Evaluating the Effectiveness of Common Structures in Property Portfolio Construction

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Abstract

A good portfolio structure enables an investor to diversify more effectively and understand systematic influences on their performance. However, in the property market, the choice of structure is affected by data constraints and convenience. Using individual return data, this study tests the hypothesis that some common structures in the UK do not explain a significant amount about property returns. It is found that, in the periods studied, not all the structures were effective and, for the annual returns, no structures were significant in all periods. The results suggest that the drivers represented by the structures take some time to be reflected in individual property returns. They also confirm the results of other studies in finding property type a much stronger factor in explaining returns than regions.

Keywords: *Property returns, portfolio structure*

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1. Introduction

Investors build portfolios of assets in order to diversify away risk and so attain superior risk adjusted returns. In addition, if their aim is to track the performance of a particular market, a portfolio in that market will be more likely to do so over time than a single asset. To achieve the best spread of assets and maximise diversification, many investors have used a structured, top-down approach to portfolio construction. This structure can then continue to be of use in managing the portfolio, giving the investor a framework for making investment decisions and for measuring the performance of his or her assets.

An individual investor is free to use whatever structure that they think is best. However, over time, certain accepted definitions of market segments have arisen. These tend to reflect the different systematic drivers of performance or the differing sensitivity of assets to those drivers. Therefore, using these segments should ensure that the portfolio is exposed to the full range of factors that influence the market as a whole. The investor may also use this structure to make tactical allocation decisions based on their beliefs about those drivers and how their interaction will affect segment returns.

Certain features of the property market make the processes of diversification and structuring more difficult than in other asset markets. In particular, for returns to reflect segment returns, a large stake in that segment is needed due to high levels of specific risk, but indivisibility and large lot sizes make this difficult to achieve. If only a small holding is purchased, though, the amount of systematic influence on its returns may not be significant and the investor may not get the performance that they expected. In addition, while market segments partly reflect perceived systematic drivers of performance, they are also influenced by data availability constraints and convenience. This raises the question of whether the segments themselves reflect enough of the systematic influences for their use in portfolio construction to be worthwhile.

With these issues in mind, this paper evaluates some common segmentations of the UK Real Estate market. Their ability to explain patterns in returns is tested against a null hypothesis of no explanatory power. The segmentations tested are based on property types, geographical regions and a combination of types and regions, as these are the most common factors that are used to segment the property market, and both annual and rolling return data for individual properties is used. It is expected that these structures will explain a significant amount about returns if they identify groups of properties that perform in a common way.

2. Background

The principle of combining assets into a portfolio in order to reduce risk was first formally set out by Markowitz (1952). Subsequently, it has been shown that the amount of risk reduction that can be achieved is limited, as there is a systematic component to risk, which is common to all assets. In order to diversify towards this systematic risk level, an investor can simply add more and more assets to their portfolio, a process known as naïve diversification. Risk can be reduced more efficiently, though, by adopting a structured top-down approach, where groups of similar performing assets in a market are identified and then diversification is done across these different groups.

However, certain features of the property market create difficulties in applying this structured approach. The indivisibility of property assets means that an investor cannot buy into segment performance by holding a stake in each asset. So exposure to the segment and its drivers will only be partial. This does not present a problem if the properties in each segment are close substitutes in terms of performance. High levels of specific risk, though, means that this tends not to be the case. Therefore, a significant stake in a segment is needed for systematic factors to be reflected. Yet this is not possible for many investors due to large lot sizes. Another problem is illiquidity, which makes it hard to rebalance the portfolio quickly.

Despite these obstacles to formal portfolio construction, there are benefits from using a top-down approach. It is clear that if groups of properties with distinct performance patterns are identified, then diversifying across these groups will be more efficient than diversifying at random. The objective of risk reduction will be achieved more quickly and at a lower cost. This structure can then be used for the evaluation of performance, the analysis of sources of return and for planning future portfolio strategies. Therefore, for those funds that are equipped to pursue a diversification strategy, the question is what is the best structure to use?

Many studies have examined whether it is better to use property types or regions as categories by which to diversify. A thorough review of this literature can be found in Lee & Byrne (1998). The use of types and regions has some economic justification. The type of property will affect the tenant and the activity that occurs there, linking the property's performance to a particular sector of the economy. Performance will also be affected by the regional economy and regional demand and supply pressures. Therefore, they are both candidates for describing the systematic influences on property returns. On balance, the literature finds that property type is more important than region for diversification.

