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By

Stephen Lee

Cass Business School,
City University London,
106 Bunhill Row,
London,
EC1Y 8TZ,
England.

Phone: +44 (0) 207 040 5257, E-mail: Stephen.Lee.1@city.ac.uk

Abstract

One of the golden rules of investing is that in order to provide returns in excess of its benchmark (alpha) a fund must be different from its benchmark but as a consequence the fund will generate tracking error, i.e. tracking error and fund performance are related. Active fund managers therefore face a constant trade-off between trying to generate alpha and minimising their tracking error. As such the ratio of alpha to tracking error, the so-called information ratio, probably provides the most appropriate measure of risk-adjusted performance of an active fund, as it focuses on the active return versus the active risk taken. Furthermore, tracking error can be decomposed into a number of components, which help to identify whether any outperformance results from the fund manager’s selection ability or simply the result of random behaviour.

Nothing is known about the tracking error and the performance of real estate funds in the UK. This paper corrects this omission and examines the decomposition of tracking error risk of UK real estate funds and relates this to their information ratios.

Keywords: Tracking Error Decomposition, Information Ratio, Real Estate Funds
Tracking Error and Real Estate Fund Performance

Introduction

One of the golden rules of investing is that in order to provide returns in excess of its benchmark (alpha) a fund must be different from the index, but as a consequence the fund will generate tracking error; i.e. tracking error and performance are related. Active fund managers therefore face a constant trade-off between trying to generate alpha and minimising their tracking error. As such the ratio of alpha to tracking error, the so-called information ratio, probably provides the most appropriate measure of risk-adjusted performance of an active fund, as it focuses on the active return versus the active risk taken (Israelsen and Cogswell, 2007).

Ammann et al. (2006) show that a fund’s tracking error can be decomposed into a number of components, which help to identify whether any outperformance results from the fund manager’s selection ability or simply the result of random behaviour. Yet only two studies have looked at tracking error and performance in the real estate market and both studies were based on Australia data (Higgins and Ng, 2009 and Higgins, 2010). Yet nothing is known about the impact of tracking error risk on real estate fund performance in the UK. This paper corrects this omission and examines the decomposition of tracking error risk of UK real estate funds and relates this to their information ratios.

The remainder of the paper is structured as follows. The next section discusses how tracking error risk can be decomposed into a number of components that can help investors identify whether the fund managers performance is due to the manager’s selection ability or simply the result of random behaviour. Section 3 discusses how active performance should be evaluated, while the following selection outlines the data used. Section 5 presents the results and final section presents the conclusions.

The Decomposition of Tracking Error

The only way a fund can achieve alpha (positive outperformance) is to be different from its benchmark and so incur tracking error risk. Therefore all tracking error measures are based on the difference between the returns of the fund and the returns of its benchmark (Pope and Yadav, 1994).

Using the single index model the returns of fund i relative to its benchmark is given by the following:

\[ R_i = \alpha_i + \beta_i R_b + \varepsilon_i \]  

(1)

Where \( R_i \) measures the return of fund i, \( R_b \) is the benchmark return and \( \alpha \), \( \beta \), and \( \varepsilon \) are regression parameters estimated by ordinary least squares (OLS)\(^1\).

Subtracting the benchmark return from both sides yields the active return of fund i:

\[ R_i - R_b = \alpha_i + (\beta_i - 1) R_b + \varepsilon_i \]  

(2)

\(^1\) We assume that all the returns of \( R_i \) and \( R_b \) within the estimation interval are identically and independently distributed (i.i.d.) such that the realisations of all \( R_i \) and \( R_b \) can be used to estimate the true tracking error.
Equation 2 decomposes the return deviation between the fund and the benchmark portfolio into two components:

1. The first component \((\beta - 1)R_b\) shows that the return performance of the fund is determined by the relationship of the fund with its benchmark index, as measured by beta \((\beta)\) and the returns of the benchmark \((R_b)\). If \(\beta > 1\) the fund is expected to outperform the benchmark if market returns are positive but underperform if the market returns are negative. Alternatively, if \(\beta < 1\) the fund is expected underperform the benchmark if market returns are positive but outperform if benchmark returns are negative. But when \(\beta = 1\) the influence of the benchmark returns on the funds outperformance is negated.

