Is there a "Case for Property" all the Time?

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Abstract

The "case for property" in the mixed-asset portfolio is a topic of continuing interest to practitioners and academics. Such an analysis typically is performed over a fixed period of time and the optimum allocation to property inferred from the weight assigned to property through the use of mean-variance analysis. It is well known, however, that the parameters used in the portfolio analysis problem are unstable through time. Thus, the weight proposed for property in one period is unlikely to be that found in another. Consequently, in order to assess the case for property more thoroughly, the impact of property in the mixed-asset portfolio is evaluated on a rolling basis over a long period of time. In this way we test whether the inclusion of property significantly improves the performance of an existing equity/bond portfolio all of the time.

The main findings are that the inclusion of direct property into an existing equity/bond portfolio leads to increase or decreases in return, depending on the relative performance of property compared with the other asset classes. However, including property in the mixed-asset portfolio *always* leads to reductions in portfolio risk. Consequently, adding property into an equity/bond portfolio can lead to significant increases in risk-adjusted performance. Thus, if the decision to include direct property in the mixed-asset portfolio is based upon its diversification benefits the answer is yes, there is a "case for property" all the time!

Key words: *Appraisal Bias, Rolling Estimation and Risk/Return Performance.*

Is there a "Case for Property" all the Time?

1. Introduction

The "case for property" in the mixed-asset portfolio is a topic of continuing interest to practitioners and academics; see MacGregor (1990) and Byrne and Lee (1995) for comprehensive reviews. The analysis is typically based on the use of mean-variance analysis techniques. The early research suggested that the inclusion of property in the mixed-asset portfolio offered large reductions in portfolio risk due to the additional diversification benefits real estate offers over that achieved from combining equities and bonds. Indeed, one study suggested an allocation to property of 100 per cent! Subsequent research has focused on the reasons for such a high weighting to property, which is clearly at odds with actual investor experience. The consensus is that the appraisal-based property data used in the analysis under estimates the 'true' risk characteristics of property and so the benefits of property as a portfolio diversifier are exaggerated. Later research has therefore tried to re-evaluate the case for property under more realistic assumptions about the 'true' nature of property returns, Byrne and Lee (1995). However, this later work is still performed over a fixed period of time, even though it is well known that the parameters used in the portfolio analysis problem are unstable through time (Lee 1998). Thus, the weight proposed for property in one period is unlikely to be that found in another, Lee and Byrne (1995).

Recognising these issues, Sa-Aadu *et al* (2001) proposed testing the diversification benefits of including of property into an existing optimal mixed-asset portfolio, on a rolling basis, to see if property offers improved risk-adjusted performance when it is most needed, i.e. in volatile market conditions. The authors conclude that property, as measured by the NAREIT monthly index, offers addition risk/return benefits above that of small-cap stocks and bonds in the mixed-asset portfolio, especially during downturns in the economic cycle.

This paper performs a similar analysis to evaluate the "case for property" in the UK but takes a somewhat different approach. First, the weight assigned to property, in the Sa-Aadu *et al* (2001) approach, could have a large variation over time in the expanded portfolio. Casual observation of actual property holdings by institution investors, however, indicates that there are only minor changes in their holdings over time, and Frost and Savarino (1988) show that constraining the weights within the portfolio leads to better *ex ante* return performance. In addition, the wholesale switching of holdings across the different asset classes, leading to a zero holding in a particular asset class in one period, or an extremely high holding in another, is unlikely to be representative of actual investor experience. Secondly, the property returns used in the Sa-Aadu *et al* (2001) study were based on the performance of the securitised property market, as measured by the NAREIT index, rather than that of the direct property market. There is some doubt as to whether the performance of REITs is equivalent to that of the direct property, see *inter alia* Ambrose *et al* (1992), Gyourko and Keim (1992), Liu and Mei (1992) and Ling and Naranjo (1999) among others. Third, under the Sa-Aadu *et al* (2001) approach the addition of property to the existing mixed-asset portfolio may offer no improvement in risk/adjusted performance. As a consequence, in various periods, the model would indicate a zero holding in property. Thus, any *negative* impact of the inclusion of property on the existing mixed-asset portfolio is excluded from the analysis. Yet, investors need to be aware of the advantages and disadvantages of holding in property in the mixed-asset portfolio. Fourth, the strategic asset allocation (SAA) decision, that determines the normal weights of the mixed-asset portfolio, is made with reference to the organisations risk tolerance and long-term financial goals. In the case of insurance companies and pension funds this would be based on the actuarial assumptions made about the liabilities of the organisation, liabilities that are not subject to wild fluctuations over time. Thus, the strategic weights will see only minor revisions to take account of changes in the estimates of the portfolio parameters and the different needs of the fund. So, although the SAA of the mixed-asset portfolio maybe periodically reviewed and occasionally rebalanced, such decisions will be made only infrequently. Yet Sa-Aadu *et al* (2001) rebalance the portfolio weights on a monthly basis, which most institutional investors would find either impractical or unrealistic. Indeed the long lead times and high search and transaction costs in the direct property market would make such switches in and out of direct property difficult if not impossible to implement, within the one-month holding period, even if such switching was prescribed by the modelling process[1]. Fifth, although the fund manager may be given discretion to deviate from the SAA weights to take advantage of any short-term tactical consideration, such deviations are usually set within tight limits (Harrison, 1992). Consequently, investors need to be aware of the impact that a specific holding in property has on their portfolio rather than widely fluctuating portfolio weights. In other words, the "case for property" needs to be examined in a more realistic framework, with a specific allocation to property, and based upon the returns in the direct property market.

