IPF Investment Property Forum

INVESTMENT PROPERTY FORUM Educational Trust

Risk Reduction and Diversification in Property Portfolios

Research Findings

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February 2007

This research was commissioned by the IPFET and IPF Joint Research Programme

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This research was commissioned and funded under the auspices of the IPF Educational Trust and IPF Joint Research Programme.

The three-year programme supports the IPF's wider goals of enhancing the knowledge, understanding and efficiency of property as an investment class. The initiative provides the UK property investment market with the ability to deliver substantial, objective, and high quality analysis on a structured basis. It will enable the whole industry to engage with the other financial markets, wider business community and government on a range of complementary issues.

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SUMMARY

- Total portfolio risk is measured by the standard deviation in portfolio total returns. If the returns on the individual properties don't move in parallel and, on occasion, move in opposite directions, then the returns on the portfolio will be less volatile than the weighted average of the standard deviation in returns on each asset.
- Total risk reduction is the decline in total portfolio risk, which can occur as properties are added to a portfolio. It reflects the reduction of specific risk and differences in systematic risk as the number of properties in a portfolio increases. Total risk reduction should be of particular interest to fund managers with an absolute return benchmark.
- The reduction of total risk in a portfolio depends upon the correlations between the returns on individual properties. It is easier to reduce the total risk on a portfolio when the returns on individual properties are weakly or negatively correlated with each other.
- Diversification is only concerned with the reduction of specific risk from a portfolio. It is classically measured by the proportion of total portfolio risk which is explained by movements in the market. Diversification should be of particular interest to fund managers with a relative benchmark.
- Diversification of specific risk depends upon the strength of the correlation between the returns on individual properties and the market as a whole.
- There is a huge variation in individual property returns, both in single years and over time.
- Although total returns on individual properties in the same segment often move up and down together, they are not highly synchronised.
- The performance of shopping centres, retail warehouses and industrials has generally been more uniform than the performance of standard retails, City offices and West End offices, both in individual years and over time.
- Variations in the level of risk across segments appear to reflect a number of factors, including the general rate of capital growth, the mix between single and multi-let properties and lease events.
- In the retail and industrial segments the segment benchmark typically explains between 10 to 20% of the variation in the returns on individual properties. In the office segments, there appears to be virtually no relationship between the returns on individual properties and the segment benchmark.
- There has been a long-term decline in the level of risk on individual properties, measured in terms of the dispersion of returns in single years.
- Although individual properties carry a high level of risk, it is lower than the risk on individual equities.
- Although the average number of direct properties in balanced funds has halved over the last 20 years, the increase in concentration has been partially offset by the growth in indirect holdings.
- Despite the fall in the number of direct properties in portfolios, the range in fund returns has narrowed over the long-term, suggesting that funds now generally carry less risk than in the past. This improvement appears to be due to the fall in the office weighting in portfolios, a shift away from smaller lot sizes, greater uniformity in market segment returns and increased market transparency. There is little evidence of convergence in the structure of balanced funds.
- There is an inverse relationship between the volatility of fund returns over time and the number of properties in a portfolio.
- The rate of risk reduction diminishes as more properties are added to portfolios. However, adding another property is always beneficial.

SUMMARY

- There is no absolute answer to the question of how many properties are required to track the market. In practice the right size for a portfolio depends on the importance investors place on tracking the benchmark average return. There is no particular significance to achieving a 90%, or 95% level of diversification.
- In general it does not appear that diversification is easier to achieve in some market segments than in others, in terms of the number of properties. However, differences in the average value of properties, means that the cost of achieving a given level of diversification does vary significantly across segments.
- Diversification is harder to achieve at the all property level than in individual segments, because the IPD Universe reflects the variation in returns across different market segments.
- Total returns on specialist funds in the shopping centre, retail warehouse and industrials ought to be relatively uniform. There should be a greater range in returns on specialist funds in the South East retail, West End office and South East office segments.

1 INTRODUCTION

This study explores risk reduction and diversification in the UK property market. Both of these terms are widely used in property investment, research and management and refer to policies or objectives investors might pursue in constructing portfolios. However, despite being common currency, these concepts are not always well understood and they are sometimes mistakenly regarded as synonymous. Furthermore, only a limited amount of research has been done with individual asset data into the possibility or practicality of achieving either. This research project seeks to clarify these two concepts and consider to what extent each might be achieved within the UK property market. It also seeks to estimate risk reduction profiles and diversification using analytical and simulation techniques.

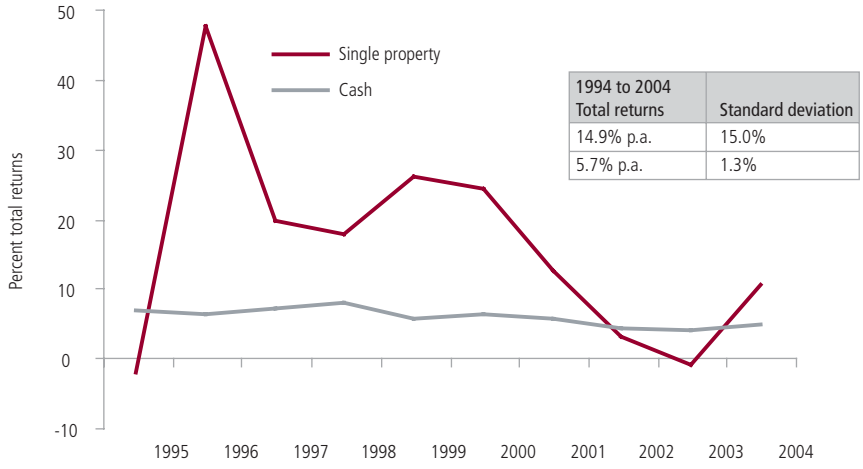
This introduction section begins by considering the different macro- and micro- factors which generate risk on individual properties. It then steps up to the portfolio level and uses hypothetical examples to illustrate how total risk reduction and risk diversification are governed by the risk characteristics of individual properties. A comprehensive review of the concepts and measures used in this study and their place in investment theory can be found in the separate *Literature Review* which accompanies this report.

1.1 Individual property risk

All property investment involves an element of risk. Whereas the future return on cash is agreed in advance and is essentially risk free if the Government is the borrower, the future return on a property is subject to all manner of uncertainties and investors have to make a raft of assumptions about not only the asset itself, but also about the wider property market.

One way of demonstrating risk is to look at the volatility in returns on individual properties over time. From the investor's standpoint this represents the issue of correctly timing their investment and buying a property before its value increases and selling a property before its value declines. Getting the timing right matters much more on an asset with volatile returns, than on asset with stable returns. Figure 1.1 shows the performance of a single property over time and the annual returns on cash. **The risk on an individual property is usually measured by the standard deviation in its total returns**[1]**.** The greater the vertical fluctuation, the higher the standard deviation.

Figure 1.1: Volatility in total returns



1994 to 2004 Total returns	Standard deviation
14.9% p.a.	15.0%
5.7% p.a.	1.3%

[1] The IPF report Risk Measurement and Management for Real Estate Investment Portfolios (2002) provides a comprehensive review of alternative definitions and measures or risk.

1 INTRODUCTION

It theory, the volatility in individual property returns can be split into two components. **Systematic risk** refers to the volatility which is due to general market factors that affect the values of all properties. Examples include fluctuations in economic growth which alter the demand for property, the volume of new development, movements in bond yields and finance rates, returns on other assets, changes in taxation and changes in planning policies.

At an aggregate level, these macro influences are reflected in the overall movement of benchmark indices such as the IPD Universe. It should be noted that although these factors may affect all properties, their impact is not necessarily uniform and some properties will be more sensitive to a particular influence than others. For example, offices appear to be more sensitive to the economic cycle than retails, while high yielding, secondary properties may be more affected by changes in interest rates than prime properties.