2. The second component \(\alpha + \varepsilon\) is the outperformance which is uncorrelated with the fund’s benchmark, due to the fund deviating from the benchmark portfolio. Since the expected value of \(\varepsilon\) is zero the mean active return is equal to \(\alpha\), the fund’s alpha, which reflects the manager’s selection ability.

Ammann et al. (2006) show that the tracking error variance (TEV) of fund i can be decomposed into the following four components:

\[
TEV_i = \alpha_i^2 + (\beta_i - 1)^2(\sigma_e^2 + \mu_b^2) + \sigma_e^2 + 2\alpha_i(\beta_i - 1)\mu_b
\]  

(3a) \hspace{2cm} (3b) \hspace{2cm} (3c) \hspace{2cm} (3d)

Where \(\alpha_i\) and \(\beta_i\) are the alpha and beta of fund i, \(\mu_b\) is the expected return of the benchmark, \(\sigma_e^2\) is the variance of the benchmark returns and \(\sigma_e^2\) is the variance of the regression residuals. Tracking error (TE) of the fund is the square root of TEV.

The terms can be described as follows:

1. The first component (3a) shows that portion of the TEV decomposition that arises from the fund managers attempt to outperform his benchmark and so can be labelled the \textit{alpha} component.

2. The second component (3b) shows that part of the TEV decomposition that is caused by the deviations by the fund from the benchmark and so can be labelled the \textit{systematic} component. The \textit{systematic} component shows that if \(\beta \neq 1\) the fund faces a certain amount of tracking error risk not under the manager’s control, as the volatility and returns of the benchmark are stochastic. This implies that the fund’s tracking error risk will be time varying and will be increased (reduced) if the benchmark returns are volatile (tranquil).

3. The third component (3c) shows the \textit{residual variance} of the TEV decomposition that is neither attributable to the \textit{alpha} component nor the \textit{systematic} component. The \textit{residual variance} component can be better understood by using the following equation:

\[
\sigma_e^2 = \sigma_i^2(1 - R^2)
\]  

(4)
Where: $\sigma^2$ is the variance of the fund and $R^2$ is the coefficient of determination from the regression of the fund against its benchmark. Equation 4 shows that for the residual variance component to be minimised the fund needs to be well-diversified, i.e. show a coefficient of determination of one. However, if the fund is not well-diversified the fund manager faces a certain amount of tracking error risk not under his control, due to the stochastic volatility of the fund’s returns. For instance, if the fund has a coefficient of determination ($R^2$) of 75% the fund faces an increase in TEV of 50% of the variance of the fund, over and above that of the alpha and systematic components.

4. The last component (3d) is a cross product term that is caused by the interaction of the alpha and the systematic components and is minimised if $\beta = 1$. However, if $\beta \neq 1$ there is another part of TEV not under the manager’s control, as the outperformance of the fund and the returns of the benchmark are stochastic. Nonetheless, since the cross product term is the produce a number of decimals it should be very low.

As far as investors are concerned the best policy, for them, is to have $\beta = 1$ and $R^2 = 1$. This implies that the TEV decomposition will only have an alpha component so that if alpha is positive or negative it is easy to see whether the fund manager has shown stock selection ability.

If $\beta = 1$ but an active fund manager uses his stock picking ability and concentrates the fund in only a few properties, which are expected to outperform the benchmark, the fund will be undiversified (i.e., $R^2 < 1$). This implies that the fund will display a high alpha component and a high residual variance component in the decomposition. This makes it easy to understand whether the fund manager has shown selection ability, or whether the fund’s performance is the result of random behaviour due to under-diversification.