To take account of these concerns the approach here is to analyse the risk/return performance of a number of equity/bond portfolios, calculated on a rolling basis, and then to compare these results with a number of expanded portfolios that also contain a specific holding in direct property over the same period. In this way the increase, or decrease, in performance from including property within the mixed-asset portfolio can be assessed more thoroughly. The remainder of the paper is organised as follows. The next section discusses the data and the de-smoothing approach adopted in the paper. Section three describes the research design employed. Results are presented and discussed in section four. Finally, section five concludes the paper.

Data

The data used in this study are the monthly returns of three asset classes: equities, bonds and property. The Financial Times All Share (FTAS) Index is used to represent the performance of the UK equity market. Bonds are represented by the 5-15 years Gilt Index. The source of the direct property market data is on the Insignia Richard Ellis (IREM) Monthly Index, which is based on a sample of 267 properties with a market value of £2.2 billion at the end of December 2001. This data used, in preference to the much larger Investment Property Databank (IPD) Monthly Index, as it is the longest monthly data series currently available (Barber, 1990), while the IREM and the IPD monthly indices show similar performance characteristics (Nanthakumaran and Newell, 1995). The returns data series covering the period 1979:2 to 2001:12, providing a time series of 274 returns. Table 1 contains summary statistics for the monthly return series.

An examination of Table 1 indicates that equities had the highest risk (4.84%) over this period but compensated investors with the highest mean returns (1.36%) (coefficient of variation of

[1] McNamara (1999) finds that 2-3 months is the typical transaction time in the UK, even time during normal times.

3.56)[2]. Property in contrast offered the lowest return (0.92%) but significantly the lowest risk (0.94%) (coefficient of variation of 1.03). Indeed the risk of property is less than half of that of UK government bonds, 2.96. Table 1 shows that the property data shows a slight positive skewness compared with equities, which are negatively skewed, and the bond returns that are symmetrical. All asset classes showing significant kurtosis and so non-normality has indicated by the Jarque-Bera test. More importantly the property returns data shows significant 1st, 2nd, 3rd and even higher levels of serial correlation, while the equity and bond data displays insignificant serial correlation at all levels.

Table 1: Summary Statistics of the Property, Equity and Bond Returns 1979:2 to 2001:12

Statistics	Property	Equity	Bonds
Mean	0.917	1.360	1.081
Std. Dev.	0.943	4.838	2.964
Skewness	0.425	-0.942	0.064
Kurtosis	4.598	6.828	3.681
Jarque-Bera test	37.43	207.81	5.48
Probability	0.000	0.000	0.065
1st Order Serial Correlation	0.750	0.014	0.094
2nd Order Serial Correlation	0.681	-0.110	-0.012
3rd Order Serial Correlation	0.578	-0.118	-0.112

The low value of the second moment and the presence of significant first order serial correlation in the returns of commercial property in the direct market is a common feature of international databases, see Fisher, *et al* (1994) and Corgel and deRoos (1999) for comprehensive reviews. The downward bias in the second moment of appraisal-based property market indices is usually attributed to the behaviour of valuers in conducting valuations and the temporal and cross sectional aggregation of individual property valuations into the market index (Geltner, 1991 and Brown and Matysiak, 1998). To account for such appraisal bias and to make the appraisal-based property data more comparably with the market based equity and bond returns, the property data was de-smoothed.

There are a number of methods that have been developed to de-smooth the appraisal-based indices, but these can be broken down to two basic approaches. Models that assume market pricing efficiency and those that do not. The models that assume market efficiency are typified by the approaches of Ross and Zisler (1991) and Geltner (1991). In this approach the 'true' market returns are recovered from the valuation based series by applying an autoregessive filter to the data set to derive a white noise process, which is then scaled by taking the relative risks of property and the equity market. The alternative methods that do not assume market efficiency are typified by the approach of Geltner (1993). This method attempts to recover the 'true' market prices by modelling the underlying appraisal process in order to correct for the weight valuers give to past prices.

Both approaches are subject to criticism.

[2] If the large negative value of the equity data from the market crash in 1987 is removed, the mean monthly return is now 1.46% and the standard deviation 4.54% (coefficient of variation 3.11). The skewness (-0.36) and kurtosis (3.62) statistics of the equity data are also reduced and although the equity data still displays non-normality (Jarque-Bera statistic 10.28, p=0.01) it seems that the non-normality in the FTAS data is significantly affected by the 1987 market crash.

First, in the case of the approach that assumes market efficiency there may be some doubt as to the efficiency of the pricing process within the property market. Secondly, a certain amount of autocorrelation within the data series may be acceptable, as the lenghth of the transaction periods and high transaction costs within the property market would make it difficult, if not impossible, for investors to take advantage of such serial dependence. Thus a process that generates a white noise process may have over-filtered the data set. Finally, the relative magnitude of the riskiness of property and the equity market is based on survey results, which show a number of differences across time and countries, Byrne and Lee (1993). Thus the use of a single value is probably inappropriate.