The other component is **specific risk** which refers to the volatility in returns due to unique factors which only affect the value of a single property, or a small subset of properties. Property specific risk can be further sub-divided into physical building risks and leasing risks. Physical risks include a building's structure and construction materials, its design and susceptibility to obsolescence and its location – which may become more or less attractive as new developments are built and as new transport infrastructure is completed. Refurbishment schemes also generate specific risk in a technical sense, if the property's final capital value is higher, or lower, than the capital injection so resulting in an enhanced or reduced total return. Leasing risks include lettings, expiries, renewals, the exercise of break clauses and tenant insolvencies. In general leasing risks tend to have an immediate impact on performance, whereas the impact of physical building risks is more gradual.

A second way of demonstrating risk is to look at the range in returns on individual properties in a single year. From the investor's standpoint this represents the risk of whether a property will perform like other properties and hence replicate the broader market. In Table 1.1 the middle column shows the range in returns on all 10,265 standing investment properties in the IPD in 2004, including refurbishment schemes. The left-hand column covers 9,862 properties excluding refurbishment schemes.

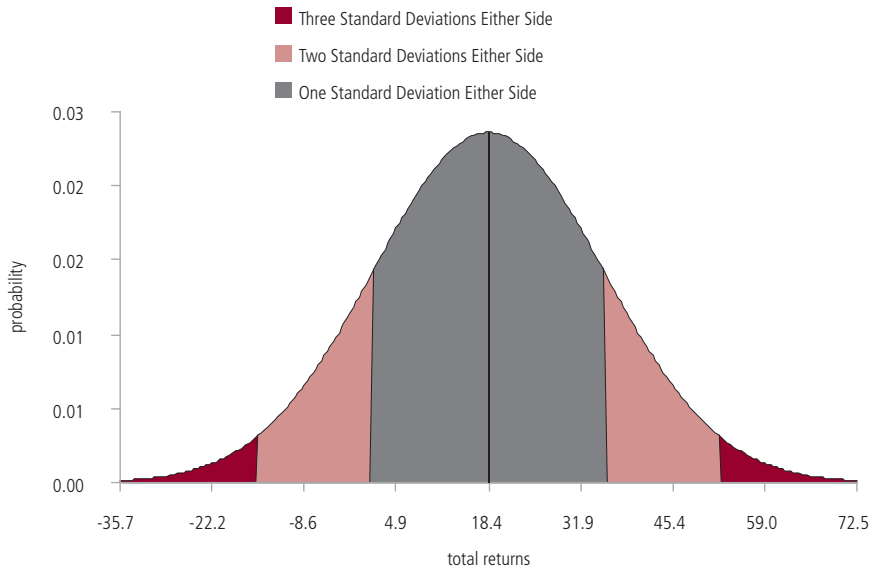
Table 1.1: The dispersion in total returns on individual assets in 2004

	Standing investment properties excluding refurbishments	Standing investment properties including refurbishments
Number of assets	9,862	10,265
95th percentile	37.9	38.8
Upper quartile	24.4	24.5
Median	18.5	18.5
Lower quartile	13.2	13.0
5th percentile	4.5	3.5
Inter-quartile range	11.3	11.5
Standard deviation	13.2	16.9
Weighted average	18.4	18.4

Source: IPD, FTSE

- There was a wide range in individual property returns in 2004. The standard deviation in total returns on all standing investment properties was 16.9%.
- If total returns are normally distributed (ie a symmetrical bell-shaped distribution), then one standard deviation above the mean and one standard distribution below will cover the middle 68% of returns. Thus in 2004 there was a 68% chance that the returns on an individual property were between 1.5% (18.4% - 16.9%) and 35.3% (18.4% + 16.9%). 16% of properties (approximately one sixth) had a total return above 35.3% and at the other extreme, 16% of properties had a return below 1.5%.

Figure 1.2: Dispersion of individual property total returns in 2004[1]



1.2 Property portfoliorRisk

Total portfolio risk is measured by the standard deviation in portfolio total returns. It is important to understand that it is not simply the weighted average of individual property risks. Instead, it is a function of the standard deviation in individual asset returns, the weights of those assets ***and*** the extent to which the returns on the individual assets are correlated with each other. If the returns on the individual properties don't move in parallel and, on occasion, move in opposite directions, then the returns on the portfolio will be less volatile than the weighted average of the standard deviation in returns on each asset. In short, the whole is less than the sum of the parts. Figure 1.3 illustrates this phenomenon. The portfolio has a standard deviation of 11.4%, well below that of either individual property.

[1] Diagram assumes returns are normally distributed.

Figure 1.3: Total risk reduction

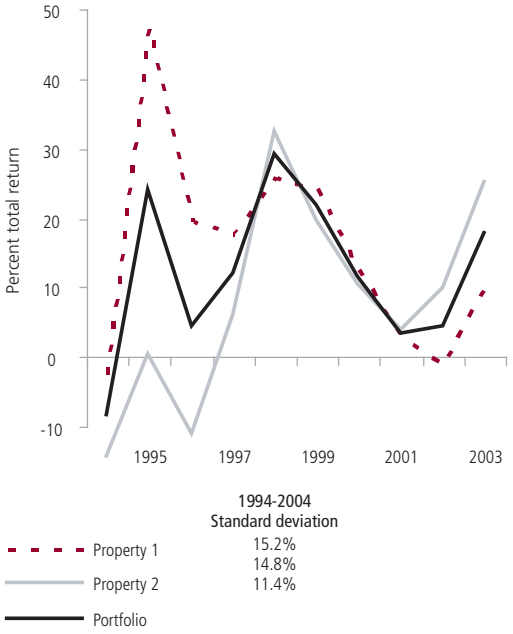
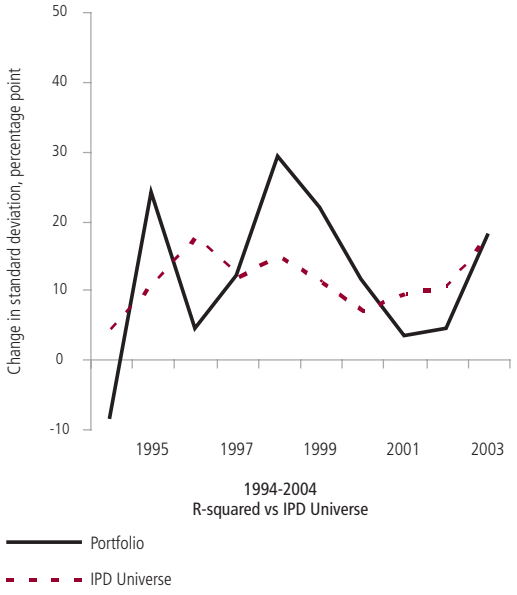


Figure 1.4: Diversification of specific risk



The decline in total portfolio risk which can occur as properties are added to a portfolio is termed total risk reduction. **Total risk reduction** reflects the reduction of specific risk and differences in systematic risk as the number of properties in a portfolio increases. Taken to its logical extreme, risk is only completely eliminated from a portfolio when total returns are constant over time.

Diversification is only concerned with the reduction of specific risk from a portfolio. (Figure 1.4) It is classically measured by the proportion of total portfolio risk which is explained by movements in the market, using a proxy such as the IPD Universe. In short, how well does a portfolio track the market? Statistically, diversification is measured by the square of the correlation coefficient (R^2)[1] between a portfolio's total returns and the market's total returns over time. If all of the variation in a portfolio's returns is explained by the market ($R^2 = 1$), then it is only influenced by systematic risk and is fully diversified because there is no specific risk left in the portfolio.