Active fund managers are likely to have $\beta \neq 1$, which makes interpretation of the decomposition complicated. For instance, some managers will be tempted to have the fund’s $\beta > 1$ to increase the alpha component from the use of leverage. However, betas in excess of one will bias alpha downwards and the residual risk upwards compared with what would be expected if $\beta = 1$. This implies that that the fund will show a relatively lower alpha component and a high residual variance components compared with a fund with $\beta = 1$, even if the fund manager has selection ability. Alternatively, some funds will have a $\beta < 1$, due to cash holdings. But betas substantially below one will bias alpha upwards and the residual risk downwards, compared with a fund with $\beta = 1$. This implies that that the fund could show relatively higher alpha component and a low residual variance component, even if the fund manager has little or no selection ability. In other words, if $\beta \neq 1$ the fund manager’s selection ability can be very difficult to unravel from the TEV decomposition.

**Performance and Tracking Error**

Roll (1992) argues that tracking error is an important criterion for assessing fund managers performance. Indeed, a couple of authors have proposed that tracking errors alone can be used to classify funds and so indicate the level of performance that investors can expect. Vardharaj et al (2004) suggest that the typical levels of annualised tracking error should be: zero for an index fund; below 2% for an enhanced index fund and between 5% and 10% for
an actively managed fund. Alford et al (2003) suggest that a “passive” fund is one with an annualised tracking error of less than 1.0%, while a “structured” fund should display an annualised tracking error between 1% and 5% and an “active” fund should show an annualised tracking error above 5%.

Israelsen and Cogswell (2007) argue that the use of tracking error alone, as an indicator of fund performance, is not suitable for active managers as it makes them afraid to drift too far from their benchmark index. These kinds of funds are often referred to as ‘closet index’ funds, since while the fund may claim to be actively managed, and therefore charges high management fees, it acts like an index fund by closely replicating some benchmark index. This is naturally the opposite of what investors are paying active managers to do. This behaviour is also noted by Cremers and Petajisto (2009) who reveal that nearly one-third of actively managed funds in the US are ‘closet indexers’, seeking to minimise their tracking error. In the real estate market Lee and Mori (2013) find that although all property funds in the UK indicated that their investment objective is to achieve above-average performance, through active management, more than half of their sample could be classified as ‘closet index’ funds.

Cremers and Petajisto (2009) argue that the two distinct approaches to active management, stock selection or factor risk, can produce substantially different tracking error volatilities. The authors therefore suggest that the fund’s level of active management would be better understood by examining the actual holdings in the portfolio and comparing those holdings to its benchmark index, which the authors call Active Share.

Cremers and Petajisto (2009) argue that there are two reasons why Active Share is a useful method to measure fund’s active management. First, since an active manager can only add value relative to the benchmark by deviating from it, Active Share can help in identifying managers capable of delivering positive alpha through their stock picking activity. Second, Active Share can also be combined with tracking error to provide a broader way to measure active management. That is, by using the double sources of active management, Active Share and tracking error, Cremers and Petajisto (2009) are able to classify the funds into one of five investment management strategies categories: pure indexes, closet indexes, diversified stock pickers, concentrated stock pickers, and factor bet funds.

Using the dual active risk measures, Active Share and tracking error, Lee and Mori (2013) find that funds with high Active Shares showed the highest returns, due to their stock-picking ability. However, if the fund failed to control its tracking error the outperformance from successful stock selection was destroyed. A result supported by Higgins (2010) who finds that Australian property funds with large property portfolios and low debt levels provided better tracking error performance. Lee and Mori (2013) also find that while Active Share was correlated with improved performance, tracking error by itself is unrelated to fund performance, which confirms the findings of Cremers and Petajisto (2009) in the stock market and Higgins and Ng (2009) in the Australian real estate market. Lee and Mori (2013), Higgins and Ng (2009) and Higgins (2010) also all note that tracking errors of property funds changed considerably between the bull and bear period due to the use of debt. These results support the view of Israelsen and Cogswell (2007) that judging the activity level of fund management based solely on tracking error can be misleading.