The approaches that do not assume market efficiency, in contrast, depends heavily on the value of the de-smoothing parameter chosen, as different weights will produce differing results. In addition, it is likely that the weights will change through time as the quality and quantity of comparable evidence changes at different points of the property market cycle. Indeed, Brown and Matysiak (1998) find a great deal of differences in the value that needs to be applied to individual property returns through time hence a time varying parameter may be more appropriate.

To account for these complicationions the approach adopted here is to use the following model suggested by Geltner (1993), which models the 'true' returns as a one period lagged function of the previous return:

$$r_t^* = \alpha r_t + (1-\alpha) r_{t-1}^* \qquad (1)$$

where r^* is the valuation based return, r is the 'true' market price and α is the de-smoothing parameter. The market price can then be recovered by the following equation:

$$r_t = \frac{1}{\alpha}\left[r_t^* - (1-\alpha) r_{t-1}^*\right] \qquad (2)$$

where the de-smoothing parameter (alpha) is estimated from the slope coefficient of the regression of the valuation based returns on their values lagged one period, as suggested by Blundell and Ward (1987)[3], with the estimation undertaken on a rolling basis[4]. Such an approach has a number of advantages. First, equation 1 does not rely on the assumption of market efficiency, implicit in the pre-whitening process nor on the assumption of a constant

[3] De-smoothing was only undertaken if the regression coefficient was significant different from zero at the 5% level. This was done for two reasons. First, if the regression coefficient was insignificant this would imply the return series displayed little appraisal bias and de-smoothing may not be required. Secondly, if the regression coefficient was essentially zero the first term on the RHS of equation 2 would be extremely large leading to an explosion in the return series and levels of risk (standard deviation) which could not be rationalised as representative to 'true' market behaviour.

[4] The analysis was also repeated with the appraisal based real estate series and a de-smoothed series using a parameter derived from the whole data set. The resultant means, standard deviations and Sharpe ratios of the expanded mixed-asset portfolio are qualitatively the same but naturally generally better than with the results reported here and so the results are not presented, but are available on request.

relationship between the variances of the property and equity markets. Secondly, this approach allows the de-smoothing parameter to vary over the rolling estimation periods to avoid any misspecification from the use of a fixed de-smoothing parameter as noted by Brown and Matysiak (1998). Finally such an approach is consistent with the optimal behaviour of valuers, Quan and Quigley (1991).

Research Design

The mean, standard deviation and the Sharpe ratio (the return per unit risk) of a number of equity/bond portfolio strategies were derived over a 36-month *ex post* period[5]. The analysis then moved forward 12 months with the parameters of the equity/bond portfolios re-estimated using the updated returns data[6]. In other words the equity/bond investment strategies used a 12-month rolling window, with the updated equity/bond portfolio holdings derived from this new data. Once the weights of these equity/bond portfolios are derived the capital market assets are then scaled down accordingly depending on the specific allocation to property, with the mean, standard deviation and Sharpe ratios of these expanded portfolios then calculated[7]. In other words, the allocation of property in the mixed-asset portfolio is made independently of the other capital market assets.

The choice of 36-months determined by a number of considerations. First, a sufficiently large number of data points are needed to minimise potential optimisation errors that can arise when semi-definite covariance matrices are estimated with small time series samples, Ong and Ranasinghe (2000). Secondly, the statistical tests employed, to test the significance of portfolio improvement, especially the Jobson and Korkie (1981) test, lose considerable power with less than 36 data points. Third, Sa-Aadu *et al* (2001) use a 36-month rolling estimation period.

Four different *ex post* equity/bond portfolio strategies are considered; (1) a naï ve equal weighted portfolio, (2) a 60/40 (equity/bond) portfolio, (3) the optimal Sharpe portfolio, and (4) the minimum variance portfolio (MVP). The naï ve portfolio was chosen, as it is the optimal portfolio for those investors with no forecasting ability, Brown (1988). While Eun and Resnick (1988) view this approach as the simplest way investors can attempt to capture some of the potential gains from diversification. However, such a portfolio is unlikely to be held in practice as it fails to take account of any differences in risk/return performance between the asset classes. In contrast, a weight of 60% in equities and 40% in bonds is often advocated as the optimal long-

[5] The actual period is 37-months for the real estate data, however, during the de-smoothing process one observation is lost leaving 36 observations.

[6] The calculations undertaken on December, i.e. it is assumed that the fund manager evaluates the mixed-asset portfolio annually. The first calculations undertaken on the 36 months preceding December 1982, as this the first time that a fully 36 months were available. This is a shorter period than the full data set, which starts February 1979.