However, the following points need to be borne in mind. Firstly, if the choice of segments is partly influenced by data constraints, then the types and regions used may not be appropriate reflections of the true type and spatial influences. If they are good approximations, then the results of such studies should be largely unaffected, but if one or both are inappropriate, then this will affect the conclusions about which contributes most to structure. Secondly, virtually all of the analysis in this area has been performed on aggregate level data. Aggregate figures hide the variability of individual properties and so may give a stronger picture of the influence of type and region factors than is really the case.

On the first of these issues, there has been considerable debate about whether a region is the appropriate level for analysis. Conventional regions often poorly reflect the economic factors that influence real estate returns, so several studies have attempted to define economic regions or areas that could be used for diversification (e.g. Mueller, 1993; Lee & Byrne, 1998). The concept of economic regions has not gone unchallenged, though, with Hamelink et al (2000) arguing that these can neglect the importance of local institutional factors that also influence performance. Some studies have looked at the role of smaller units such as metropolitan areas, but such areas need to be grouped together for a practical number of investment categories. Generally, there has been less controversy over the definitions of property types.

One study that sheds some light on both these issues is that of Andrew et al (2003). This examined whether the dominance of type over region was robust to different definitions of types and regions. Economic regions were not tested. Unlike most studies, individual property data was used. In terms of relative importance, they found that type continued to dominate, even when 63 regions (UK counties) were tested. However, the overall level of explanation, as measured by the adjusted R^2, was only 5% compared with 22% found in a similar study by

Lee (2001), which used aggregate numbers[1]. This raises the question of whether those conventional categories explain a significant amount of individual return variation

The issue of whether structures make a significant contribution to diversification has not been widely considered. Some studies have looked at the significance of various allocations in the optimisation context. Cheng & Liang (2000) examined whether optimal portfolios within real estate were significantly better than ones diversified naively across the groups of the chosen structures. The significance of a structure versus random selection was not tested, though. A partial test is provided by Lee (2001), who, using town level data, compared the explanatory power of regressions using property types against those of regressions on random groups as a check on the main results of his study. The r^2 values for the property type regressions were much higher, but this test relies on the town level data being a good proxy for individual asset performance.

In this study, the ability of standard property types and regions to define an effective portfolio structure is tested explicitly. It aims to discover whether these categories explain a significant amount of variation in individual property returns. This is done by sampling many times from the data for a particular period and then measuring how well a structure explains the returns in each sample. Both annual and rolling returns are tested, as the drivers that a structure reflects may take time to impact on individual returns. The results suggest that not all the structures are effective and, for the annual returns, that no structures are effective in all periods.

3. Data and Segmentations

The data that is used are individual property annual returns, three year rolling returns and five year rolling returns for the period 1981 to 2001. This data was drawn from the databases of Investment Property Databank (IPD), a commercial organisation that provides performance measurement and benchmarking services to property investors. All handling and processing of the data was done at IPD to maintain investor confidentiality. At the end of 2001, the *IPD UK Annual Index* included 236 portfolios, covering approximately 75% of the total property assets held by UK institutions and listed property companies (IPD, 2002).

Only the returns for standing investments were used in the analysis. These are properties that are held in portfolios during a period and not bought or sold, or subject to development or significant improvement expenditure. In addition, if properties did not belong to one of the three main sectors (Office, Retail or Industrial) then they were excluded. These three sectors make up the bulk of the UK property investment market and there are only a small number of observations for properties outside of these sectors. This still leaves on average 11,000 annual returns, 7,000 three year rolling returns and 5,000 five year rolling returns in each period for analysis.

Each of the properties in the databank has a type and location code and from these codes, the segmentations were constructed. The individual segments in each case are shown in Table 1. Two property type segmentations were tested, one being based on the three main sectors and the other being based on the property types used in the IPD *Property Investors Digest* (IPD, 2003). Two region segmentations were also tested. One of these is the three super-region split of the UK suggested by Key *et al* (1994) and used in diversification studies by Eichholtz *et al* (1995) and Lee & Byrne (1998). The other is based on the UK standard Government Office regions, but with the Yorkshire and North East regions combined due to only a small number of observations in the earlier years of the sample.