Active fund manager face a constant trade-off between trying to generate alpha and minimising their tracking error. As such the ratio of alpha to tracking error probably provides
the most appropriate measure of risk-adjusted performance of an active fund, as it focuses on the active return versus the active risk taken. This comparative measure is known as the information ratio (Treynor and Black, 1973) and can be formularised as:

\[ IR_t = \frac{\alpha}{TE} \]  

(5)

Where \( \alpha \) is the fund’s active return, estimated from the regression of the fund against its benchmark, and TE is the square root of the TEV from equation 3.

The information ratio identifies those fund managers that delivered the highest outperformance with the least tracking error. For instance, the alpha of the an aggressive fund manager, who is taking large bets against his benchmark and so incurring a large tracking error, can be compared against a fund manager who is producing a lower alpha but with a lower tracking error, as a result of a more passive investment strategy. Israelsen and Cogswell (2007) arguing that active managers should seek to maximise their information ratio, rather than minimising their tracking error. Indeed, Goodwin (1998) contends that the information ratio is “the best single measure of the mean-variance characteristics of an active portfolio.”

According to Grinold and Kahn (2000), the information ratio is analogous to a normal bell-shaped curve with an IR = 0 as the mean of the distribution. An information ratio greater than zero therefore shows that a manager has performed in the top 50% of the population while a manager with an information ratio less than zero is performing in the bottom half of the active portfolio managers. This implies that a manager who is performing in the top quartile needs to have an information ratio of above 0.5. Grinold and Kahn (2000) suggesting that an IR = 1.0 is an exceptional number and it should be the goal of management to reach this level.

It should be noted that the definition of the tracking error in equation 5 is not the same as that proposed by Treynor and Black (1973). Treynor and Black (1973) define tracking error as the square root of the residual variance (\( \sigma^2_z \)). But as equation 3 shows (\( \sigma^2_z \)) is only a part of the TEV, the residual variance component. Therefore if investors concentrate on the residual variance alone this implies that investors are implicitly assuming that the expected increase in outperformance due to (\( \beta - 1 \))\( \bar{R}_b \) is large enough to justify the increase in TEV as a result of the manager’s decision to deviate from a beta of one. Otherwise, as Ammann et al. (2006) note this “allows fund managers to manipulate the results of their performance evaluation because leverage is not controlled for.” The TEV decomposition therefore is more helpful to investors, than \( \sigma^2_z \) alone as it identifies the extent to which any outperformance is due to the fund manager’s selection ability or simply the result of random behaviour. In other words, the TEV decomposition provides a more detailed evaluation of tracking error risk and so is more useful “in the performance evaluation of investment managers” (Ammann et al., 2006).

Data

Data on 47 UK real estate funds are used in this study, which had complete fund data over the period from Q4:2005 to Q4:2011. All the data is taken from the publications of the Association of Real Estate Funds (AREF) as compiled by IPD.

Of the 61 real estate funds covered by AREF at the end of 2011, 14 funds were excluded as they had had incomplete balance sheet data or insufficient returns data over the period. The
remaining 47 real estate funds accounting for over 90% of the £19,793 billion aggregate value of funds covered by AREF at the end of 2011. In addition, as the NAV of the funds varies widely from £5.5 million to £2,112 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.

IPD classify real estate funds into two categories: Specialist and Balanced. IPD define a Specialist real estate fund as such when 70% or more of their capital is invested in one specific market sector (e.g. Retail, Office, Industrial or Residential). In all other cases the fund is categorised as a Balanced fund. We have 22 Balanced funds and 25 Specialist funds in our sample, under the IPD classification scheme.