[7] In a previous paper Byrne and Lee (1995) also considered the impact of cash within the mixed-asset portfolio. There are a number of reasons for excluding cash from this analysis. First, the proportion in cash depends upon the availability, or lack of availability, of investment opportunities in the other asset classes. In other words, holdings in cash not determined by its investment characteristics and so cash should not be part of the mixed-asset class optimisation. Secondly, if the optimisation process is left unconstrained the allocation to cash within the MVP can be over 90%, an allocation clearly at odds with actual investor experience. Finally, if a fixed allocation to cash were made casual empirical evidence would suggest a holding of only 2 or 3% is the norm for most institutional investors. Thus, the results are unlikely to be significant if cash is excluded from the analysis.

term equity/bond portfolio given the long run risk/return performance of the two assets. However, such a portfolio may not be efficient in the short-run given the highly volatile nature of returns overtime. To account for such instability the actual *ex-post* optimal Sharpe portfolio was calculated as it the portfolio that offered the highest mean return per unit risk over the evaluation period[8]. Furthermore, the composition of such a portfolio is independent of the investors' preference structure, Tobin (1958). Consequently it is the portfolio most consistent with financial theory and the most desirable to all investors. Finally, property is often characterised as a low risk investment and so offers very good diversification benefits. Thus, if property is truly a diversifier it should have a significant impact on the performance of the MVP. This is because the estimation of the weights in the MVP portfolio depends solely on the risk characteristics of the assets. The optimum Sharpe portfolio and the MVP, therefore, provide a stronger test of the benefits of including property within the mixed-asset portfolio than the first two strategies.

To these various equity/bond portfolios a holding in property of 5%, 10%, 15% and 20% was added and the resultant risk/return performance calculated, the use of these differing weights dictated by a number of factors. First, a holding of 5% is seen as the one of the lowest allocations to property that institutional investors have chosen to hold across the world, Chun and Shilling (1998). Nonetheless, such a low allocation is unlikely to have a significant impact on the overall portfolio performance. In contrast, an allocation to property of 10% weight is likely to be least weight property could have in a mixed-asset portfolio and still have an impact on performance. The 15% and 20% levels, meanwhile, have been suggested in a number of studies, as the target level property should have in the mixed-asset portfolio. A holding of 20% (or higher) suggested in many academic studies before the adjustment of the property returns for appraisal bias, see *inter alia* Sweeny (1988), Fogler (1984), and Firstenberg, *et al* (1988). In contrast, the 15% allocation has been advocated, as the weight property should have in the mixed-asset portfolio on both an *ex-post* or *ex-ante* basis, even after correcting for appraisal bias, Byrne and Lee (1993) and Lee *et al* (1996). UK institutional investors also see the 15% allocation as the target allocation they would like to see for property in their mixed-asset portfolio, Byrne and Lee (1999).

The reasons for a fixed allocation to property are twofold. First, as a result of illiquidity in the direct property market rebalancing a property portfolio may be impractical even within a year, especially in market down turns. The second consideration is the very high transaction costs of managing a property portfolio compared with that of equities of bonds. For instance, it has been suggested that 95% of the costs of managing a mixed-asset portfolio can be attributed to just 5% of the assets (property). A constant allocation to property would minimise these transaction costs as under the scenarios proposed here changes in the composition of the mixed-asset portfolio are achieved by re-balancing the equity and bond holdings. In other words, property fund managers are likely to favour a specific allocation to property in the mixed-asset portfolio that will remain largely unchanged overtime.

The re-allocation of the capital market assets to property was done in three ways. First, the holding in property replaced the same percentage in the equity holdings. In the second approach

[8] This also makes the work comparable with that of Sa-Aadu *et al* (2001) as the approach they used, the volatile bounds methodology of Hansen-Jagannathan (1991) produces results that correspond to the optimal Sharpe ratio.

the percentage allocated to property replaced the same proportion in the bond holding. Finally, the holding in property was equally split between the equity and bond weightings[9]. In this way the impact of property on the mixed-asset portfolio could be evaluated under a number of scenarios.

To evaluate the relative performance of adding property to an existing equity/bond portfolio the difference in mean, standard deviation and Sharpe performance (return per unit risk) of the various portfolio strategies were tested by the following statistical tests. The difference in means was assessed by the t-test. The difference in standard deviation was evaluated by the Brown-Forsythe modified Levene test (Brown and Forsythe, 1974). The difference in the Sharpe performance between the initial equity/bond portfolios and the expanded portfolios, containing property, was evaluated by calculating the Jobson and Korkie (1981) Z statistic.

Results

Portfolio Returns

Table 2 presents the average, maximum and minimum percentage increases (+), or decreases (-), in mean returns of the expanded portfolios containing 5%, 10%, 15% or 20% in property compared with the four equity/bond portfolio investment strategies and for the three re-allocation methods, over the whole 20 periods of analysis. As can be seen, holding property, over this period, has on average led to slight reduction in portfolio returns compared with the initial equity/bond portfolios. This is true for all four-portfolio strategies and at all property allocations. The greatest impact is when the allocation to property replaces the same allocation in equities the least when property replaces bonds.

The maximum and minimum values in Table 2, however, show that the average results hide a good deal of variation over time. As seen in Figure 1[10] an allocation of 5% or 20% to property, replacing the same percentage in equities, shows that there are periods when including property can lead to an increase in return. Figure 1 shows that an allocation of 5% to property whilst only leading to small reductions in portfolio return overall, rarely offers a positive improvement in performance. In contrast, an allocation of 20% to property naturally leads to large increases and decreases in portfolio return in the mixed-asset portfolio. Not surprisingly these are the periods when property performed well, as during the property booms of 1986-1990 and 1999-2001. However, based on the results of t-tests, not shown, in no case is the increase or decrease in mean return of the expanded portfolios containing property significant different from that of the equity/bond portfolios, for any re-allocation to property in any period, and for all portfolio investment strategies.