[1] The correlation coefficient (R) measures the relationship between two data series. The coefficient can vary between +1 and -1. A correlation coefficient of +1 shows that the two series rise and fall together. A correlation coefficient of -1 shows that the two series are the exact mirror image of each other and when one rises, the other falls and vice-versa. A correlation coefficient of zero indicates that there is no relationship between the two. The square of the correlation coefficient (R^2) shows what proportion of the variation in the first series is explained by the second series. The R^2 can vary between 0 and 1.

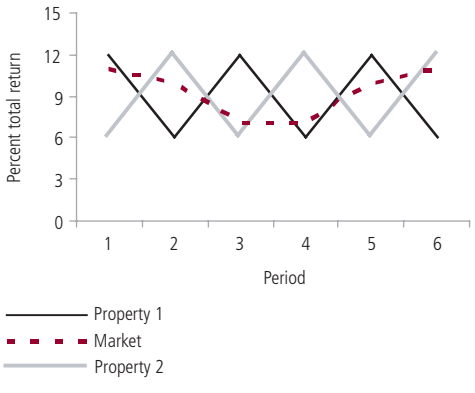
Figures 1.5 to 1.7 present three[1] extreme hypothetical scenarios which demonstrate how total risk reduction and risk diversification at the portfolio level are affected by the correlations between the returns on individual properties and by the correlations between the returns on individual properties and the market benchmark. In each scenario, the two properties in the left-hand chart are combined to form the portfolio on the right-hand chart. These hypothetical examples show that:

- The reduction of total risk in a portfolio depends upon the correlations between the returns on individual properties. It is easier to reduce the total risk on a portfolio when the returns on individual properties are weakly or negative correlated with each other. It is far harder to reduce total risk when the returns on individual properties are strongly positively correlated with each other.
- Diversification of specific risk depends upon the strength of the correlation between the returns on individual properties and the market as a whole. It is easier to create a well diversified portfolio when the returns on individual assets are strongly positively correlated with the market.

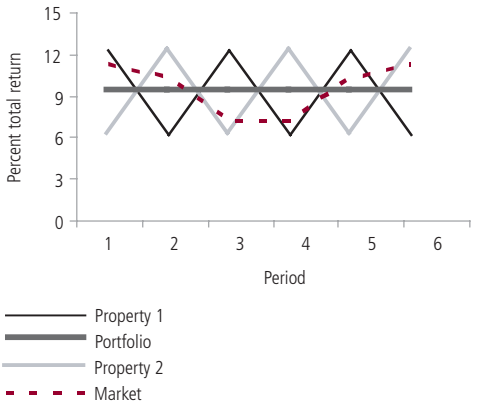
It might be expected that fund managers with a relative benchmark such as the IPD Universe would be more interested in risk diversification than with the reduction of total risk from a portfolio. Alternatively, fund managers with an absolute total return target might have different priorities and be more concerned with the reduction of total risk than with risk diversification.

Figure 1.5: Hypothetical properties

Returns on individual properties are negatively correlated with each other and weakly correlated with the market.



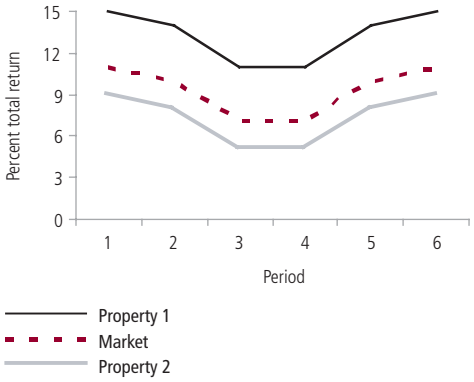
Combining the properties greatly reduces the total risk of the portfolio, but does not necessarily improve diversification.



[1] Although intuitively it might seem that there should be a fourth permutation - properties which are strongly correlated with the market, but negatively correlated with each other – this scenario is a contradiction in terms, because if the first condition were met, then the properties would also be strongly positively correlated with each other.

Figure 1.6: Hypothetical properties

Returns on individual properties are strongly positively correlated with each other and with the market.



Combining the properties does not reduce the total risk of the portfolio. The portfolio is well diversified and tracks the market.

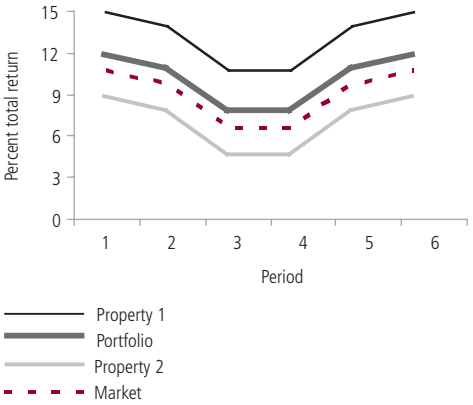
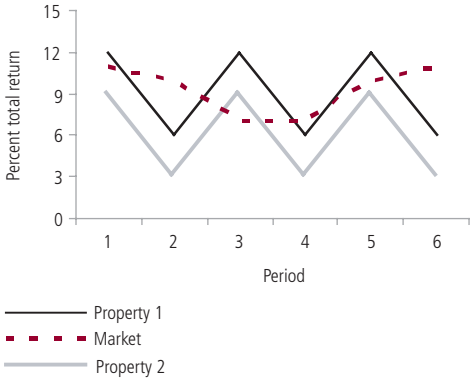
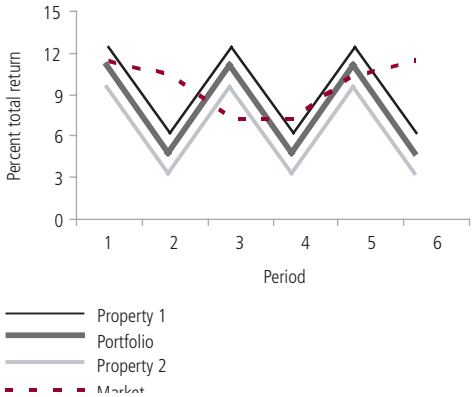


Figure 1.7: Hypothetical properties

Returns on individual properties are strongly positively correlated with each other and weakly correlated with the market.



Combining the properties does not reduce the total risk of the portfolio, or improve diversification.



2 SIMULATION METHODOLOGY

This section describes the simulations used to test the relationship between total risk reduction, risk diversification and the number of properties in a portfolio. The research involved cross-sectional simulations to analyse the range in fund returns within a single year, and longitudinal simulations to measure the volatility of fund returns over time.

The longitudinal study was split into two parts. The first part involved creating a large set of hypothetical portfolios of different sizes by randomly combining actual properties which had been held as standing investments in the IPD from 1994 to 2004. The standard deviation in annual returns over the 10 years was used to measure risk reduction. The returns on the hypothetical portfolios were also compared against the IPD Universe over the 10 years to end-2004 to measure diversification.

The second part of the longitudinal analysis was to compile background data on the individual held properties including the standard deviation in their annual returns, correlations between individual properties and correlations between each individual property and the market. The data on the individual properties was then used to try and explain the portfolio results on total risk reduction and risk diversification from a theoretical perspective.

The cross-sectional analysis involved looking at the range in portfolio returns around the market average in a single year (measured by the standard deviation) and comparing the ranges for small and large funds. The analysis again relied upon a simulation technique to generate a large number of hypothetical portfolios of different sizes by randomly combining actual properties in the IPD Databank.

2.1 Longitudinal analysis

The longitudinal, or time series, analysis was based upon a sample of properties, which had been held continuously by IPD investors over the 10 years to end-2004. IPD constructed thousands of hypothetical portfolios by randomly combining the held properties using Monte Carlo simulations. This simulation technique has been widely used in the property industry in the field of development appraisal (e.g. Byrne, 1996[1]). It has also been applied previously to analysing risk reduction (Byrne and Lee, 2000[2]).