Lee and Mori (2013) show however that although the classification scheme by IPD easily identifies Balanced funds as ‘index’ funds, it doesn’t differentiate between ‘pure’ and ‘closest’ index funds. In addition, although the IPD Specialist funds were typically identified as ‘active’ funds, the IPD method couldn’t differentiate them into ‘diversified stock pickers’, ‘concentrated stock pickers’ or ‘factor bet’ funds. In addition, Lee and Mori (2013) found that a couple of funds do not fit with the usual definition of Balanced/Specialist as defined by IPD. That is one Balanced fund was more like the Specialist funds, while one Specialist fund was more like the Balanced funds. Therefore, we follow the approach of Lee and Mori (2013) and classify funds on their tracking error and Active Share, where the funds tracking error is calculated from equation 3 as the square root of the fund’s TEV² (TE) and the fund’s Active Shares is calculated as follows:

\[ Active \ Share = \frac{1}{2} \sum_{i=1}^{MS} |W_{fund,i} - W_{index,i}| \]  

Where: \( W_{fund,i} \) and \( W_{index,i} \) are the portfolio weights of property market segment i in a fund and in its benchmark index and sum up across MS market segments³. Where the market segments are the 10 used by IPD in their standard performance analysis reports to investors. Plus a further segment, Other Property, which represents holdings in non-traditional property sectors such as: residential property, student housing and leisure property, etc. The 11 market segments weights calculated from the IPD Quarterly Index data series.

Using the dual active risk measures, Active Share and tracking error, the 47 real estate funds were classified into resulted in 3 pure index fund, 16 closet index funds, 22 diversified stock pickers, 3 concentrated stock pickers and 1 factor bet fund. The factor bet fund was therefore

² Note this is not the way Lee and Mori (2013) calculated tracking error in their classification of funds. Lee and Mori (2013) calculated tracking error as the standard deviation of the benchmark-adjusted return \( \sigma(R_p - R_b) \), as did Petajisto (2010) and Cremers and Petajisto in their original working paper (Cremers and Petajisto, 2006). But as Frino and Gallagher (2002) point out the results should be similar between TE and \( \sigma(R_p - R_b) \). Indeed, the average difference between TE and \( \sigma(R_p - R_b) \) for the sample is only 20bps. However, in their published paper Cremers and Petajisto (2009) used standard deviation of the residuals of a linear regression between the returns of the fund and those of the benchmark portfolio (\( \sigma^2 \)). However, \( \sigma^2 \) is only a part of the TEV, as such it will underestimate the amount of tracking error in the fund. For instance, the average difference between TE and \( \sigma^2 \) for the sample is 109bps. Therefore, we use TE, the square root of the TEV, as our measure of tracking error as it produces the same classifications of funds as in Lee and Mori (2013) and enables us to identify the extent to which any outperformance is due to the fund manager’s selection ability or simply the result of random behaviour.

³ We could not use individual property data due to confidentially.
dropped from the following analysis. The summary statistics of the various fund types for the 46 funds in our final sample are presented in Table 1.

Table 1: Summary Statistics

<table>
<thead>
<tr>
<th>Fund Type</th>
<th>Average Return</th>
<th>Standard Deviation</th>
<th>Sharpe Ratio</th>
<th>Av Size £m</th>
<th>Av Lev %</th>
<th>Av Cash %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pure Index</td>
<td>0.4</td>
<td>5.0</td>
<td>-0.04</td>
<td>1,478</td>
<td>3.1</td>
<td>4.6</td>
</tr>
<tr>
<td>Closet Index</td>
<td>0.5</td>
<td>5.2</td>
<td>-0.03</td>
<td>557</td>
<td>6.7</td>
<td>5.3</td>
</tr>
<tr>
<td>Diversified Stock Picker</td>
<td>0.4</td>
<td>7.3</td>
<td>-0.03</td>
<td>482</td>
<td>41.6</td>
<td>4.3</td>
</tr>
<tr>
<td>Concentrated Stock Picker</td>
<td>-2.7</td>
<td>16.1</td>
<td>-0.20</td>
<td>535</td>
<td>58.8</td>
<td>6.2</td>
</tr>
</tbody>
</table>

