A Meta Analysis of Real Estate Fund Performance

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Abstract

This paper provides evidence regarding the risk-adjusted performance of 19 UK real estate funds in the UK, over the period 1991-2001. Using Jensen's alpha the results are generally favourable towards the hypothesis that real estate fund managers showed superior risk-adjusted performance over this period. However, using three widely known parametric statistical procedures to jointly test for timing and selection ability the results are less conclusive. The paper then utilises the meta-analysis technique to further examine the regression results in an attempt to estimate the proportion of variation in results attributable to sampling error. The meta-analysis results reveal strong evidence, across all models, that the variation in findings is real and may not be attributed to sampling error. Thus, the meta-analysis results provide strong evidence that on average the sample of real estate funds analysed in this study delivered significant risk-adjusted performance over this period. The meta-analysis for the three timing and selection models strongly indicating that this out performance of the benchmark resulted from superior selection ability, while the evidence for the ability of real estate fund managers to time the market is at best weak. Thus, we can say that although real estate fund managers are unable to outperform a passive buy and hold strategy through timing, they are able to improve their risk-adjusted performance through selection ability.

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1. Introduction

This paper extends the existing literature on the investment performance of real estate funds by utilising a statistical technique called meta-analysis. Meta-analysis is a parametric technique for the accumulation of results across studies, providing estimates of the mean and standard deviation of the population values (Coggins and Hunter, 1987, 1993). In addition, it provides information on the proportion of the observed variation in studies that can be explained by sampling error. Its application in the current study is concerned with the assessment of the selection and timing ability of real estate funds[‡]. In terms of this application of meta-analysis, the timing and selection ability of each fund manager is viewed as a study. Thus the purpose of this study is twofold. The first objective is to provide evidence on the risk-adjusted timing and selection ability of real estate funds in the UK using three widely used models of performance; the Treynor and Mazuy (TM) (1966) quadratic method and two specifications of the Henriksson and Merton (HM) (1981) dual-beta approach. However, as there are a number of potential flaws that have been pointed out with these approaches, casting doubt on the findings based on these models, a second objective of this study is to re-examine the risk-adjusted performance of the real estate funds using the meta-analysis methodology of Coggins and Hunter (1987, 1993) and Hunter and Schmidt (1990), as the technique provides a means of examining whether the observed variation in timing and selectivity across funds is real or artificial.

A number of previous studies have examined the performance of real estate funds, however, none have utilised meta-analysis as a means of explicitly comparing the results across the funds. Lee (1997) analyses 37 UK based real estate funds using Jensen's alpha and the original HM model, finding evidence perverse market timing ability, but some evidence of out performance with regard to selection ability. Stevenson *et al* (1997) and Lee and Stevenson (2001) both examine the performance of Irish based real estate funds using conventional CAPM based models. Stevenson *et al* (1997) finds that while real estate fund managers show no signs of selection ability, there is evidence of superior market timing ability. Lee and Stevenson (2001) extend the aforementioned paper to examine an extended period of time and also utilising the Bhattacharya and Pfleiderer (1983) quadratic based model. The results are generally similar, with evidence of poor selection ability, while the timing results are not as conclusive as those reported in Stevenson *et al* (1997). Gallo *et al* (1997) examined the performance of mortgage backed security (MBS) funds and find evidence of underperformance on both a selection and timing ability. In contrast, Gallo *et al* (2000) report that real estate mutual funds, which invest in REITs, show evidence of outperformance over the benchmark portfolio.

The remainder of the paper is laid out as follows. The following section briefly describes the performance evaluation techniques used. Section three describes the institutional characteristics of the real estate funds as well as the data used in the study. This is followed by a discussion of the meta-analysis technique. The next section discusses the empirical findings, while the final section provides concluding comments.

2. Risk-adjusted Models of Performance

The most popular measure of risk-adjusted performance is the Jensen alpha, which is taken as the intercept in equation (1), which is a general empirical expression of the Capital Asset Pricing Model (CAPM).