These type and region factors may reflect enough systematic influences on returns to be worth using in their own right. However, it is likely that a better portfolio structure can be obtained by combining these factors together. Therefore, two further segmentations that use types and regions to define segments were tested. The first of these simply combined the three sectors and three super regions to produce a nine group split of the market. The second is the standard IPD portfolio analysis segmentation. This would appear to have advantages over the first as the segments are more tailored to reflect the perceived sub-markets within the UK property market – in particular, the distinct office markets found within London.

Table 1 - The Segmentations Tested in the Analysis

3 Types	Retail, Office and Industrial
10 Types	Standard Shops, Shopping Centres, Retail Warehouses, Department/Variety stores, Supermarkets, Other Retail, Offices, Standard Industrials, Industrial Parks, Distribution Warehouses
3 Regions	London, Rest of South East and Rest of UK
10 Regions	London, South East, South West, Eastern, East Midlands, West Midlands, Yorks/NE, North West, Scotland, Wales
9 Mixed	A combination of the 3 sectors and 3 regions defined above
10 Mixed	Standard Retail South East, Standard Retail Rest of UK, Shopping Centres, Retail Warehouses, City Offices, West End Offices, Rest of South East Offices, Rest of UK Offices, South East Industrials, Rest of UK Industrials

4. Method

The analysis takes a cross-sectional approach, focusing on return variation. This is partly due to the structure of the dataset that was made available. In any one year, returns will vary across properties due to both systematic and property specific influences. The aim is to find those segmentations that best reflect the systematic patterns in the data and so which define groups of properties with similar return characteristics.

Rather than run the analysis on all the data in each period, samples were taken instead. This is so that any bias resulting from uneven group sizes could be eliminated. For the sectors and super-regions, in each case, 50 properties were selected without replacement from each group, drawing at random from within the segments themselves. This effectively creates an equal weighted portfolio from the data in a period. The samples comprised 150 properties in total and 200 samples were made for each period in the study. For the other segmentations, 15 properties were selected from each group and 200 samples were made.

On each of these samples, an analysis of variance test was then carried out. This calculates the amount of variance in the sample returns that is explained by a particular factor, in this case, the segmentation under study. The statistical significance of that explanation is measured by the F-statistic. Both the calculation of this figure and its critical value adjust for the number of groups used, so the significance of a structure will not simply be due to using more groups. The analysis of variance was used instead of more conventional cross-sectional regression, as it produces the same F-statistic in each case and it was computationally faster on such a large amount of data.

In each year, therefore, a set of F-statistics was generated for each structure being tested. The mean for each set and its associated p-value were then calculated, with the p-value measuring the probability that the null hypothesis has been rejected in error. The null hypothesis in each case is that the structure being tested explains nothing about sample returns. It is expected that this null will be rejected if the structure defines underlying systematic influences on property returns.

5. Results

The analysis was first carried out on the annual returns. The results of testing the significance of each structure are summarised in Table 2. A full set of F statistics and p-values for each year are presented in Table 5 at the end of the paper.

Table 2 - The Significance of Different Segmentations, using Annual Returns for 1981-2001

Significant at 5% level	3 Types	3 Regions	10 Types	10 Regions	9 Mixed	10 Mixed
Number of years	14	6	12	3	14	15
Percentage of years	67%	29%	57%	14%	67%	71%
Significant at 1% level	3 Types	3 Regions	10 Types	10 Regions	9 Mixed	10 Mixed
Number of years	9	4	7	0	9	10
Percentage of years	43%	19%	33%	0%	43%	48%

The most notable thing about the results is that the structures are only significant in some of the years and not for every year in the sample period. In fact, when measured at the 1% level, no structure is significant for more than half of the years. This means that in several periods, they were not effective descriptors of the returns in the sampled portfolios.

The property type based structures appear stronger than the regional ones overall and this is due to the weakness of the latter throughout the 1980s, where, between them, the regions were significant just once. Then, surprisingly, the mixed segmentations are only as strong or just stronger than the best type structure (the 3 sectors). This seems to suggest that only a small benefit has been gained from combining types and regions together. Table 5 shows that all the segmentations were weak in the years 1994, 1995 and 1996.

Another notable thing from Table 2 is that the more detailed structures do not appear to yield greater benefits. For both property types and regions, fewer periods are significant when ten groups are used than when three groups are used. These results contrast with those of Cheng & Liang (2000) who found that, where the sampling and testing period were the same, using more detailed type and region structures tended to increase significance. The results seem to suggest, therefore, that adopting a more detailed structure may not be worthwhile.