The simulation process began by measuring the standard deviation in total returns for individual properties between end-1994 and end-2004. The higher the standard deviation, the greater the volatility of returns. The simulation program then compiled the returns for 20,000 hypothetical portfolios of two properties and computed the average standard deviation in their returns over the 10 years. The routine was then repeated for 20,000 hypothetical portfolios of three properties, 20,000 hypothetical portfolios of four properties, and so on. Increases of one property at a time were used for portfolios up to 20 properties and then the simulation increased in steps of 10 up to 100 properties and steps of 50 up to portfolios of 500 properties.

In order to replicate reality, the portfolio returns were value-weighted, so that the contribution of each individual property was in direct proportion to its share to the portfolio's total capital value, Table 2.1. This meant that more valuable properties had a bigger impact on a fund's return than less valuable properties.

[1] Byrne, P. 1996. Risk, Uncertainty and Decision Making in Property Development. London: E & F.N. Spon.

[2] Byrne, P. and Lee, S. 2000. Risk Reduction in UK Property Market. Journal of Property Research. 17 (1): 23-46

2 SIMULATION METHODOLOGY

Table 2.1: Calculating hypothetical portfolio return from actual properties

Number of properties	January	February	March	April	May	June
Actual property 1						
Numerator £	18,050	18,050	18,050	18,050	18,050	18,050
Denominator £	2,950,000	2,950,000	2,950,000	2,950,000	2,950,000	2,950,000
Actual property 2						
Numerator £	2,511	8,868	7,077	11,317	17,790	25,347
Denominator £	2,600,000	2,588,345	2,583,047	2,575,958	2,573,109	2,576,733
HypotheticalpPortfolio						
Numerator £	20,561	26,918	25,127	29,367	35,840	43,397
Denominator £	5,550,000	5,538,345	5,533,047	5,525,958	5,523,109	5,526,733
Portfolio return	0.4	0.5	0.5	0.5	0.6	0.8
Index Dec=100	100.4	100.9	101.3	101.9	102.5	103.3

Note: The numerator is the sum of the change in capital value during the month and the income receivable.
The denominator is the average capital employed in the property during the month.

In more detail, the program which ran the simulations carried out the following steps:

1. It assigned a random number to every property in the Databank which was a standing investment in the particular year (or segment) being analysed.
2. The program then ranked all the properties according to the size of the random number and selected all those ranked beneath the target number of properties to be included in the hypothetical portfolio. The sampling was 'without replacement' in the sense that once a property was selected, it could not be included again in that same portfolio.
3. The program then calculated the 10 annual total returns for the hypothetical portfolio to end-2004 by combining the monthly numerators and denominators of the returns for the actual properties. This meant that the returns for the portfolio were value weighted, rather than equal weighted, so that the contribution of each individual property was in direct proportion to its share of capital value.
4. The annual returns for the hypothetical portfolio were recorded and the computer program was then re-run 19,999 more times to create a set of returns for 20,000 hypothetical portfolios, all with the same number of actual properties. The program computed the average standard deviation in returns between 1994 to 2004 recorded by the 20,000 portfolios and the average R-squared coefficient between the portfolios' returns and the IPD Universe.
5. It is likely that some combinations of actual properties were repeated, although the probability of this repetition distorting the standard deviations was limited by the large number of simulations.
6. No constraints were placed on the sampling to control for the maximum contribution made by a single property, so that the program was allowed to pick any property regardless of its capital value. It is conceivable therefore that some of the hypothetical portfolios with two properties were unlikely combinations, for example, including one extremely valuable shopping centre and one small unit shop. However, this enables the results to be treated as a baseline rather than a feature of particular 'rules' placed on the program by the researchers.
7. The number of properties to be included in the hypothetical portfolio was then increased by one and another 20,000 hypothetical properties were simulated for that portfolio size, until all desired sizes had been computed.

2 SIMULATION METHODOLOGY

The second stage of the longitudinal analysis involved calculating the key individual property characteristics which influence risk reduction and risk diversification. This required:

- Calculating the standard deviation in the total returns of each individual property over the 10 years 1994 to 2004 and then working out the average at the All Property level and for each market segment.
- Calculating the correlation coefficient between the total returns on each individual property and the returns on every other property over the 10 years to 1994 to 2004 at the All Property level and for each market segment[1].
- Working out the average correlation coefficient for every market segment and at the all property level.

It should be noted that although these averages are useful, there is a potential incompatibility between these data and the portfolio results from the simulations. In keeping with reality, the hypothetical portfolio results from the longitudinal study were value-weighed so that more valuable properties had a bigger impact on a fund's return than less valuable properties. However, in order to keep the task manageable, the average standard deviations and correlation coefficients for the individual properties were calculated on an equally-weighted basis.

Although the results from the longitudinal analysis are valid, the approach potentially suffers from two limitations. First, although the size of the held sample of properties is adequate for simulations at the All Property level, the number of held properties in some market segments, such as shopping centres and City offices, is quite low (Table 2.2).

The second issue is survivor bias in the sense that the set of properties that IPD investors chose to hold between 1994 and 2004 might not be representative of the wider population of investment properties. It is possible, for example, that the sample of held properties understates the true level of volatility in annual returns, because investors might prefer to sell properties whose performance is particularly erratic.

One way of testing for this potential bias is to compare the average standard deviation in individual property returns for the 10 year held sample with that for a larger set of held properties. Table 2.2 compares the average volatility of the returns on the 1,728 individual held properties between 1999 and 2004 with the average volatility of the returns on 3,719 individual properties held continuously over the same five years. (The former is a subset of the latter).

In general, Table 2.2 suggests that investors don't discriminate against properties whose performance is particularly erratic and the performance of the properties in the longitudinal analysis was no smoother, or more volatile, than that of the properties in the larger held sample. This in turn suggests that the results from the longitudinal analysis are representative in terms of their volatility and are not subject to survivor bias. (A separate analysis examining whether the properties in the 10 year held sample delivered higher returns over the period 1999 to 2004 is included in the Appendix).

[1] The All Property calculation required 1,492,128 correlation coefficients. (1728 x (1728-1)) / 2

Table 2.2: Average volatility of returns on properties in held samples, 1999 to 2004

	Properties held 1994-2004			Properties held 1999-2004	
	Number of properties	Average standard deviation in returns[1]		Number of properties	Average standard deviation in returns[1]
Std. Retail -South East	368	10.0		702	11.6
Std. Retail - Rest UK	418	11.9		741	12.0
Shopping Centres	27	9.9		54	8.0
Retail Warehouses	116	11.2		270	9.6
City Offices	50	9.9		125	13.0
West-End Offices	125	9.5		251	12.9
Rest of S.E. Offices	160	10.1		336	9.7
Rest of UK Offices	88	10.3		207	7.2
Industrial South East	209	11.2		459	8.0
Industrial Rest UK	145	10.3		378	6.8
Other Property	22	11.0		196	14.5
All Property	**1,728**	**10.7**		**3,719**	**10.4**

[1] Average standard deviation in annual total returns over the period on individual properties.

2.2 Cross-sectional simulations

In addition to the longitudinal simulations, it was decided to undertake a cross-sectional analysis looking at the range in portfolio returns in a single year and then comparing the ranges for funds of different sizes. This involved adapting the simulation process detailed in Section 2.1 to randomly select actual properties in the IPD and create 20,000 hypothetical portfolios in a single year with one property, with two properties, with three properties, etc. In line with the longitudinal analysis, the portfolio returns were valued weighted, so that the contribution of each individual property was in direct proportion to its share of total portfolio value. One major difference from the longitudinal analysis is that the program was able to sample from all the standing investments in the IPD in a single year, drawing on over 10,000 properties. The program recorded the average fund return, the standard deviation (ie the range in returns across the 20,000 portfolios within the year, not volatility over time), quartiles and percentiles. This process was repeated for every year in the IPD history from 1981 to 2004 and at a market segment level in certain key years at turning points in the property cycle: 1988, 1991, 1997, 2001 and 2004.

