of the instruments, and equal weights for the instruments, applying this formula: =SQRT (MMULT (cells with the weights, Variance-Covariance matrix), TRANSPOSE (cells with the weights).

At the end of the process, this will be the result:

SUMM	BONDS	ALSI	PROPERTY	*EXPT RTRN*	*STD DEV*
100.00%	33.33%	33.33%	33.33%	1.35%	3.49%

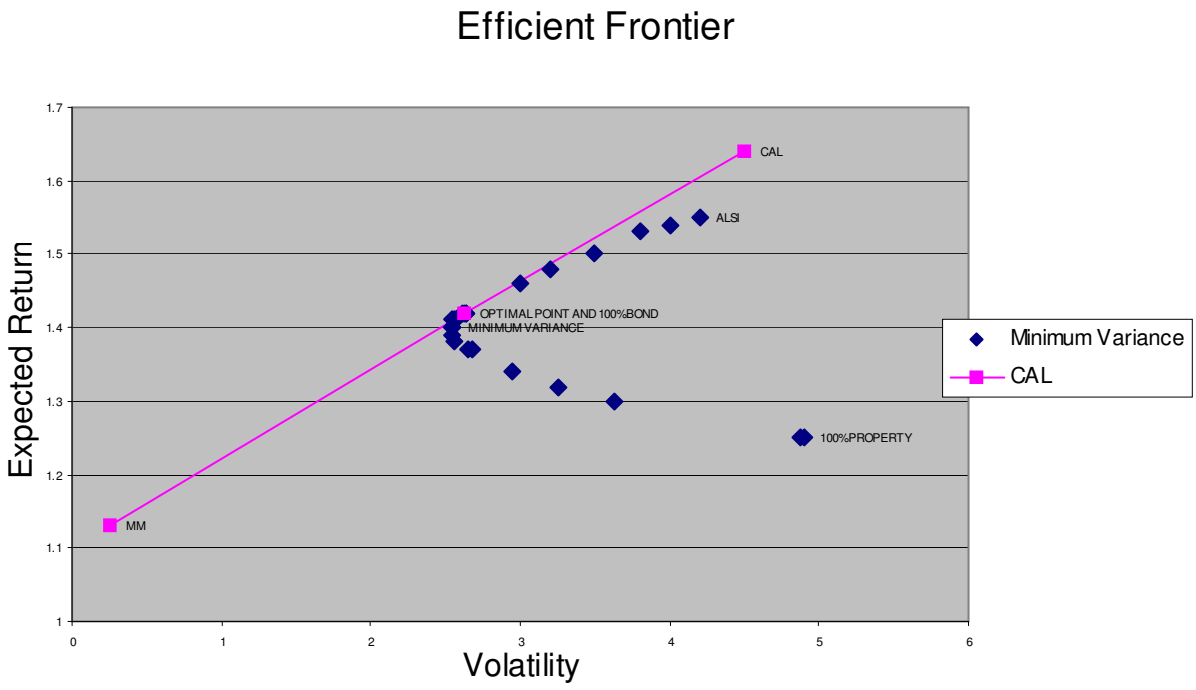
Using Solver, first determine minimum variance portfolio (MVR) and optimal portfolio.

The results we get are the weights, the expected return and the standard deviation for minimum variance portfolio as illustrated below:

SUMM	BONDS	ALSI	PROPERTY	*EXPT RTRN*	*STD DEV*
100.00%	85.04%	0.70%	14.25%	1.40%	2.54%

Repeat the process, so as to generate enough combinations to graph the efficient frontier and combinations from Table 2. At the end of the process, a table of returns, standard deviations, and allocation is created as in Annexure D.

Graph the chart using Chart Wizard (XY Scatter). Create the optimal portfolio and capital allocation line (CAL) based on the calculated expected returns of the different asset-classes multiplied by the assigned weight. The point of tangency is the optimal point, because it corresponds to the one for which the Sharpe ratio, or slope is the highest.



6.2. Results

Real estate provided a lower return of 1.25% and a lower standard deviation of 4.90% compared to equities with a return of 1.39% and the highest standard deviation of 6.23%, whilst bonds provided the best risk-return trade off, with a return of 1.42% and the lowest standard deviation see Table 2. Money market returns have been used as the risk free benchmark, because bonds formed part of the mixed asset portfolio.

An investigation of the impact on portfolio risk and return from adding real estate to an equally -weighted ALSI index and bond portfolio is demonstrated in Table 7 and 8. The data is from 1986-2003.

Table 7, is a portfolio of shares and bonds only.