There could be several reasons why segmentations lack significance. Firstly, it may be that while the segments appear, from aggregate indices, to perform differently, there is high cross-sectional variation in their returns. In other words, the segments are internally heterogeneous, with individual properties producing returns that are very different from the segment average return. Secondly, it may be that the segments chosen do not, in fact, perform much differently from each other. In other words, at the segment level, the groups are too homogeneous and do not show distinct performance patterns at all.

However, it could also be that the results are function of using a short time period. It may be that the structural effects represented by the segments only show through over a longer time horizon. It is also this longer time horizon that may be of more interest to property portfolio managers, given high transaction costs and the difficulties in implementing strategies quickly. Therefore, the method above was also applied to properties with three and five year returns.

The results in Tables 3 and 4 show that the structures are significant more often when longer time periods are used. Some of the structures are now significant in every period. Full results are displayed in Table 6 at the end of the paper.

Table 3 - The Significance of Different Segmentations, using 3 year Returns

Significance at 5% level	3 Types	3 Regions	10 Types	10 Regions	9 Mixed	10 Mixed
Number of periods	6	3	7	1	6	7
Percentage of periods	86%	43%	100%	14%	86%	100%
Significance at 1% level	3 Types	3 Regions	10 Types	10 Regions	9 Mixed	10 Mixed
Number of periods	5	3	6	1	6	7
Percentage of periods	71%	43%	86%	14%	86%	100%

Table 4 - The Significance of Different Segmentations, using 5 year Returns

Significance at 5% level	3 Types	3 Regions	10 Types	10 Regions	9 Mixed	10 Mixed
Number of periods	4	2	4	1	4	4
Percentage of periods	100%	50%	100%	25%	100%	100%
Significance at 1% level	3 Types	3 Regions	10 Types	10 Regions	9 Mixed	10 Mixed
Number of periods	4	2	4	1	4	4
Percentage of periods	100%	50%	100%	25%	100%	100%

Once again, the type based structures are better than the regional ones, with the latter only significant in 50% of the time at best. Broad structures no longer dominate the more detailed groupings, though, with the ten type split better than the three sector split when three year periods are considered.

6. Implications and Conclusions

The aim of this study was to discover whether conventional splits of the UK real estate market explained a significant amount about property returns. It was suggested that if they did not, it would call into question their use in portfolio construction and analysis. Using annual periods, the results show that the structures are often not significant. However, as the time period used increases, most of the structures become more successful in describing return differences. It is concluded that most of the structures describe enough systematic pattern to be worth using.

The findings may have a number of implications for property portfolio managers. Firstly, they suggest that the influence of the return drivers that the structures represent take time to show through in individual property returns. Returns may not be as sensitive to wider conditions as might be expected, with factors such as tenant and lease structure dominating the performance of an individual building. However, as this study tests existing segmentations, the possibility remains that there are other groupings of properties yet to be found that will reflect systematic drivers better. Secondly, the findings suggest that the impact of a structure decision on returns may not be significant immediately. Therefore, frequent rebalancing, as well as being costly and difficult in an illiquid market, is unlikely to have major benefits, except in exceptional market circumstances.

The results also show that the choice of structure for the property portfolio does matter. It is unlikely that a manager would choose to manage their portfolio on a purely regional split, but if they did, they may be at a significant disadvantage in understanding the market compared to a manager using property types. In this respect, the results of the study confirm earlier work on the relative importance of types and regions, which have generally favoured property types for the first level of portfolio analysis. Interestingly, though, the mixed structures do not appear to be much better than the ones based on type alone. This suggests that most of their explanatory power is derived from the type component in their makeup, though more refined regional boundaries could have marginal benefits, enabling the PAS structure to explain more than the other mixed group.

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Notes

[1] Here, the r^2 values for identical three group property-type structures are being compared.