[‡] A number of recent papers examining the issue of timing and selection ability have utilized meta-analysis, for example Coggin and Hunter (1993), Coggin et al. (1994), Sahu *et al* (1998) and Stevenson (2001).

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_t \tag{1}$$

where: R_{it} is the excess return of the fund in question and R_{mt} is the excess return of the benchmark index. As the expected value of the error term in equation (1) is equal to zero, the intercept can be taken to be a measure of the portfolio manager's selection ability. However, Fama (1972) noted that the performance of fund managers could be separated into two components: selectivity (the ability to select undervalued assets), and timing (the ability to adjust security holdings in anticipation of general market movements). Jensen's framework does not allow for the possibility of market timing and as a consequence the results of the regression analysis based on equation 1 will be biased and any tests of significance distorted, see Fama (1972), Jensen (1972), Grant (1977), Admati and Ross (1985) and Dybvig and Ross (1985) amongst others. As a result our study also uses models of risk-adjusted performance that incorporate both micro (selectivity) and macro (market timing) forecast abilities. Three alternative models are used to estimate market timing and selection ability. As stated in the introduction these are the quadratic model proposed by TM and two specifications of the HM dual-beta model.

The TM quadratic model adds a quadratic term to equation (1) to allow for market timing ability, and can represented as follows:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \gamma_i R_{mt}^2 + \varepsilon_t \tag{2}$$

The dual-beta model also complies with the assumptions of the CAPM and as with the quadratic models, aims to provide a means of overcoming potential bias in the measure of selectivity. The difference between it and the quadratic model is how the two model market timing ability. The dual-beta model is based on the concept that a fund manager will either forecast that the market will outperform the risk-free asset, or that the risk-free asset will outperform the market. The original dual-beta model of HM can be expressed as follows:

$$R_{it} = \alpha_i + \beta_{1i} R_{mt} + \beta_{2i}[D_t(R_{mt})] + \varepsilon_{it} \tag{3}$$

The dummy variable takes the value of zero when the market return is greater than that of the risk-free asset, and –1 when the risk-free asset's return exceeds that of the benchmark. The alternative specification, proposed by Henriksson (1984), takes into account problems with the return generating process and specifically the omission of relevant factors and issues concerning the choice of benchmark portfolio. Henriksson (1984) adds a second factor based on the excess return of an equally weighted portfolio of the funds analysed. The modified HM model can be expressed as follows:

$$R_{it} = \alpha_i + \beta_{1i} R_{mt} + \beta_{2i}[D_{1t}(R_{mt})] + \beta_{3i}[R_{ewt} - \beta_{ew}(R_{mt})] + \beta_{4i}(D_{1t}[R_{ewt} - \beta_{ew}(R_{mt})]) + \varepsilon_{it} \tag{4}$$

Where R_{ewt} is the excess return on the equally weighted fund portfolio, β_{ew} is the beta of this portfolio relative to the benchmark index. The fourth expression takes the value of $\max[0, w(t)]$ where $w(t)$ equals the third expression. The dummy variable takes the value of zero when the return on the equally weighted portfolio exceeds that of the riskless assets and the –1 if the reverse occurs.

However, although the coefficients of the ordinary least squares (OLS) estimation of equations 1 through 4 provide consistent parameter estimates, all three may require correction for heteroskedasticity in the error term ε_{it}, which causes the parameter estimates to be inefficient, see Henriksson and Merton (1981), Chen and Stockum (1986), Lee and Rahman (1990) and Coggin *et al* (1993). In all cases this it is corrected using the methods of Hansen (1982) and White (1980).

3. Data

Indirect investment in real estate by UK pension funds can be made through a number of vehicles, but for a number of reasons the nearest equivalent to direct real estate investment is through either a Property Unit Trust (PUT) or a Managed Property Funds (MPF), Investment Property Forum (1996). Each alternative offering tax-exempt institutions the opportunity to invest in real estate, on an incremental basis, without the need to acquire the necessary management and investment skills required to manage a real estate portfolio. While the 'pooled' nature of their structure means that PUTs and MPFs are able to offer a wider diversified portfolio of properties than could be held by one pension fund in isolation.