Table 2: Percentage Increase (+) Decrease (-) in Portfolio Mean Due to Adding Property to the Existing Equity/Bond Portfolios: 1982-2001

9 If the required allocation to property was greater than the holding in either equities or bonds the following procedure was undertaken. The proportion in property was added to the equity/bond portfolio until the allocation to the asset it was to replace was driven to zero, while the remaining proportion was then taken from the other asset, a process that was only required in very few cases.

10 The graphs for the position when property replaces bonds or equity/bonds show similar results and so are not shown but are available upon request.

Replacing		Equity			Bonds				Equities/Bonds			
Property %	5	10	15	20	5	10	15	20	5	10	15	20
50/50 Equities Bond Portfolio												
Average	-0.1	-2.8	-5.6	-8.4	1.8	0.9	0.0	-0.9	0.9	-1.0	-2.8	-4.6
Max	39.4	25.0	10.6	9.3	52.9	51.9	50.9	49.9	46.2	38.5	30.8	23.1
Min	-5.8	-11.6	-17.4	-23.2	-6.4	-12.8	-19.2	-25.6	-6.1	-12.2	-18.3	-24.4
60/40 Equities Bond Portfolio												
Average	-1.2	-2.4	-3.6	-4.8	-0.5	-1.0	-1.6	-2.1	-0.9	-1.7	-2.6	-3.4
Max	16.0	32.0	48.0	64.0	6.4	12.8	19.3	25.7	11.2	22.4	33.6	44.8
Min	-5.9	-11.8	-17.6	-23.5	-6.5	-12.9	-19.4	-25.9	-6.2	-12.3	-18.5	-24.7
Ex Post Sharpe Equity/Bond Portfolio												
Average	-1.8	-3.7	-5.5	-7.2	-1.0	-1.9	-2.9	-3.8	-1.4	-2.8	-4.2	-5.6
Max	3.0	6.0	9.0	11.9	4.4	8.7	13.1	17.4	3.2	6.3	9.5	12.7
Min	-6.5	-13.0	-19.5	-24.9	-6.0	-12.1	-18.1	-24.2	-6.0	-12.1	-18.1	-24.2
Minimum Variance Equity/Bond Portfolio												
Average	-1.6	-3.2	-4.4	-5.4	-0.6	-1.2	-1.9	-2.5	-1.1	-2.2	-3.4	-4.5
Max	8.4	16.8	25.1	33.5	5.1	10.1	15.2	20.3	5.9	11.7	17.6	23.5
Min	-7.9	-15.7	-18.1	-24.2	-6.0	-12.1	-18.1	-24.2	-6.0	-12.1	-18.1	-24.2

Portfolio Risk

Table 3 shows the average, maximum and minimum percentage increases (+), or decreases (-), in portfolio risk (standard deviation) of the expanded portfolios containing 5%, 10%, 15% or 20% in property compared with the four-equity/bond portfolio investment strategies and for the three re-allocation methods, over the whole 20 periods of analysis. Here the risk reduction benefits of property within the mixed-asset portfolio are clearly demonstrated. In all cases the inclusion of property leads to a reduction in portfolio risk in the expanded portfolio compared with its equity/bond comparator, the reduction in risk increasing when more is allocated to property irrespective of the investment strategy or re-allocation scheme. The greatest reduction in risk typically occurring for the simplest portfolio strategies, i.e. the equal-weighted and 60/40 portfolios, as would be expected. Nonetheless, the expanded mixed-asset portfolios containing property still offers average reductions in portfolio risk of between 15%-20% even when compared with the efficient equity/bond portfolios, i.e. the Sharpe and MVP portfolios. The greatest reduction occurring when the allocation to property is 20% and the least when only 5% is re-allocated to property. However, Figure 2 shows that this reduction in risk is variable over time.

Figure 2 shows that an allocation of 5% to property, replacing the same percentage in equities, across all re-allocation schemes, leads to only minor reductions in risk levels. In contrast, a holding of 20% in property, replacing the same percentage in equities, can lead to a percentage reduction in risk of over 33% or 40% in some periods, depending on the re-allocation scheme. More importantly, an allocation of 20% in property still offered equity/bond portfolios reductions in risk of about 20% even during the property market crash of 1990-1993. In other words, property offers portfolio diversification benefits all the time! However, in only one case was there a significant difference in portfolio standard deviation between the existing equity/bond portfolio and the expanded portfolio containing property, based on the results of the Brown-Forsythe test.

Table 3: Percentage Increase (+) Decrease (-) in Portfolio Risk Due to Adding Property to the Existing Equity/Bond Portfolios: 1982-2001

Replacing		Equity			Bonds				Equities/Bonds			
Property %	5	10	15	20	5	10	15	20	5	10	15	20