Table 7	BONDS	ALSI	Money Market
Mean return	1.42%	1.39%	1.13%
Risk	2.64%	6.23%	0.26%
Sharpe ratio	0.11	0.04	

-Table 7 < Equally weighted portfolio of Shares and Bonds			
Hold	50.00%		
Mean return:	**1.41%**	Std Dev:	**3.76%**

Minimum variance portfolio is dominated by Bonds			
Mean return:	**1.42%**	Std Dev:	**2.62%**

Fund 1 (MVP)			**Fund 2 (MVP)**	
	Weight			Weight
BONDS	95.558%		BONDS	96.021%
ALSI	4.441%		ALSI	3.979%
Sum(Wi)	100.00%		Sum(Wi)	100%
Mean	1.42%	Covar(1,2)	**Mean**	1.42%
Variance	0.00069	0.000688	**Variance**	0.00069
Std. Dev	2.62%		**Std. Dev**	2.62%

The equally weighted portfolio in Table 7 provides a return of 1.41% and a standard deviation of 3.76%. The minimum variance with bias to bonds provides a higher return at a low level of risk.

Table 8 is the equally weighted portfolio of bonds, shares and real estate.

Table 8

	BONDS	ALSI	REAL ESTATE	MM
Mean return	1.42%	1.39%	1.25%	1.13%
Risk	2.64%	6.23%	4.90%	0.26%
Sharpe ratio	0.11	0.04	0.02	

-Table 8< Equally weighted portfolio **Iof Bonds, ALSI and Real Estate**

Hold	33.33%		
Mean return:	**1.35%**	Std Dev:	**3.49%**

-< Minimum variance portfolio >-

Hold as per Fund 1			
Mean return:	**1.40%**	Std Dev:	**2.54%**

Fund 1 (MVP)	Weight		**Fund 2 (MVP)**	Weight
BONDS	85.04%		BONDS	88.107%
ALSI	0.70%		ALSI	1.224%
Real Estate	14.25%		Real Estate	10.67%
sum(Wi)	100.00%		sum(Wi)	100.00%
Mean	1.40%	Covar(1,2)	**Mean**	1.40%
Variance	0.00064	0.00064	**Variance**	0.00065
Std. Dev	2.54%		**Std. Dev**	2.54%

The return on the equally weighted portfolio is 1.35%, with less risk of 3.49% against 3.76% provided by the bond and share portfolio. The investigation found that the minimum variance portfolio to have a higher return of 1.40% and a lower standard deviation of 2.54%.

6.3. Interpretation

Bonds have a very dominant position in the minimum variance calculation due to their relatively low risk over the period. Bond returns, is an example of a basic portfolio theory example, high return and low standard deviation. The diversifying aspects of property ensured that it had an allocation in the minimum variance portfolio. In fact, had listed property had a higher expected return, it is likely that it would have had an allocation in the optimal portfolio, which is 100% bonds.

The risk-return trade-off is low, when bond allocation is high as explained in Annexure D. The optimal portfolio allocation in this case will only consist of bonds providing a return of 1.42% and a standard deviation of 2.64%. The minimum allocation to bonds is 78.32%, and beyond the risk-return trade off increases as illustrated by allocation of 54.77%, which yields a risk-return ratio 2.19%. The equity allocation is virtually non-existent in the efficient frontier. The ALSI has a return of 1.36%, higher than property of 1.25%, and yet the highest volatility of 6.23%. In the real world, the model should to be constrained to contain a minimum equity allocation based on historical average.

The minimum variance portfolio has the lowest risk-return ratio of 1.81% and a return of 1.40%, marginally below the optimal portfolio, but at a lower risk of 2.54%. The minimum variance allocation is 85.48% and 14.52% for bonds and property. The objectives of the portfolio strategy must be clearly articulated, to be able to mix and match allocations.

The maximum allocation to property is 21.68%, because the risk-return is equal to the optimal portfolio. The marginal contribution declines and risk increases, and the risk-return trade off increases incrementally as illustrated in Annexure D.

6.4. Hypotheses Testing

The Chi-square, a statistical tool used to test for a single population variance was considered the most appropriate tool to conduct the diversification test. The Sharpe ratio was considered appropriate for the risk adjusted returns.

Table 7, presents an equally - weighted portfolio of Bonds and ALSI with a return of 1.41% and a standard deviation of 3.76% Table 8, presents an equally-weighted portfolio of Bonds, ALSI and Property with a return of 1.35% and a standard deviation of 3.49%.

6.4.1. Diversification Testing

The Null hypothesis:
Hypothesis: The null hypothesis is that the standard deviation of the portfolio reduces with the addition of property.