3 RESULTS – INDIVIDUAL PROPERTY RISK

This section investigates risk at the individual property level. It includes a cross-sectional analysis, measuring the dispersion of returns in a single year, and a longitudinal analysis, measuring the volatility in returns over time. The section also considers the extent to which the returns on individual properties are synchronised with each other and with the benchmark for their segment. These characteristics ought to have a direct influence on risk reduction and diversification at the portfolio level. (See Section 4). Finally, the section compares the degree of risk on individual properties and individual equities.

3.1 CROSS SECTIONAL RESULTS

One approach to measuring risk on individual properties is to analyse the range in their total returns around the average. From the investor's standpoint this represents the risk of whether a single property will perform like other properties and hence replicate the broader market. Table 3.1 shows the standard deviation in individual property returns across all properties in the IPD in 2004, split by market segment. The table also shows the corresponding ranges for four previous years, which marked turning points in the property cycle. The right-hand column shows the average for the five annual cross-sections.

Table 3.1: Dispersion in individual property total returns

	Standard deviation %					
	1988	1991	1997	2001	2004	Average
Std. Retail – South East	36.8	31.1	15.3	13.4	15.4	22.4
Std. Retail – Rest UK	33.5	30.4	15.2	12.1	14.5	21.1
Shopping Centres	17.3	13.9	9.5	7.7	8.0	11.3
Retail Warehouses	15.5	14.7	12.3	30.5	11.0	16.8
City Offices	21.3	41.5	41.2	31.9	28.5	32.9
West-End Offices	41.6	19.1	28.7	15.5	28.7	26.7
Rest of S.E. Offices	34.0	17.5	16.2	11.3	12.9	18.4
Rest of UK Offices	32.8	17.7	23.3	11.3	10.4	19.1
Industrial South East	33.5	13.6	12.8	14.4	11.6	17.2
Industrial Rest UK	24.3	13.9	10.4	10.5	10.4	13.9
All Property	**35.1**	**26.6**	**21.3**	**18.2**	**16.9**	**23.6**

- There was a wide range in individual property returns in 2004. The standard deviation in total returns on all standing investment properties was 16.9%.
- The mean total return across all standing investments in 2004 was 18.4%. Assuming returns were normally distributed around the mean, there was a 68% chance that the returns on an individual property were between 1.5% (18.4% to 16.9%) and 35.3% (18.4% + 16.9%). 16% of properties (approximately one sixth) had a total return above 35.3% and at the other extreme, 16% of properties had a return below 1.5%. (See Figure 1.2 in the Introduction).
- Over the long run the annual range in returns has become tighter, indicating that the performance of individual properties has become more uniform. The possible causes of this trend are discussed in Section 4.7.

3 RESULTS – INDIVIDUAL PROPERTY RISK

Comparing the range in individual returns across segments:

- Shopping centres had the narrowest range in individual property total returns in 2004. Total returns were also relatively uniform in the retail warehouse, Rest UK office and industrial segments.
- At the other extreme, City and West End offices displayed the greatest heterogeneity in 2004; despite, paradoxically, being the smallest markets in geographical terms.
- Total returns on individual standard retails were significantly more varied than those on shopping centres and retail warehouses in 2004.
- The average for the five years shows the same basic story, but with the odd interesting twist. City office returns were relatively uniform in 1988 and a similar phenomenon occurred in the West End in 1991. Conversely, total returns on standard retails were relatively diverse in 1991 and there was a wide range in retail warehouse returns in 2001.

To some extent these variations in the range in individual property returns within each segment can simply be explained by variations in capital growth at the market level. Segments where capital values are rising rapidly, or falling sharply, might exhibit a wider range in individual property returns than segments where capital values are relatively stable, because there is greater uncertainty among valuers about pricing. Table 3.2 shows, for each year, the correlation across market segments between the rate of capital growth and the range in individual property returns within each segment. It also shows the correlation with the difference in capital growth between the year in question and the previous year, This tests whether the range in individual returns is sensitive to either an acceleration or deceleration in capital growth at the market level.

Table 3.2: Correlation between the range in individual property total returns and capital growth at the market level

	1988	1991	1997	2001	2004
Correlation between range in individual returns and change in capital values	0.68	-0.55	-0.22	0.67	-0.24
Correlation between range in individual returns and difference in capital growth between year and previous year	0.30	-0.39	0.34	-0.11	0.91

[1] A negative correlation coefficient may reflect a year when capital values are falling at the market level.

[2] Correlation coefficients are explained in a footnote in the Introduction on page 5.

The correlation coefficients suggest there was some relationship between the range in individual property returns within each segment and the rate of capital growth in 1988, 1991 and 2001. There is also evidence that the range in 2004 was influenced by the rate of acceleration in capital growth.

However, the variation in the range in individual property returns across segments is not just a matter of scaling. Risk at the individual property level is also affected by whether a property is single-let or multi-let, and by the strength of tenant demand. Table 3.3 shows for 2004 the range in individual property returns, the average number of tenancies per property and the proportion of units which were still vacant at the end of the year following a lease expiry during 2004.

3 RESULTS – INDIVIDUAL PROPERTY RISK

Table 3.3: Dispersion in individual property total returns and lease events in 2004.

	Standard deviation in individual property returns %	Average units per property	Vacant units as % of lease expiries by ERV[1]
Std. Retail –South East	15.4	4.1	28
Std. Retail – Rest UK	14.5	3.9	33
Shopping Centres	8.0	73.7	24
Retail Warehouses	11.0	5.4	35
City Offices	28.5	7.0	77
West-End Offices	28.7	6.4	72
Rest of S.E. Offices	12.9	4.4	65
Rest of UK Offices	10.4	6.2	66
Industrial South East	11.6	7.5	53
Industrial Rest UK	10.4	8.6	39
All Property	**16.9**	**7.6**	**48**
Correlation with range	1.00	-0.33	0.64

[1] Strutt & Parker / IPD Lease Events Review 2005

- The relatively homogeneous performance of shopping centres in 2004 was probably in part a function of the high number of tenancies per centre, so that any new letting or vacancy (due to either a lease expiry or default) had only a limited impact on each centre's income stream and valuation.
- The greater diversity in the performance of standard retails in 2004 compared with shopping centres was probably in part due to the lower number of units per property, so that any vacancy had a greater impact on their performance.
- However, perhaps more important than whether a property was single, or multi-let and therefore potentially vulnerable to a lease expiry, was what happened once a lease expired. Data from the *Strutt & Parker / IPD Lease Events Review* suggests that part of the greater variance in individual returns on City and West End offices in 2004 was due to relatively weak tenant demand, so that if a lease expired there was a high probability of a vacancy.
- By contrast, standard retails benefited from a relatively strong occupier market, so that there was a high probability that either the tenant would renew their lease, or that the unit would quickly be re-let. As a result, the range in returns for standard retails was narrower than that for central London offices in 2004, even though a greater proportion of them are single-let.

3.2 Longitudinal results

The alternative longitudinal approach to measuring risk on individual properties is to analyse the volatility in their total returns over time. From the investor's viewpoint this represents the issue of correctly timing their investment and buying a property before its value increases and selling a property before its value declines. The left-hand side of table 3.4 shows the average standard deviation in annual returns on individual properties between end-1994 and end-2004, based upon those properties in the IPD which were held continuously by the same investor over the period. The right-hand side of the table shows the corresponding measure for a larger set of properties which were held between end-1999 and end-2004. (The right-hand set of data is the same as in Table 2.2 in the Methodology).