Table 1 shows that all but concentrated stock picker funds showed positive returns, over the sample period. This can largely be explained by the greater level of leverage of the concentrated stock picker funds. This confirms the findings of Lee and Mori (2013), Higgins and Ng (2009) and Higgins (2010) that real estate fund performance is time-varying. The level of risk, as measured by standard deviation, shows that risk increases with the level of active management and leverage; as is to be expected. Next apart from the 3 pure index funds the fund management groups show similar average sizes. Lastly, both types of ‘index’ funds in our sample are all open-ended funds and so are required to keep a degree of liquidity in the fund in the form of cash to meet redemptions. However, the ‘active’ funds are all closed-ended where cash balances are not impacted by regular investment flows and income is treated separately in the balance sheet to the NAV calculation. But as the Investment Property Forum (2012) notes the cash holdings in Specialist funds rose significantly after June 2008 to resolve breaches of loan-to-value covenants. Therefore, it is not surprising to see similar holdings in cash across the various fund types over the whole sample period.

Tracking Error and Performance

The information ratio is used as a measure of risk-adjusted performance to avoid rewarding managers from taking on more risk than the benchmark portfolio. However, as discussed above if the estimated $\beta$ is greater than one, then the alpha would decrease in comparison to the alpha computed with $\beta = 1$, while the residual risk would be greater than the residual risk computed if $\beta = 1$. These two changes result in a lower information ratio for the fund. However, if the estimated $\beta$ is less than one, the overall result would be an increase in the information ratio due to an increase in the estimated alpha and a decrease in residual risk. Therefore, if the manager takes on less risk than the benchmark, he is rewarded with a higher information ratio. Since one of the key ideas is that the benchmark closely resembles the systematic risk of the fund it makes sense to try and get the fund $\beta$ as close to one as possible. This shows how easily the information ratio can be manipulated to achieve the desired results and implies that the information ratio is most useful and accurate when the benchmark has been carefully chosen to match the style of the fund manager.

The best benchmark to use to calculate the fund’s information ratio is that reported by a manager in the fund prospectus. The benefit of reported benchmark is that it is the index the fund manager has publicly committed to beat, so both investors and the manager are likely to focus on the fund’s performance relative to that benchmark. However, from an inspection of information in the AREF reports it is clear that the benchmark used has varied over time and with the changes in managers, leaving us with no consistent way to identify the funds’ reported benchmark over our sample period. Moreover, while the AREF database contains a number of alternative indexes of fund performance that could be used they are based on the Balanced/Specialist classifications by IPD. But as shown above such a classification scheme
cannot distinguish between pure and closet ‘index’ funds or diversified and concentrated ‘stock picker’ funds. Therefore we tested two alternatives to see if the choice of a benchmark matters. First, the Pooled Property Fund Index (PPFI) which covers all funds in AREF database and so is the benchmark which is used to measure the performance of real estate funds in the UK. The second benchmark index chosen was the IPD property fund sub-index with the highest coefficient of determination ($R^2$) with the fund over the sample period (Best). The summary statistics presented in Table 2.

Table 2: Summary Regression Statistics: Pooled Property Fund Index (PPFI) and ‘Best’ Index

<table>
<thead>
<tr>
<th></th>
<th>Pooled Property Fund Index (PPFI)</th>
<th>‘Best’ Index</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alpha</strong></td>
<td><strong>Beta</strong></td>
<td><strong>R-Sq</strong></td>
</tr>
<tr>
<td>Pure Index</td>
<td>0.41</td>
<td>0.76</td>
</tr>
<tr>
<td>Closet Index</td>
<td>0.45</td>
<td>0.78</td>
</tr>
<tr>
<td>Diversified Stock Picker</td>
<td>0.35</td>
<td>1.06</td>
</tr>
<tr>
<td>Concentrated Stock Picker</td>
<td>-2.78</td>
<td>2.25</td>
</tr>
<tr>
<td><strong>Best index</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pure Index</td>
<td>-0.06</td>
<td>1.03</td>
</tr>
<tr>
<td>Closet Index</td>
<td>0.07</td>
<td>0.99</td>
</tr>
<tr>
<td>Diversified Stock Picker</td>
<td>0.34</td>
<td>1.03</td>
</tr>
<tr>
<td>Concentrated Stock Picker</td>
<td>-2.20</td>
<td>1.79</td>
</tr>
</tbody>
</table>