Ho: $\sigma^2 0 = 3.76\%$ (without property)

The Alternative hypothesis

Ha: $\sigma^2 a < 3.76\%$ (with property)

Test Statistics

The appropriate test statistic for tests of variance using the chi-square distribution is computed as follows:

$$x^2 = \frac{(n-1)s^2}{\sigma^2}$$

n = 212 Degrees of freedom (Annexure F) = 211

s^2 = 3.49% (sample variance)

$\sigma^2 a$ = 3. 76% (hypothesized population variance)

x^2 = 181.78

6.4.2. Significance level

A 5% level of significance is chosen for the one tailed test of the chi-square distribution.

6.4.3. Decision rule

There are 212 observations, and 211 degrees of freedom. Look up Annexure F, which gives the critical values, the critical value is 245.89.

Thus the decision rule is:
Since the computed test statistic (181.78) falls below the critical value (245.89), we fail to reject the null hypothesis that the variance is equal to 3.76%.
It can be concluded that the standard deviation of the portfolio with property is close enough to the standard deviation without property of 3.76%. We cannot statistically say that it is different given the 5% level of significance.

6.5. Risk- adjusted returns testing.

Sharpe ratio was used to calculate risk-adjusted returns, and is computed as follows:

Portfolio Return (W/out) Property – Money Market Return
Standard deviation of portfolio
Equally weighted (Equities and Bonds)

$$\frac{1.41\% - 1.13\%}{3.76\%} = 7.44\%$$

Portfolio Return (W) Property – Money Market Return
Standard deviation of portfolio
Equally weighted (Equities, Bonds and Property)

$$\frac{1.35\% - 1.13\%}{2.54\%} = 8.66\%$$

It can be concluded that property provides high risk-adjusted returns and provide diversification benefits, as illustrated with the increasing portfolio return from 7.44% to 8.66% on a Sharpe ratio basis and a decreasing standard deviation from 3.76% to 2.54%.

6.6. Interpretation.

The efficient frontier comprises of portfolios that are highly diversified. The efficient frontier portfolio combinations as illustrated in Annexure D, suggest a 14.52% minimum real estate allocation, with a risk-return ratio of 1.81% and a maximum of 21.68% with a risk-return ratio of 1.86%, also the optimal risk-return ratio.

The Chi-square, statistical tests of variances, reveals that the standard deviation decreases the portfolio risk, but the standard deviation is not statistically significant.

The calculated of x^2 of 181.78 is less than the critical value of 245.88 from the table, and thus we fail to reject the Sharpe ratio illustrates that property provides high-risk adjusted returns. Addition of property to a portfolio increases the Sharpe ratio from 7.44% to 8.66%, thus providing high -risk adjusted returns.

The empirical review reveals that physical property fundamentals are now similar to 1994 as illustrated by vacancies at highest levels in 2003 as demonstrated in Figure 3, and the encouraging office take-up. Currently the fundamentals in the physical property market, a factor that drive earnings of listed property, confirm that the listed property market is beginning to emerge from the bottom of the earnings cycle in 1994 as illustrated in Figure 8

.

Capitalisation rates appear to be strengthening; fuelled by listed property funds' insatiable demand for non- residential directly held property. Rode and Associates say, word in the market is that because of listed property's premium trading position Eighteen months ago property unit trusts were on average

undervalued by 25% compared to directly held property, creating an environment where it is attractive to list property portfolios.

Investing in a South African listed property company carries long- term capital protection benefits and attractive yields, and investors should give serious consideration to including the listed property market in their portfolio to ensure that it is well - diversified. The more diversified the listed property portfolio, the greater the spread in terms sectoral split and geographic diversification.

Property achieved medium term out-performance, but over the longer period, property was characterised by high volatility because of interest rates spikes experienced in 1998, and poor performance during the late 1980s and early 1990's. However, physical property fundamentals (as explained by Rode cap rates in Figure 3 and 4) at this stage suggest that property will continue to deliver stable, predictable income yields and expected positive capital returns and play an important role in a diversified portfolio

7. Conclusions and recommendations

7.1. Conclusions

The hypothesis being tested in this research report is that real estate provides diversification benefits in investment portfolios because it provides high-risk adjusted returns.

The monthly returns for asset classes from 1986 to 2003 were compiled and compared using the mean, standard deviation and correlation of those returns. An efficient frontier combination was constructed, and found that real estate allocation has a minimum of 14.52%, the minimum variance portfolio and a maximum of 21.68%, the optimal risk-return ratio.