Table 3.4: Volatility in individual property total returns

	Properties held 1994-2004			Properties held 1999-2004	
	Number of properties	Average std. deviation in individual property returns %		Number of properties	Average std. deviation in individual property returns %
Std. Retail -South East	368	10.2		702	11.6
Std. Retail - Rest UK	418	11.8		741	12.0
Shopping Centres	27	10.1		54	8.0
Retail Warehouses	116	11.0		270	9.6
City Offices	50	10.0		125	13.0
West-End Offices	125	9.8		251	12.9
Rest of S.E. Offices	160	10.6		336	9.7
Rest of UK Offices	88	12.8		207	7.2
Industrial South East	209	11.7		459	8.0
Industrial Rest UK	145	11.0		378	6.8
Other Property	22	11.2		196	14.5
All Property	**1,728**	**11.0**		**3,719**	**10.4**

The results from the 10 year longitudinal analysis are to some extent surprising, because they do not reveal major variations in individual property risk across the different market segments. City and West End offices, which showed the largest dispersion in the cross-sectional analysis, actually emerge as the most stable segments between end-1994 and end-2004, albeit within a tight range. This finding tends to refute the notion that the wide dispersion in individual property returns in the City and West End offices segments is because returns on individual assets swing from one extreme to the other in successive years. Instead, it raises the possibility that the performance of individual central London offices was relatively polarised between 1994 to 2004 and that there was a significant minority of properties which consistently under-performed by a relatively wide margin and a significant minority which consistently out-performed by a relatively wide margin. If this were the case, then it might be explained by differences in the performance of over-rented and reversionary offices in central London during the recovery in office rents between 1994 and 2001.

By contrast, the results from the five year longitudinal analysis present broadly the similar picture as the results from the cross-sectional analysis. The one obvious limitation of these results is that the standard deviations are based on only five annual observations.

- City and West End offices saw the greatest volatility in individual property returns between 1999 to 2004.
- Total returns on individual standard retails were also relatively volatile.
- Shopping centres, provincial offices and industrials had relatively stable returns between 1999 to 2004.

3.3 Correlations across individual properties and with segment benchmarks

Table 3.5 considers two further aspects of the performance of individual properties which ought to have a direct bearing on risk reduction and diversification at the portfolio level. First, the average correlation in annual total returns across properties in the same market segment; second, the average correlation in annual total returns between each property and the weighted average for its segment. The data are again based upon the 1,728 properties in the IPD which were held continuously between end-1994 and end-2004. The results should be regarded as indicative because in certain segments such as shopping centres, or City offices, the number of continuously held properties is quite limited. (See Table 2.2 in Methodology). In addition, the table shows the standard deviation in the individual property correlation coefficients to give an indication of whether they are tightly clustered around the average, or are polarised towards the extremes of 1 and -1.

Table 3.5: Held sample individual property characteristics 1994 to 2004

	Average correlation in returns between individual properties	Standard deviation in correlation coefficients	Average correlation in returns between properties vs segment[1]	Standard deviation in correlation coefficients
Std. Retail -South East	0.22	0.34	0.42	0.33
Std. Retail - Rest UK	0.20	0.35	0.44	0.34
Shopping Centres	0.21	0.33	0.37	0.31
Retail Warehouses	0.27	0.33	0.36	0.34
City Offices	0.29	0.31	0.11	0.35
West-End Offices	0.21	0.33	0.14	0.37
Rest of S.E. Offices	0.22	0.50	0.30	0.33
Rest of UK Offices	0.18	0.37	0.11	0.31
Industrial South East	0.16	0.36	0.28	0.33
Industrial Rest UK	0.16	0.34	0.39	0.31
Other Property	0.23	0.35	0.07	0.32
All Property	**0.18**	**0.34**	**0.41**	**0.30**

[1] Weighted by capital value.

Looking at the correlations across the returns on individual properties:

- In all segments the average correlation in annual total returns across individual properties between 1994 to 2004 was weak, but positive at 0.2-0.3.
- The standard deviations around the average correlation in each segment were also fairly constant at 0.3 to 0.5%. In two thirds of cases, the correlation coefficients between individual properties were between -0.24 and 0.49.
- The correlation coefficients suggest that while the total returns on individual properties move up and down together in the majority of years, it is not the case in every year. The analysis refutes the notion that the returns on individual properties are highly synchronised and rise and fall in parallel.
- The similarity in the correlation coefficients suggest that there are no market segments where the performance of individual properties over time is highly regimented and uniform. By the same token, there are no segments where the performance of individual properties is particularly idiosyncratic over time.

- Another conclusion is that while the breakdown of the property market into 10 segments is helpful, it only explains a small fraction of the variations in returns on individual properties over time. It might be possible to identify a more meaningful 10 segment classification using cluster analysis.

The correlations between the returns on each property and the benchmark for its segment also reveal a high degree of heterogeneity:

- In the retail and industrial segments the average correlation coefficient between the returns on each property and its segment benchmark over the 10 years to end-2004 was weak but positive at 0.30 to 0.45. This meant that the segment benchmark typically explained between 10 to 20% of the variation in the returns on individual retails and industrials.
- In the office sector there was virtually no relationship between the returns on individual properties and the segment benchmark. The average correlation coefficient was between 0.10 and 0.15, meaning that the segment benchmarks typically explained only 1 to 2% of the variation in individual office returns over time. The exception was South East offices where the average correlation coefficient at 0.3 was closer to the norm for retails and industrials.
- One reason why the office benchmarks appear to be less representative could be to do with index construction. The average correlations in Table 3.5 are unweighted by the capital value of the individual properties. By contrast, the segment benchmarks are weighted by capital value, so that more valuable properties have a greater influence. It is conceivable either that the City and West End benchmarks are more influenced by a few very valuable properties than the other segment benchmarks, or that variations in performance between large and small properties are more marked in the office segments. It is notable that the diversification results in Section 4, which are value weighted, don't reveal major differences across sectors.
- In theory, the fact that the Rest UK office benchmark is less representative than the South East office benchmark might simply be because its covers a far bigger geographical area. While the historic performance of Birmingham, Manchester and Glasgow office markets has been relatively homogenous, the Bristol and Edinburgh office markets have tended to follow their own cycles.
- However, differences in geographical coverage don't appear to have been a factor in the standard retail and industrial segments. Moreover, if geography were a major influence then the correlations for the City and West End office markets ought to be relatively high.

3.4 Property vs equities

Table 3.6 puts the dispersion in individual property returns in context by showing the corresponding data for UK equities in 2004. The property data is the same as in Table 1.1 in the Introduction. The equities data is based upon the annual returns of equities which were listed throughout 2004.

Table 3.6: The dispersion in total returns on individual assets in 2004

	Standing investment properties including refurbishments	Equities
Number of assets	10,265	618
95th percentile	38.8	70.5
Upper quartile	24.5	38.6
Median	18.5	19.5
Lower quartile	13.0	6.0
5th percentile	3.5	-24.2
Inter-quartile range	11.5	32.5
Standard deviation	16.9	42.5
Weighted average	18.4	12.8

Source: IPD, FTSE.

Admittedly, the comparison is only for one year and both the ranges for individual property returns and for individual equity returns are probably understated to some extent. The range in property returns is understated because of valuation smoothing. The range in equity returns is understated because the sample excludes new listings, mergers, companies taken private during the year and companies which became insolvent in 2004. (Insolvencies would result in an equity return of -100%).

Putting these caveats to one side, however, the comparison suggests that individual properties typically carry a lower level of total risk than individual equities. It should be noted that the analysis does not identify whether the lower level of risk on individual properties is due to specific risk, or systematic risk. It is conceivable, for example, that the higher level of equity risk is mainly due to the greater volatility of the stockmarket compared with the property market (even allowing for de-smoothing), rather than due to differences in specific risk.