50/50 Equities Bond Portfolio												
Average	**-6.6**	**-12.7**	**-18.7**	**-24.4**	**-3.7**	**-7.0**	**-10.2**	**-13.3**	**-5.2**	**-10.1**	**-15.0**	**-19.8**
Max	**-9.1**	**-18.0**	**-26.7**	**-35.1**	**-13.8**	**-22.8**	**-31.8**	**-40.8**	**-9.6**	**-14.3**	**-19.1**	**-23.8**
Min	**-5.1**	**-5.8**	**-6.3**	**-6.7**	**-0.9**	**-1.7**	**-2.4**	**-2.9**	**-4.3**	**-8.5**	**-12.6**	**-16.6**
60/40 Equities Bond Portfolio												
Average	**-6.5**	**-12.9**	**-19.2**	**-25.4**	**-2.5**	**-4.9**	**-7.2**	**-9.3**	**-4.6**	**-9.1**	**-13.6**	**-18.0**
Max	**-8.0**	**-16.0**	**-23.9**	**-31.6**	**-4.4**	**-8.7**	**-12.8**	**-16.7**	**-5.0**	**-10.1**	**-15.1**	**-20.0**
Min	**-5.5**	**-10.9**	**-16.1**	**-21.3**	**-0.5**	**-0.9**	**-1.3**	**-1.5**	**-3.8**	**-7.5**	**-11.2**	**-14.8**
Ex Post Sharpe Equity/Bond Portfolio												
Average	**-5.4**	**-10.3**	**-14.7**	**-18.8**	**-4.5**	**-8.9**	**-13.2**	**-17.4**	**-5.0**	**-10.0**	**-14.8**	**-19.5**
Max	**-6.6**	**-13.0**	**-19.3**	**-25.5**	**-5.2**	**-10.4**	**-15.6**	**-20.7**	**-5.8**	**-11.1**	**-16.4**	**-21.6**
Min	**-3.6**	**-6.4**	**-7.8**	**-7.6**	**-1.3**	**-2.3**	**-3.1**	**-3.7**	**-4.0**	**-7.9**	**-11.7**	**-15.5**
Minimum Variance Equity/Bond Portfolio												
Average	**-4.7**	**-8.9**	**-12.6**	**-16.3**	**-4.9**	**-9.8**	**-14.5**	**-19.2**	**-4.9**	**-9.7**	**-14.4**	**-18.8**
Max	**-5.4**	**-10.6**	**-15.7**	**-20.5**	**-5.2**	**-10.3**	**-15.4**	**-20.4**	**-5.3**	**-10.6**	**-15.9**	**-21.0**
Min	**-4.0**	**-5.5**	**-7.7**	**-7.1**	**-4.5**	**-8.9**	**-13.1**	**-17.2**	**-4.4**	**-8.8**	**-12.6**	**-15.5**

Sharpe Performance

As the reduction in portfolio risk is greater than the fall in portfolio returns, from adding property to the equity/bond portfolios, this can lead to large improvements in risk-adjusted performance, as shown in Table 4. As can be seen in Table 4 the return per unit risk (Sharpe Ratio) of the expanded portfolios, containing property, shows an increase in risk-adjusted performance of about 15% on average overall across the various investment strategies and re-allocation schemes, but as much as 153%, in one period, for specific allocations. The greatest improvement in Sharpe performance occurring when the holding in property was 20% and consequently the least impact occurred for the 5% allocation.

Table 4: Percentage Increase (+) Decrease (-) in Sharpe Performance Due to Adding Property to the Existing Four Equity/Bond Portfolios: 1982-2001

Replacing	**Equity**				**Bonds**				**Equities/Bonds**			
Property %	**5**	**10**	**15**	**20**	**5**	**10**	**15**	**20**	**5**	**10**	**15**	**20**
50/50 Equities Bond Portfolio												
Average	**6.9**	**11.3**	**16.4**	**22.1**	**6.1**	**9.3**	**12.8**	**16.7**	**6.5**	**10.3**	**14.4**	**19.1**
Max	**47.2**	**32.7**	**43.4**	**64.6**	**77.4**	**96.8**	**121.3**	**153.1**	**61.6**	**61.6**	**61.6**	**61.6**
Min	**0.5**	**1.0**	**1.5**	**1.8**	**-3.5**	**-7.4**	**-11.6**	**-16.1**	**-1.5**	**-3.2**	**-5.1**	**-7.3**
60/40 Equities Bond Portfolio												
Average	**5.7**	**12.2**	**19.7**	**28.3**	**2.1**	**4.1**	**6.1**	**8.0**	**3.9**	**8.1**	**12.7**	**17.8**
Max	**25.2**	**54.6**	**89.3**	**130.8**	**7.1**	**14.2**	**21.3**	**28.2**	**15.9**	**33.2**	**52.0**	**72.5**
Min	**0.2**	**0.3**	**0.3**	**0.3**	**-4.0**	**-8.3**	**-13.0**	**-18.0**	**-1.9**	**-4.1**	**-6.5**	**-9.2**
Ex Post Sharpe Equity/Bond Portfolio												
Average	**3.8**	**7.5**	**10.9**	**14.4**	**3.7**	**7.7**	**11.9**	**16.4**	**3.8**	**8.0**	**12.5**	**17.3**
Max	**9.0**	**18.3**	**29.1**	**41.2**	**9.1**	**19.0**	**29.5**	**41.2**	**9.5**	**19.5**	**30.0**	**41.2**
Min	**-1.2**	**-2.7**	**-4.3**	**-6.3**	**-1.2**	**-2.7**	**-4.3**	**-6.3**	**-1.2**	**-2.7**	**-4.3**	**-6.3**
Minimum Variance Equity/Bond Portfolio												
Average	**3.2**	**6.2**	**9.3**	**12.8**	**4.5**	**9.5**	**14.8**	**20.7**	**4.0**	**8.3**	**12.8**	**17.7**
Max	**12.9**	**25.1**	**35.5**	**46.3**	**10.3**	**21.4**	**33.6**	**46.9**	**11.2**	**23.2**	**36.1**	**49.6**
Min	**-2.9**	**-6.6**	**-5.3**	**-8.7**	**-1.2**	**-2.7**	**-4.3**	**-6.3**	**-1.2**	**-2.7**	**-4.3**	**-6.3**
Percentage Number of Times when there is a Significant Difference in Sharpe Performances												
50/50	**0**	**20**	**30**	**45**	**0**	**0**	**5**	**5**	**0**	**0**	**20**	**60**
60/40	**0**	**5**	**35**	**60**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**45**
Sharpe	**0**	**0**	**5**	**10**	**0**	**5**	**25**	**45**	**0**	**5**	**20**	**60**
MVP	**0**	**0**	**0**	**5**	**0**	**5**	**35**	**80**	**0**	**0**	**25**	**50**