Table 2 shows that the $R^2$ values using the PPFI are less than those by the ‘Best’ index; as is to be expected. More importantly, 79% of the betas using the PPFI were significantly different form one, whereas the ‘Best’ index resulted in only 60% of the betas being significantly different from one. In addition, 70% of the tests of significance tests were lower for the betas estimated using the ‘Best’ index compared with others produced by the PPFI. The use of the PPFI as the fund’s benchmark index also results in alphas that are different from those using the ‘Best’ index. For instance, the alphas of the ‘pure’ and ‘closet’ index funds are substantially lower using the ‘Best’ index than those if the PPFI is used. However, the alphas of the ‘diversified stock picker’ and ‘concentrated stock picker’ funds are hardly changed.

The average tracking errors derived from the PPFI are considerable larger than if the ‘Best’ index is used. Nonetheless, even the ‘Best’ index suggests that funds in the real estate market still show relatively high levels of tracking error risk compared with stock market mutual funds. The average annualised tracking error of the sample is 7%\(^5\), with only one fund with a tracking error below 3% and four funds with tracking errors above 20%. In comparison, Cremers and Petajisto (2009) find that the majority of their mutual funds had lower tracking errors. For example, at the end of 2002, Cremers and Petajisto (2009) find that 59% of their sample had tracking errors below 8% and 88% had tracking errors below 12%, while only 5% had tracking errors above 16%.

This high level of tracking error by funds in the real estate market is not unexpected for at least three reasons. First, although it would be ideal if the fund was fully invested in property this may not be possible as the fund has to set aside some amount of its money to meet redemptions. Further, the fund may have additional monies from investors yet to be invested due to the long transaction periods in the property market. So when a fund holds cash, it has that much less to invest in property, which leads to mismatch in the returns between the fund.

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\(^4\) IPD produce five property fund sub-indexes namely (1) Other balanced funds index, (2) Managed property unit trust index, (3) Low geared balanced property funds index, (4) All balanced property funds index, and (5) Specialist property funds index.

\(^5\) To calculate the annualised tracking error of a fund, we multiple the fund’s quarterly tracking error by the square root of 4, i.e. 2.
and its benchmark and so increase in tracking error, or relative risk, even though holding cash reduces the fund’s absolute return volatility (standard deviation). Further, cash holdings lead to a $\beta < 1$ and so acts as a drag on performance in a bull markets as interest rates are generally below the return of the real estate market. However, in the downturn cash can offset some of the negative real estate performance.

Second, real estate funds also can, and do, use leverage leading to a $\beta > 1$, which results in an increase in tracking error, as well as an increase in absolute return volatility (standard deviation). In addition, leverage leads to an increase in the amount of tracking error outside the manager’s control, due to the stochastic volatility of the benchmark, as shown by equation 3b. Further, the impact of leverage on fund performance is asymmetric, with the greatest impact in the market downturn (Farrelly and Matysiak, 2013).

Lastly, real estate funds find it very difficult to have a high correlation with the benchmark index, due to the indivisibility and the large lots sizes in the commercial market. Indeed to achieve a satisfactory level of diversification the results in a number of studies suggest investors would need to hold hundreds of properties (see inter alia, Byrne and Lee, 2000a, 2000b, and 2001; Investment Property Forum (IPF), 2007; and Cheng and Roulac, 2007). For instance, the study by the Investment Property Forum (IPF, 2007) indicates that a real estate fund requires 150 and 300 properties to achieve an $R^2$ of 90% or 95%, respectively. Yet the average number of direct properties in funds declined from 93 in 1981 to 45 by 2004 (Investment Property Forum, 2007). While the holding today is even less, with the average institutional investors now holding only about 40 properties (IPD, 2010). De Wit (1997) therefore argues that in the real estate market “perfectly diversified portfolios are illusory.”