One way of dealing with risk on individual assets is to split their ownership. However, while all equities quoted on the London Stock Exchange have multiple shareholders (this is a basic requirement), the vast majority of properties in the UK are owned by a single investor, or more precisely, held in a single portfolio. (Ultimately, all institutional and quoted property company portfolios are owned by a large number of individual policyholders and shareholders). According to the IPD databank, only 17% of the properties in portfolios at the end of 2005 were leasehold and only 1% of freehold properties were jointly owned. Freehold properties held by a single investor accounted for 82% of all properties. It therefore appears that investors are more concerned with keeping full control over their properties than spreading risk through joint-ownership.

3.5 Conclusions

1. There is a huge variation in individual property returns, both in single years and over time.
2. Although total returns on individual properties in the same segment often move up and down together, they are not highly synchronised.
3. The performance of shopping centres, retail warehouses and industrials has generally been more uniform than the performance of standard retails, City offices and West End offices, both in individual years and over time.
4. Variations in the level of risk across segments appear to reflect a number of factors including the general rate of capital growth, the mix between single and multi-let properties and lease events.
5. In the retail and industrial segments the segment benchmark typically explains between 10 to 20% of the variation in the returns on individual properties. In the office segments, there is virtually no relationship between the returns on individual properties and the segment benchmark.
6. There has been a long-term decline in the level of risk on individual properties, measured in terms of the dispersion of returns in single years.
7. Although individual properties carry a high level of risk, it is lower than the risk on individual equities.

4 RESULTS – PORTFOLIO RISK

This section starts with a review of empirical evidence on portfolio risk reduction, drawing upon the performance of actual funds in the IPD. The section looks at long-term changes in the number of properties in portfolios and how the range in returns across balanced funds has changed over the past 20 years. There is also a detailed cross-sectional analysis of fund performance in 2004, looking at how the ranges in returns vary according to fund type and size.

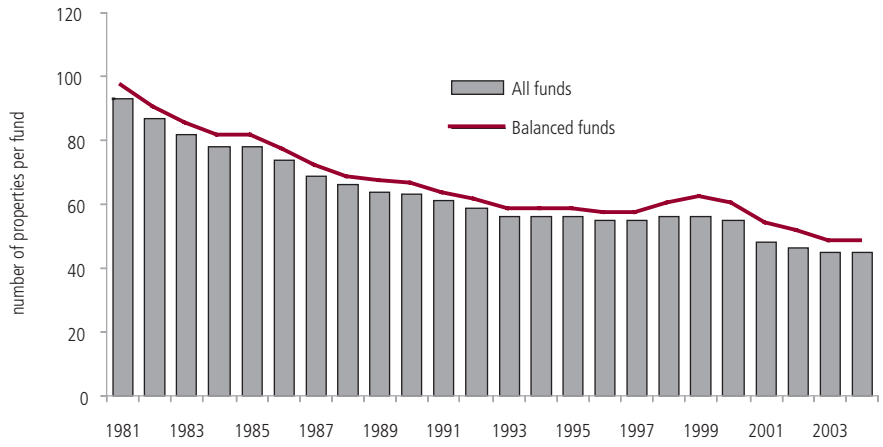
One limitation of the empirical evidence is that the ranges in fund returns are influenced not only by the size of funds, but also by funds' structures and their exposure to different market segments. In order to overcome this problem, the section also presents a series of analyses based upon a large number of hypothetical portfolios which were created by randomly combining actual properties in the IPD using Monte Carlo simulations. The results from the longitudinal simulations investigate the relationship between the number of properties in a fund and volatility in returns and diversification. Diversification is measured both in terms of the R^2 coefficient and by tracking error.

The section also presents the results from the cross-sectional simulations. The research replicates the empirical evidence on the dispersion of fund returns in 2004, but in much greater detail and considers whether the returns on specialist funds ought to be more uniform in some market segments than in other segments. Finally, the section reviews the factors which may explain the long-term narrowing in the range in fund returns; the fall in office weightings, the concentration on large lot sizes, disinflation, the property cycle, the range in returns across different market segments and greater market transparency.

4.1 The long-term trend in the number of properties in portfolios

Despite the risk reduction and diversification benefits associated with having a large number of assets, there has been a steady decline in the number of properties held directly in portfolios. IPD data show that the average number of direct properties in funds covered by the Databank halved from 93 in 1981, to 45 in 2004.

Figure 4.1: Average number of direct properties per fund in the IPD



See Table 4.1 for figures on the average number of properties in balanced funds.

In part the decline in the average number of properties per fund in the IPD sample is simply a by-product of the growth of indirect investment and the proliferation of small specialist limited partnerships and PUTs over the past 10 years. Many of these vehicles have been deliberately set up to split the ownership of a highly valuable property, or to provide exposure to a niche segment of the market and few, if any, have sought to provide a diversified exposure to the whole market.

However, the growth of unlisted vehicles is only part of the story. In addition, the average number of direct properties in balanced funds fell steeply from 97 properties in 1981 to 48 properties in 2004, as institutional investors disposed of smaller lot-size properties such as single-let shops and provincial offices. Superficially, this sharp decline might suggest that the typical balanced fund has become more concentrated and carries a higher level of risk than it did 20 years ago. That decline must be seen, however, in the context of the growth of indirect investment and the fact that many balanced funds now have indirect interests. Indeed, some of the new specialist vehicles were created by the transfer of assets from large balanced funds, which then retained an interest.

On average balanced funds had 1.5 indirect investments at the end of 2004 and the median number of properties in specialist funds was 17. (Specialist funds had an average of 32 properties, but the average is heavily skewed by a few portfolios). Taking the product of the median and the average number of indirect holdings suggests that the average balanced fund had an indirect exposure to 26 properties at the end of 2004. If that estimate is then added to the average number of direct properties (48+26=74), it is apparent that the increase in concentration in balanced portfolios over the last 20 years has been more modest than the figures on direct properties alone suggest.

4.2 Empirical evidence: dispersion in returns on balanced funds

Paradoxically, despite the overall decline in the number of properties in portfolios, the range in total returns across funds has narrowed over the long-term, rather than widened. Table 4.1 shows the upper and lower quartile portfolio return for balanced funds in the IPD for every year from 1985 to 2004.

Table 4.1: The dispersion in portfolio total returns from balanced funds, 1985 to 2004

	Average number of properties	Lower quartile	Median	Upper quartile	Inter-quartile range
1985	81	6.0	8.9	11.7	5.7
1986	77	7.3	10.5	14.0	6.8
1987	72	16.9	21.9	26.8	9.9
1988	68	25.2	29.6	34.4	9.2
1989	67	11.4	16.7	21.5	10.0
1990	66	-10.7	-7.6	-4.1	6.6
1991	63	-4.2	0.7	4.4	8.6
1992	61	-4.3	-0.5	3.1	7.4
1993	58	15.0	20.2	24.2	9.1
1994	58	9.7	12.3	15.4	5.7
1995	58	1.3	3.8	5.7	4.4
1996	57	7.8	9.5	11.1	3.3

1997	57	12.8	15.7	18.0	5.2
1998	60	9.7	11.8	13.5	3.8
1999	62	12.7	14.2	15.8	3.1
2000	60	8.8	10.9	12.7	3.9
2001	54	5.7	7.6	9.2	3.5
2002	51	8.2	10.2	11.9	3.6
2003	48	9.6	11.5	12.9	3.3
2004	48	16.7	18.9	20.6	3.9

Note. Figures are portfolio returns, not managed standing investment returns. The returns in this table reflect the impact of indirects, developments and trading. Returns are un-geared.

- Although the narrowing in fund returns has not been a simple straight-line trend and there have been several interruptions, the long-term pattern is clear. The inter-quartile range in returns across balanced funds shrank from 5.7 percentage points in 1985 to 3.9 percentage points in 2004.