Two alternative procedures have been used in previous studies to test the significance difference in the Sharpe ratios of portfolios. The first method is that suggested by Gibbons *et al* (1989) and the second test is that proposed by Jobson and Korkie (JK) (1981). However, use of the Gibbons *et al* test statistic assumes that portfolio holdings are unconstrained, i.e. short selling can occur, an assumption that is unrealistic within most capital market but especially in property markets. If no short selling is assumed this means that the distribution of the test statistic is unknown and needs to be approximated using simulations, Glen and Jorion (1993). In contrast, the JK statistic can be used without adjustment for constrained portfolio allocation, i.e. with no short selling as is the case here, and so is easier to apply. In addition, the results of the Gibbons *et al* and JK tests produce similar conclusions, Lee and Stevenson (2001). Jobson and Korkie (1981) showing that the test statistic is approximately normally distributed with a zero mean and a unit standard deviation for large samples. Thus, observing a statistically significant Z score between two portfolios can be seen as a strong evidence of a difference in risk-adjusted performance. Jobson and Korkie (1981) and Jorian (1985) note, however, that the statistical power of the test is low, especially for small sample sizes, i.e. less than 36 observations.

Using this approach the final panel of Table 4 shows that an allocation of 5% to property *never* leads to a significant increase in risk-adjusted performance, across any of the investment strategies and re-allocation schemes. An allocation of 10% to property, meanwhile, only shows a significant improvement in portfolio performance in a few periods and then only against the simplest portfolio strategies, i.e. the equal-weighted and 60/40 portfolios. Indeed, an allocation of only 5% or 10% would more than likely lead to a reduction in portfolio performance, once the higher management costs of the direct property portfolio were considered. It is only when the holding in property is 15% and especially 20% that the 'true' portfolio enhancing characteristics of property in the mixed-asset portfolio really begin to be seen. When an allocation of 15% or 20% in property is considered Table 4 shows a number of features of interest. First, when the allocation to property replaced the same percentage in equities Table 4 shows the greatest increase in performance and significance is achieved in the simple equal-weighted and 60/40 portfolios, as is to be expected. However, a 15% or 20% allocation to property rarely leads to a significant increase in performance when compared to the efficient equity/bond (Sharpe and MVP) portfolios. The reverse is true when property replaces bonds in the expanded portfolio. Replacing 15% or 20% in bonds with property leads to the greatest increase in Sharpe performance and level of significance when compared with the efficient equity/bond (Sharpe and MVP) portfolios rather than the naï ve (equal-weighted and 60/40) portfolios. This is probably due to the higher percentage holdings of bonds in the efficient portfolio strategies, compared with the naï ve investment portfolios, and the lower levels of returns of bonds compared with equities (see Table 1). Finally, 15% or 20% in property replacing an equal amount of equities and bonds seems to offer the best performance across all the equity/bond investment strategies. As shown in the final panel of Table 4 an expanded portfolio containing 20% in property, replacing an equal amount of equities and bonds, would have offered significant improvements in risk-adjusted performance for up to 60% and not less than 45% of the time. This confirms the findings of Sa-Aadu *et al* (2001) who found that real estate investment offers improved levels of risk-adjusted performance compared with an existing optimal mixed-asset portfolio above that of bonds and small company stocks.

Conclusion

The advantages of including property to the mixed-asset portfolio has been the subject of continuing analysis by academics, the initial studies suggesting an allocation to property far in excess of that observed in practice. This difference is usually attributed to the use of appraisal-based property data in comparison with market-based equity and bond returns. Appraisal-based data, which has been shown to significantly under estimate the individual and portfolio risk characteristics of the property returns and so over emphasise the allocation to property. The later work has tried to account for such appraisal bias by de-smoothing the property data to test the case for property in a more realistic context. Nonetheless, such studies have inferred the allocation to property over a fixed period, even though it is well known that the portfolio parameters are unstable over time. Thus an allocation implied in one period is unlikely to be the same in another. To address this issue this paper has analysed the "case for property" in the mixed-asset portfolio on a rolling basis to see if property would have offered improved portfolio risk/return performance all the time.