Table 3 shows the information ratios and the decomposition of the various components of the TEV for the various fund groups using the PPFI and the ‘Best’ index. Table 3 shows that the information ratios are generally much higher for the PPFI than the ‘Best’ Index, except for those of the concentrated stock picker funds, suggesting that ‘index’ funds showed greater outperformance than ‘active’ funds. However, the ‘Best’ index shows that it is really only the ‘diversified stock picker’ funds that generated good performance. This can be easily explained from an examination of the TEV decomposition.

| Table 3: The Information Ratio and TEV Decomposition: Pooled Property Fund Index (PPFI) and ‘Best’ Index |
|-------------------------------------------------|----------------|----------------|----------------|----------------|
| **PPFI Fund Type** | **Information Ratio** | **Alpha %** | **Systematic %** | **Rand %** | **Cross %** |
| Pure Index | 0.21 | 9.8 | 59.0 | 31.4 | -0.2 |
| Closet Index | 0.19 | 8.2 | 44.6 | 47.3 | -0.1 |
| Diversified Stock Picker | 0.12 | 13.6 | 27.8 | 58.7 | -0.1 |
| Concentrated Stock Picker | -0.23 | 6.5 | 49.8 | 43.9 | -0.2 |
| **Best Index Fund Type** | **Information Ratio** | **Alpha %** | **Systematic %** | **Rand %** | **Cross %** |
| Pure Index | 0.05 | 15.7 | 14.5 | 71.0 | -1.2 |
| Closet Index | 0.06 | 7.6 | 21.1 | 72.2 | -0.9 |
| Diversified Stock Picker | 0.11 | 12.8 | 27.4 | 59.7 | 0.1 |
| Concentrated Stock Picker | -0.23 | 5.8 | 42.8 | 50.5 | 1.0 |

Table 3 also shows that if the PPFI is used the *systematic* component is higher than those using the ‘Best’ index. This is to be expected given the results in Table 2. In contrast, the *systematic* component using the ‘Best’ index are all smaller for the ‘pure’ and ‘closet’ index funds, but unchanged for the two ‘active’ fund groups. As a result the *alpha* components of the ‘index’ funds are all much higher using the PPFI than those using the ‘Best’ index, whereas the ‘active’ group values are unchanged. This suggests that funds can appear to
show substantial out- or under-performance when in fact it is the use of an inappropriate benchmark that is giving a high systematic component and so clouding the interpretation of the tracking error decomposition.

The random variance components of the two ‘index’ funds types is increased substantially if the ‘Best’ index is used, but unchanged for the two ‘active’ fund groups. This implies that the apparent outperformance of the ‘pure’ and ‘closet’ index funds is more the results of random behavior than any real selection ability. In contrast, the outperformance by the diversified stock picker funds and the under-performance of the concentrated stock picker funds is a result of the fund manager’s investment strategy.

Lastly, the cross product terms for the ‘Best’ index are all higher than those using the PPFI. Nonetheless, even the cross product terms from the ‘Best’ index are all very small, as is to be expected.

Conclusion

Using the tracking error decomposition approach of Ammann et al. (2006) together with the Active Share methodology of Cremers and Petajisto (2009) we have examined the impact of tracking error on the performance for sample of 47 real estate funds in the UK over the period from Q4:2005: to Q4:2011 and make a number of conclusions. First, since tracking error risk makes fund managers inclined to hug the benchmark, it needs to be supplemented with Active Share to control for the activity level in the portfolio. Second, the choice of benchmark is crucial to the correct interpretation of the fund’s performance. Finally, once these adjustments have been made the tracking error decomposition of Ammann et al (2006) is able to differentiate between manager skill and random performance.
References