Data on 19 UK real estate funds are used in this study, consisting of 12 PUTs and 7 MPFs. All the data taken from the publications of Association of Property Unit Trusts (APUT) as complied by the Investment Property Databank (IPD). Of the 26 real estate funds covered by APUT, seven funds were excluded as they were all only recently incorporated into the database, thus, they did not have an adequate time series to be included in the study. The remaining 19 real estate funds accounting for 77% of the £7.1 billion aggregate value of funds covered by APUT at the end of 2001. In addition, as the NAV of the funds varies widely from £14.2 million to £1.2 billion, the results should be indicative of real estate fund performance over this period. Nonetheless, the results only hold for those real estate funds that existed throughout the sample period.

The benchmark portfolio used throughout the analysis is the Jones Lang LaSalle (JLL) UK Property Index. Since the index is constructed to represent the actual performance of a "typical" institutional real estate portfolio in terms of fund flow and geographical spread. The analysis performed over the period 1991Q1-2001Q3 using quarterly data. All data used are logarithmic returns in excess of the risk free rate, as measured by the return on 90 day Treasury Bills.

4. Meta Analysis

This section of the paper briefly discusses meta-analysis. Meta analysis is a parametric technique for the accumulation of results across studies. However, a number of "study artefacts" can cause the results from one study to appear different or even contradictory to those of another. Among the more obvious artefacts are sampling error and measurement error. Meta-analysis is designed to overcome these problems and so provide estimates of the mean and standard deviation of the population values. Also, although meta-analysis was originally designed for cross-sectional data, the time-series performance models used here are identical in model specifications across the sample of real estate funds. Thus, in terms of the meta-analysis technique, each real estate fund is viewed as a "study" and we accumulate the results across funds. In this way the method provides a means of examining whether the observed variation in timing and selectivity across funds is real or artificial. In addition, it provides information on the proportion of the observed variation that can be explained by sampling error variation (Coggin and Hunter, 1993).

For each study the observed values are denoted as b, the population values as β and e represents the sampling error.

$$b = \beta + e, \text{or}, e = b - \beta \tag{5}$$

The average observed value is:

$$\bar{b} = \bar{\beta} + e \tag{6}$$

As the average error will be zero across a large number of studies the above equation can be re-written as: $\bar{b} = \bar{\beta}$. In the case of the current study we are comparing regression results across individual funds denoted by *i*, therefore we can re-write equation (6) as:

$$\bar{b}_i = \bar{\beta}_i + e_i \tag{7}$$

As β and e will be uncorrelated across funds, the variances of the observed values (σ_b^2) will be larger than the variance of the population values (σ_β^2) by the amount of the sampling error (σ_e^2). Therefore:

$$\boldsymbol{s}_b^2 = \boldsymbol{s}_b^2 - \boldsymbol{s}_e^2 \tag{8}$$

As the variance of the sampling error can be computed, we can directly estimate the population variance. Hunter and Schmidt (1990) show that in the case of a small sample size and under the assumption that the population value is constant across studies, the best estimate for it is the frequency weighted value.

$$\bar{b} = \frac{\sum [N_i b_i]}{N_i} \tag{9}$$

where b_i is the observed value and N_i is the number of observations in the study. The variance used is the frequency weighted average square deviation.

$$s_b^2 = \frac{\sum \left[N_i \left(b_i - \bar{b}_i\right)^2 \right]}{\sum N_i} \tag{10}$$