Using monthly data, over the period 1979:2 to 2001:12, the main conclusions are that including property into an existing equity/bond portfolio can lead to an increase or decrease in portfolio returns, depending on the performance of property relative to the other asset classes. However, the inclusion of property within the mixed-asset portfolio *always* leads to reductions in risk, even after the property data is de-smoothed to account for any potential appraisal bias in the return series. In other words, the benefit of including property in the mixed-asset portfolio comes from its risk reduction ability rather than any return enhancement. This large reduction in portfolio risk, at the cost of only a minor loss in average returns, meant that property also offered increases in risk-adjusted (Sharpe) performance a good deal of the time. Indeed, the results here show that adding property into an existing equity/bond portfolio often led to *significant* increases in risk-adjusted performance. This is especially so for an allocation to property of at least 15% but especially at 20%. In contrast, an allocation of only 5%, or even 10%, to property offers little improvement in risk-adjusted performance.

In conclusion, if the decision to include property in the mixed-asset portfolio is based upon its diversification benefits the answer is yes, there is a "case for property" all the time! Confirming the findings of Sa-Aadu *et al* (2001) who used a different methodology and data set. However, this is only true if the allocation to property is about 15% or 20%. Indeed an allocation of only 5% or even 10% is likely to prove detrimental to the performance once the management costs of property are taken into account. So to truly reap the benefits of including property within the mixed-asset portfolio institutional investors need to consider an allocation of at least 15%, but more likely 20%.

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Figure 1: The Percentage Increase/Decrease in Portfolio Return from Replacing 5% and 20% in Equities with Property for all Four Equity/Bond Strategies: 1982-2001

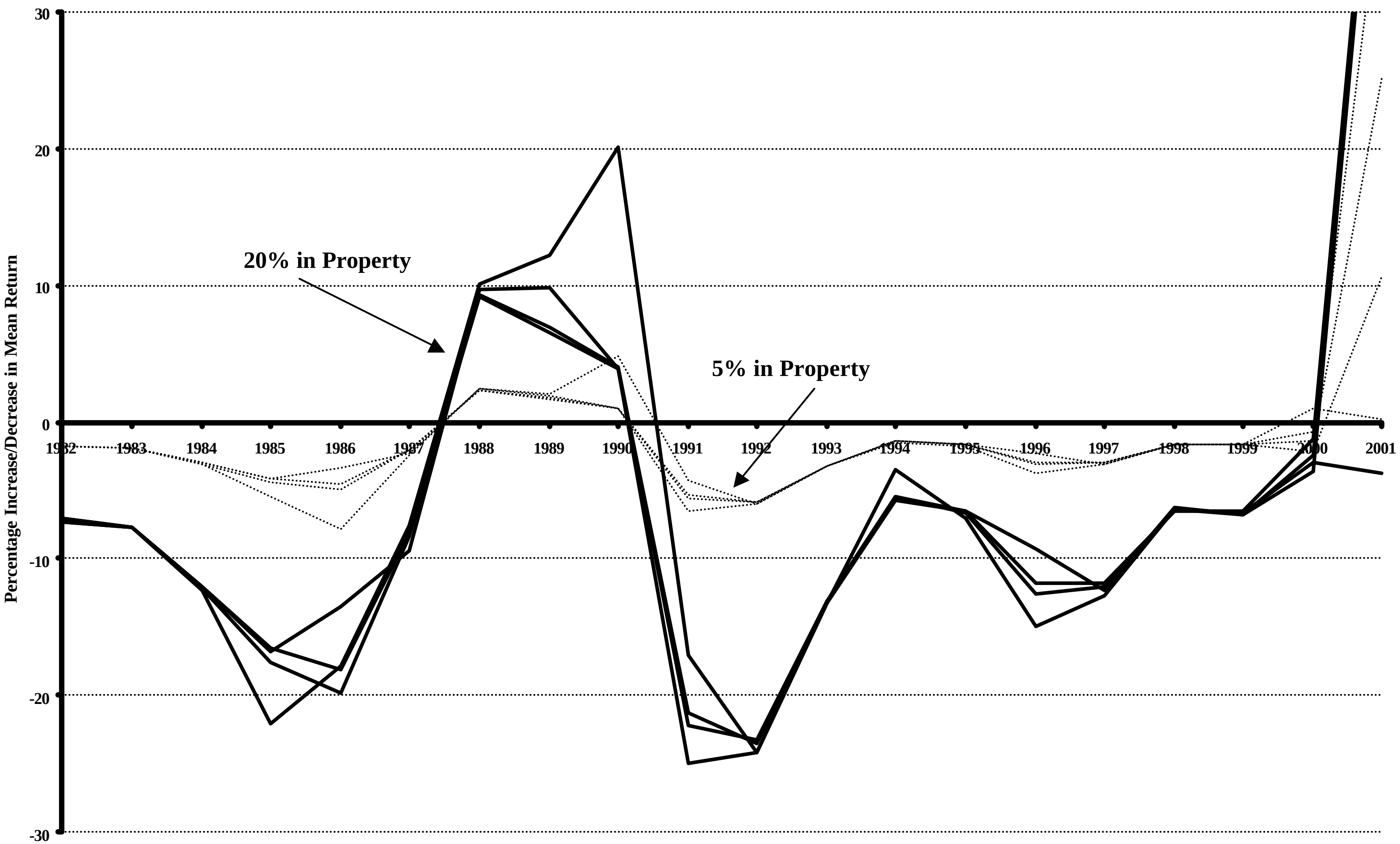

Figure 2: The Percentage Decrease in Portfolio Risk from Replacing 5% and 20% in Equities with Property for all Four Equity/Bond Strategies: 1982-2001