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Table 5: Mean F Statistics for the Different Segmentations and the Probabilities of Difference from Zero – Annual Returns

Year	Sectors		Super regions		Ten sectors		Ten regions		Nine Mixed		10 PAS Segments	
	F-stat	p-value	F-stat	p-value	F-stat	p-value	F-stat	p-value	F-stat	p-value	F-stat	p-value
1981	4.33	0.01	1.03	0.36	1.61	0.12	1.20	0.30	1.79	0.09	1.55	0.14
1982	4.94	0.01	1.08	0.34	2.08	0.04	1.12	0.35	1.90	0.06	1.58	0.13
1983	8.29	0.00	1.01	0.37	2.50	0.01	1.11	0.36	2.87	0.01	2.18	0.03
1984	7.12	0.00	0.91	0.41	2.20	0.03	1.13	0.34	2.44	0.02	2.17	0.03
1985	9.04	0.00	1.34	0.26	3.41	0.00	1.10	0.37	2.81	0.01	2.53	0.01
1986	2.51	0.08	2.58	0.08	1.32	0.23	1.27	0.26	2.24	0.03	2.74	0.01
1987	1.89	0.16	6.67	0.00	1.28	0.26	1.73	0.09	2.83	0.01	4.30	0.00
1988	5.89	0.00	2.01	0.14	2.91	0.00	1.22	0.29	2.28	0.03	2.95	0.00
1989	12.95	0.00	1.26	0.29	5.08	0.00	1.17	0.32	4.91	0.00	5.51	0.00
1990	4.26	0.02	3.37	0.04	1.99	0.05	1.50	0.15	3.12	0.00	3.98	0.00
1991	17.65	0.00	9.32	0.00	3.75	0.00	2.29	0.02	6.00	0.00	10.98	0.00
1992	9.43	0.00	8.36	0.00	4.23	0.00	2.24	0.02	3.95	0.00	7.72	0.00
1993	1.92	0.15	2.16	0.12	2.94	0.00	1.22	0.29	1.43	0.19	2.70	0.01
1994	1.43	0.24	2.07	0.13	1.53	0.14	1.45	0.17	1.27	0.27	1.75	0.08
1995	1.21	0.30	2.45	0.09	1.42	0.19	1.28	0.25	1.48	0.17	1.81	0.07
1996	2.77	0.07	1.30	0.27	1.90	0.06	1.08	0.38	1.79	0.08	2.25	0.02
1997	1.73	0.18	3.86	0.02	2.16	0.03	1.30	0.24	2.66	0.01	2.88	0.00
1998	3.37	0.04	2.96	0.05	1.54	0.14	1.34	0.22	2.22	0.03	1.76	0.08
1999	3.58	0.03	1.76	0.17	1.61	0.12	1.25	0.27	2.42	0.02	1.68	0.10
2000	16.43	0.00	9.27	0.00	3.88	0.00	2.10	0.03	5.86	0.00	6.49	0.00
2001	3.23	0.04	2.28	0.11	1.73	0.09	1.23	0.28	1.77	0.09	2.02	0.04

Table 6: Mean F Statistics for the Different Segmentations and the Probabilities of Difference from Zero – Rolling Returns

Years	Sectors		Super regions		Ten sectors		Ten regions		Nine Mixed		10 PAS Segments	
	F-stat	p-value	F-stat	p-value	F-stat	p-value	F-stat	p-value	F-stat	p-value	F-stat	p-value
3 year periods												
1981-1983	13.59	0.00	1.29	0.28	3.73	0.00	1.25	0.27	3.92	0.00	3.32	0.00
1984-1986	14.98	0.00	1.34	0.26	3.41	0.00	1.31	0.24	4.47	0.00	3.69	0.00
1987-1989	18.77	0.00	2.63	0.08	5.99	0.00	1.50	0.16	5.23	0.00	6.33	0.00
1990-1992	16.79	0.00	12.17	0.00	4.56	0.00	2.75	0.01	8.01	0.00	13.81	0.00
1993-1995	1.46	0.23	2.65	0.07	5.02	0.00	1.74	0.09	1.72	0.10	4.63	0.00
1996-1998	4.04	0.02	4.89	0.01	2.38	0.02	1.59	0.12	3.77	0.00	3.39	0.00
1999-2001	15.83	0.00	6.97	0.00	3.73	0.00	1.70	0.09	6.00	0.00	5.19	0.00
5 year periods												
1981-1985	22.08	0.00	1.17	0.31	5.62	0.00	1.40	0.19	5.57	0.00	4.47	0.00
1986-1990	14.47	0.00	2.10	0.13	5.21	0.00	1.38	0.20	4.51	0.00	5.52	0.00
1991-1995	12.97	0.00	9.53	0.00	9.06	0.00	2.80	0.00	5.15	0.00	15.23	0.00
1996-2000	9.62	0.00	7.00	0.00	3.47	0.00	1.93	0.05	6.65	0.00	4.46	0.00