While the sampling error variance can be represented as:

$$s_e^2 = \frac{\sum [N_i (\text{standard error } b_i)]}{\sum N_i} \tag{11}$$

Coggin and Hunter (1993) note that if the number of studies is large there is the risk that the null hypothesis may be rejected even if there is a small amount of variation. This problem can arise due to the potential situation where similarities in the funds may lead to the sampling errors for the coefficients being non-independent and positively correlated. Therefore, we take the sampling error variance as $\left[(1-r)s_e^2\right]$, where r is the average correlation between the regression residuals. The population variance can therefore be estimated as:

$$s_b^2 = s_\beta^2 + (1-r)s_e^2 \qquad (12)$$

$$s_\beta^2 = s_b^2 - (1-r)s_e^2 = \left(s_b^2 - s_e^2\right) + rs_e^2 \qquad (13)$$

Under the null hypothesis that there is no variation in parameter estimates the ratio of the observed variance to the sampling error has a chi-squared distribution with k-1 degrees of freedom, where k is the number of studies (real estate funds). Rejection of the null hypothesis can then be taken as evidence of a real variation in observed values.

$$\chi^2 = ks_b^2 / s_e^2 \qquad (14)$$

However, if the k studies are not independent, then the statistical power of the test is reduced. To correct for this possibility equation the standard error can be written as follows:

$$SE = \sqrt{\left(s_b^2 / k\right) + rs_e^2} \qquad (15)$$

and the chi-square calculation adjusted as follows:

$$\chi^2 = \frac{ks_b^2}{(1-r)s_e^2} = \left[1/(1-r) \left(\frac{ks_b^2}{s_e^2} \right) \right] \qquad (16)$$

Finally, we can estimate the percentage of total observed variance accounted for by sampling error, $(1-r)s_e^2 / s_b^2$.

5. Empirical Results

Table 1 provides the results of the initial performance evaluation using Jensen's alpha and the selectivity and market timing results using the quadratic model the models of TM and the dual-beta models of HM. Using Jensen's alpha the results show strong evidence of outperformance by the funds over the market benchmark, with 15 (79%) of the funds displaying positive risk-adjusted performance. Of these 15 funds, 10 (53%) show statistically significant performance at the usual levels of significance. In contrast, only 4 funds (21%) show negative alphas, with 3 (16%) funds displaying significant inferior performance at conventional statistical levels. This implies that on average the 19 real estate funds analysed here out performed a passive buy and hold strategy. The results, however, do not indicate whether this superior risk-adjusted performance was a consequence of timing or selection ability or both.

The results for the three alternative timing and selection models highlight some of the problems inherent in the Jensen measure and in particular the potential bias that can be introduced in the measure d ue to the presence of market timing. The quadratic model of TM produces identical results in relation to selectivity, as the Jensen measure, in terms of the number of positive intercepts and the number of those that are significant. The number of funds showing positive selection ability does, however, fall when the dual-beta models of HM are used. In addition, the number of statistically significant coefficients falls to 8 (42%) using the original HM model and 4 (21%), when the adapted dual-beat model is used. In contrast, the number of funds showing significant inferior selection ability remains constant across all four models. On average, therefore, the results indicated positive selection ability on the part of the 19 real estate funds analysed over this period.

In the quadratic specification only 8 (42%) funds show positive timing ability, the figures for the two dual-beta models are 16 (84%) and 14 (79%) respectively. The number of significant findings is, however, relatively stable across the three models. In the case of the quadratic model the number of significant coefficients is 4 (20%), while the figures for the two dual-beta models are 6 (32%) and 5 (26%) respectively. In contrast, the number of funds displaying perverse market timing changes considerably across the various models. The quadratic model showing 11 (58%) funds with perverse market timing, however, the figures for the two dual-beta models are only 3 (16%) and 5 (26%). In addition, the number of funds showing significantly perverse timing ability is only 3 (16%), 2 (11%) and 1 (5%) respectively for the three models. Overall the results indicate that the ability of the real estate funds to time the market are considerably weaker than the their ability to select undervalued real estate.