It has been shown how MPT analysis can be used to optimally diversify an investment portfolio and to allocate overall fund assets among real estate, shares and bonds. Bonds dominate the efficient frontier because of the low risk of 2.64%, against the 6.23% and 4.90% for equities and property respectively and the 1.42% mean return, which is also the optimal point. Equities do not feature on the efficient frontier because of the high risk and mediocre returns. A practical approach will be to constrain allocation to realistic levels based on historical averages, process explained in the literature review.

The literature review supports the view that both securitised and unsecuritised real estate has a role to play in a mixed portfolio. Although the researchers differ in the percentage to be allocated, they all agree that the theoretical allocation is far less than the actual allocation.

A comparison of the optimal allocation, minimum variance allocation and historical allocations, supports the view that institutions are under-invested in real estate.

	Optimal	Minimum	Actual	International
Real Estate		14.52%	6%	**4.69%**
Bonds	100%	85.48%	28%	
ALSI			56%	
International			10%	

International allocation is based on the mean average study by Chun, G.H. and Shilling, J.D. (1998, p,.20). Equity REITs returns and risks, in a study performed by Muller et al. 2003, are either first or second in a 20- year time series. The research report revealed that PUT's have outperformed all the other asset classes over the last 7 years and is expected to continue. Finally the literature review highlighted the inflation capabilities of real estate. The majority of the researchers found that real estate provide partial hedge against (expected or unexpected) inflation and only Rubens, J. H. (1989, p.50) found against complete hedge.

7.2. Recommendations

The MPT results suffers from the well known problem of extreme portfolio choice, where, due to good historical performance, the optimisation procedure tends to select a few high performing assets and neglect or ignore other potentially important assets. Equities are not represented in the efficient frontier model and yet the actual allocation by pension funds is higher at an average of 58%.

Despite the inherent real estate property predicaments, real estate minimizes risk and offers diversification benefits and deserves a premium built into the current valuations and therefore should at a discount to bond yields. An allocation of between 10% based on the lower end of the minimum variance and 15% of the lower end of the risk/return ratio is recommended for a balanced portfolio.

(See Excel Research)
List of References
Summary of Research
(See Word Research)
Cover
Exhibit
Abbreviations

Annexure A Description of listed property

This section gives the descriptive over view of the listed property Investment available. There are currently 6 listed PUT with a total market value of R8, 3 billion and 21 PLS companies with market value of R16, 5 billion. The total value of PUT plus PLS is R24, 8 billion against the capitalization of the ALSI of R1, 60 trillion.

Property equity companies are engaged primarily in active directly help property trading, ownership operation and/or development of assets (improved as well as land), including secondary agents, Maritz J & Miller K (2004). Property equity assets pay after tax dividends and they are attractive for investors seeking long-term total returns

PUT, (a proxy for property)used for the purpose of this research, is a portfolio of investment segregate by either geographic or sectoral spread. PUT generates value for the investors in two ways: through rental income of the portfolio properties, and through the appreciation in the value of these properties over time ,Maritz J & CISCA under the auspices of the Register of Unit Trust –a FSB function.

Under the CISCA, the following concessions have been made for PUT's

Invest in fixed property in foreign countries
Gear up to 30% of the value of the underlying assets
Invest directly in property

PLS, (which have been excluded because of the short history of the index), is the same as the PUT , except that PLS is a riskier investment than a PUT , because there is no statutory limit ti its borrowing relative to the value of its underlying assets. See table 3 for difference between PUT and PLS

	PLS	PUT
Governed by	Companies Act less regulated	Unit Trust Control Act, more regulated, less risky
Gearing	Limited to company's articles i.e. company can decide	Limited to 30% of market capitalization. Legislation pending
Capital structure	Linked units i.e. one share linked to debentures	Units
Income Tax	Paid by the company, minimized by debenture interest	No tax payable by the trust
Capital Gain Tax	Company incurs CGT on realization of capital gain	Trust exempted from CGT
Distribution	Small dividends plus interest on debentures	Distributed as dividend, taxed as interest

ANNEXURE G: PENSION FUND ACT: REGULATION 28

Category	**Maximum % of Total Fair Value of Assets**
(a) Equity Including - Listed equities - Preference Shares - Unlisted equities - Unit trusts (other than funds) (Excluding any investments relating to property; including convertible debentures, whether voluntarily or compulsory convertible)	75
(b) Property Including - Fixed Property - Shares in Property companies - Property Units Trust - Loans to and Debentures of Property Companies **Total of (a) and (b)**	25 90
(c) Mortgage Bonds, Non-Convertible Debentures and Secured Claims	25
(d) International Investments	15
Total of (a), (b) and (c) together with - Money (in the RSA) - Unit trusts (Incomes funds only) - Investments in the Business of a Participating Employer.	95

Graphs Annexure E and H