Table 2 reports the findings of the meta-analysis. The aim of this analysis is to examine whether the observed variation in timing and selectivity across funds is real or artificial. Following the format of Coggin and Hunter (1993), Table 3 reports the average coefficient (β mean) in each case; the standard deviation of the relevant coefficient ($\sigma\beta$); the error term ($\sigma\varepsilon$); the average correlation (ρ) between the residuals in each model; the chi-square value (χ^2) for the ratio of the observed variance to the sampling error variance, adjusted for the average residual correlation; and the last row shows the estimates of the percentage of total observed variance accounted for by sampling error, $(1-\rho)\sigma^2_\varepsilon / \sigma^2_\beta$.

The χ^2 statistics for selectively are all highly significant and positive across all four models of investment performance. This indicates the variation in results across the finds is real and not due to sampling error. These results are also confirmed by the last row of Table 3, which provides evidence as to the proportion of the variance that can be accounted for by sampling error. The highest observed variation attributable to sampling error is 28% for the selectivity measure using the adapted dual-beta model, while the lowest is the Jensen measure at 5%. This lends support to the argument presented above that on average real estate funds in the UK have shown superior risk-adjusted performance compared with the benchmark of performance, and that this can be attributed to the fund manager's selection ability.

In contrast, the meta-analysis results about timing provide mixed evidence regarding the ability of real estate fund managers to successfully time the market. The mean timing value is negative for the quadratic model of TM, but positive for the two dual-beta models of HM. A negative value indicating that fund managers are on average unsuccessful in their ability to time the market, while a positive value implies successful timing ability. The χ^2 statistics for timing are all highly significant across all three models, indicating that these conclusions are a consequence of a real variation in results across the funds and not a result of sampling error. A result also confirmed by the last row of Table 3, which shows that the proportion of the variance that can be accounted for by sampling error is relatively small and no more 27%. This difference in the conclusions from the various models indicates the results are quite sensitive to the timing and selection model adopted.

The results of the meta-analysis for a sample of real estate funds are similar to the meta-analysis based findings of Goggin and Hunter (1993), Goggin *et al* (1993) and Sahu *et al* (1998) in the stock market and Stevenson (2001) in the real estate market. Like this study, their results find that the best funds can deliver substantial risk-adjusted performance. Also, their results show that the superior risk-adjusted performance is mainly derived from fund managers selection ability rather than any timing skills.

6. Conclusion

This paper provides evidence regarding the risk-adjusted performance of 19 UK real estate funds in the UK. This paper differs from previous studies by examining the whether the differences in the regression coefficients across funds results from significant sampling error or whether the findings show a real variation in performance. Thus, the findings of this study supplement those of previous studies that have tested the selection and timing ability of real estate fund managers.

Using four parametric models of investment performance, one that tests overall performance, and three that conduct a joint test for the presence of timing and selection ability, the results are generally favourable towards the hypothesis that the sample of real estate funds analysed showed superior risk-adjusted performance over this period. However, the results reveal the potential biases in the Jensen measure, with the number of significant positive results reduced in the models that examining selectivity and market timing ability simultaneously. Nonetheless, in most cases the models show a greater number of funds with positive selection skills than negative selection ability. In addition, the market timing results reveal some evidence of significantly positive timing ability by a few real estate fund managers with only a few funds showing significantly perverse market timing.

The paper then utilised the meta-analysis technique to further examine the results in an attempt to estimate the proportion of variation in regression coefficients is attributable to sampling error. The meta-analysis results reveal strong evidence, across all models, that the variation in findings is real and may not be attributed to sampling error. Thus, the meta-analysis results provide strong evidence that on average the sample of real estate fund managers analysed in this study delivered significant risk-adjusted performance over this period. The three timing and selection models indicating that this out performance of the benchmark resulted from superior selection ability by real estate fund mangers. In contrast, the results on timing ability are mixed. For instance, we obtain a negative mean timing value using the quadratic model of TM, but positive average timing values using the two HM models. The meta-analysis results indicating that the ability of real estate fund managers to time the market is at best weak. Thus we can say that although real estate fund managers are unable to outperform a passive buy and hold strategy through timing, they are able to improve their risk-adjusted performance through selection ability.

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Table 1: Jensen's Alpha, Quadratic Model and Dual-Beta Results

	Jensen's	TM Quadratic Model		HM		Adapted HM	
Fund Number	**Alpha**	**Selectivity**	**Timing**	**Selectivity**	**Timing**	**Selectivity**	**Timing**
Fund 1	1.1016***	1.0598*	-0.0116	0.9242**	0.6886	0.3749	0.1580
Fund 2	0.6732	0.7943*	0.0335*	0.4805	0.7481	-0.0592	0.2171
Fund 3	0.1912	0.1036	-0.0243	0.1736	0.0683	-0.5934	-0.6181
Fund 4	-0.6737	-0.7175	-0.0121	-0.9151	0.9372	-1.6568	0.6891
Fund 5	2.4065***	2.0905**	-0.0875*	2.2852**	0.4708	1.1256	-0.1562
Fund 6	0.6660***	0.6660***	0.0000	0.6660***	0.0000**	0.6660***	0.0000
Fund 7	-0.6569***	-0.7296***	-0.0201***	-0.6857***	0.1118	-0.7065***	0.1282
Fund 8	-0.7086***	-0.7560***	-0.0131***	-0.7500***	-0.1607*	-0.8831***	0.1107***
Fund 9	1.2204**	1.1789**	-0.0115	1.1184*	0.3957	0.3683	-0.4012
Fund 10	1.7614***	1.9657***	0.0566***	1.4993***	1.0173**	1.1176***	0.7022*
Fund 11	1.9272***	1.9774***	0.0139	1.7096***	0.8445**	1.3457***	0.6553*
Fund 12	2.2119***	2.5677***	0.0985***	1.8217***	1.5148***	1.4509***	1.1583***
Fund 13	0.8086**	0.8450*	0.0101	0.6339	0.6780*	0.2881	0.3189
Fund 14	-1.5408***	-1.7949**	-0.0704	-1.0172*	-2.0323***	-1.7815***	-2.5277***
Fund 15	0.6909*	0.9085**	0.0603***	0.4519	0.9274	-0.2310	0.2980
Fund 16	0.3151	0.2406	-0.0206	0.2009	0.4431	-0.3565	0.1121
Fund 17	0.4495	0.4852	0.0099	0.0749	1.4539	-0.4349	1.0861
Fund 18	0.8608**	0.7602	-0.0279	0.8720*	-0.0437	0.1258	-0.6185
Fund 19	0.6250	0.5358	-0.0247	0.4553	0.6588**	-0.0394	0.3797*
Average Coefficient	**0.6489**	**0.6411**	**-0.0022**	**0.5263**	**0.4590**	**0.0063**	**0.0891**
Number Positive	**15**	**15**	**8**	**15**	**16**	**9**	**14**
Number Positive (Significant)	**10**	**10**	**4**	**8**	**6**	**4**	**5**
Number Negative	**4**	**4**	**11**	**4**	**3**	**10**	**5**
Number Negative (Significant)	**3**	**3**	**3**	**3**	**2**	**3**	**1**

Table 2: Meta Analysis Results

	Jensen	Quadratic		HM		HM Adapted	
	Selectivity	**Selectivity**	**Timing**	**Selectivity**	**Timing**	**Selectivity**	**Timing**
β mean	0.6489	0.6411	-0.0022	0.5263	0.4590	0.0063	0.0891
$\sigma\beta$	1.0243	1.1613	0.0018	0.8307	0.5562	0.7986	0.6082
$\sigma\varepsilon$	0.2486	0.3594	0.0008	0.3463	0.3068	0.4450	0.3087
ρ	0.1167	0.1273	0.1273	0.0998	0.0998	0.0900	0.0900
χ^2	88.6210***	70.3416***	50.9795***	50.6225***	38.2732***	37.4745***	41.1367***
$(1-\rho)\sigma^2_{\varepsilon}/\ \sigma^2_{\beta}$	0.0520	0.0836	0.1724	0.1564	0.2739	0.2826	0.2344