One possible explanation for the narrowing in fund returns might be that the structure of balanced funds has become more uniform over the last 20 years, on the assumption that fund managers have become increasingly obsessed with tracking the IPD Universe. However, figures for balanced funds which measure the average difference in their segment weightings from the IPD Universe is inconclusive and shows only a modest convergence in fund structures (Table 4.2). Many fund managers still appear to be willing to place large sector 'bets' against the IPD. Instead, it seem more likely that the long-term narrowing in the range in fund returns is closely linked to the parallel narrowing in the range in individual property returns noted in Section 3. This phenomenon is discussed in more detail in Section 4.7.

Table 4.2: Average difference in fund weightings from IPD Universe balanced funds 1995 to 2004

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Average difference	8.3	8.4	8.3	8.1	7.9	7.8	7.6	7.5	7.4	7.3

The data show the average absolute difference in the structure of funds' weights relative to the IPD Universe, based upon eleven standard market segments.

4.3 Empirical evidence: variations in the dispersion in returns in 2004 balanced vs specialist funds and large vs small funds

Figure 4.2 divides the 231 funds in IPD in 2004 into specialist funds focused on one sector and balanced funds and then further sub-divides the balanced funds into large and small portfolios. The data are the ungeared total returns on standing investments, excluding the impacts of trading and development and the contribution from indirect holdings. The weighted average total return was 18.4% in 2004.

As might be expected, the specialist funds tended towards either extreme, reflecting their concentration on a single sector and the range in returns across different market segments, such as retail warehouses and Central London offices. Looking at the balanced funds, it is possible to see circumstantial evidence of a relationship between fund size and risk, with the larger balanced funds being more bunched in the middle of the distribution than the smaller balanced funds.

Figure 4.2: Dispersion in fund total returns in 2004

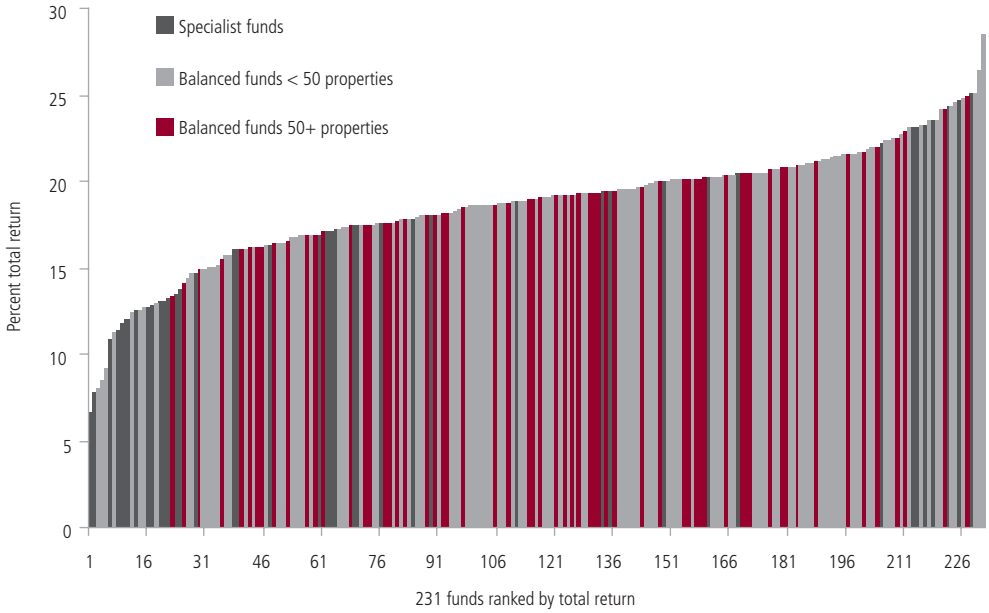


Table 4.3 quantifies the relationship between risk and number of properties by measuring the range in individual fund return in 2004 for portfolios of different sizes. Focusing on balanced funds, the table shows a clear inverse relationship, with the standard deviation in returns in 2004 among the larger funds with 150+ properties at just a quarter of the range in returns among balanced funds with fewer than 10 properties. (The results suggest that a small balanced fund is an oxymoron).

Table 4.3: Number of properties and the range in fund returns in 2004

Number of properties	Number of funds	Standard deviation in returns in 2004[1]	Average total return[2]
Specialist funds			
<10	19	4.5	15.1
10+	23	4.3	18.2
Balanced funds			
<10	8	5.5	15.8
10-24	54	3.3	19.3
25-49	66	2.7	19.2
50-74	25	2.7	18.8
75-149	27	2.4	18.9
150+	9	1.4	19.6

[1] Standard deviation in individual fund returns in 2004.
[2] Unweighted average.
[3] On average there were 32 properties in specialist funds in 2004, although the average is heavily skewed by a few portfolios. Half of the specialist funds had fewer than 10 properties.

4 RESULTS – PORTFOLIO RISK

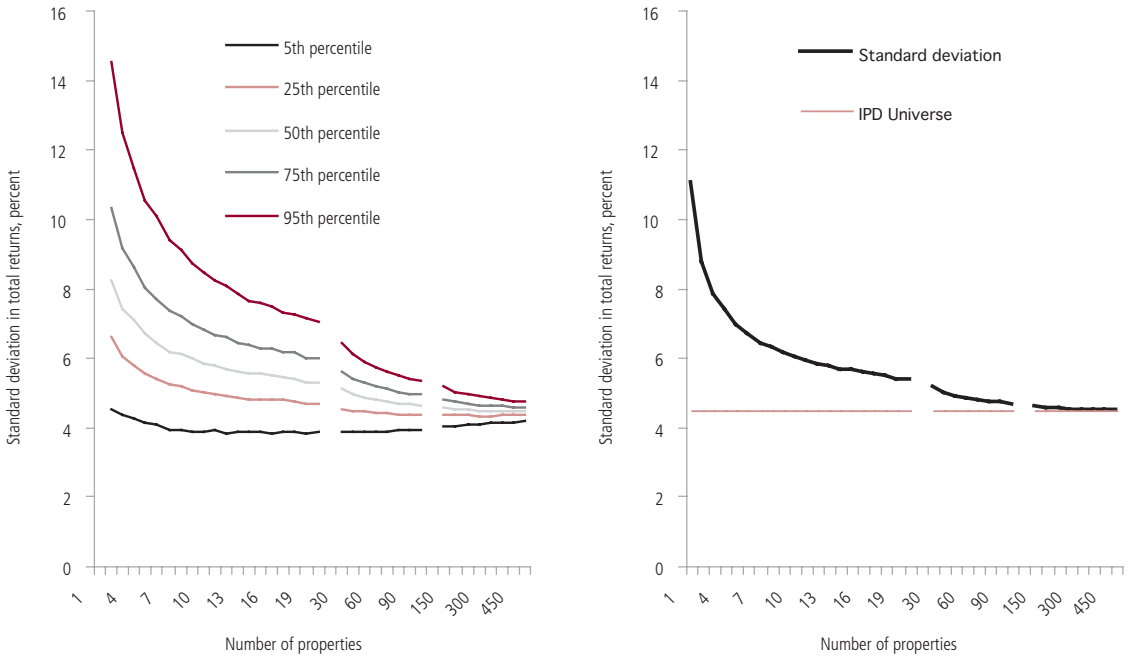
Despite the sample of 231 funds in the IPD in 2004, it is not possible using data on actual funds to fully test the relationship between the number of properties and risk, where risk is defined as the standard deviation in returns. The main limitation is that even among the balanced funds, there are significant variations in their exposure to different market segments, so that the range in fund returns is not simply a function of the number of properties. For example, large balanced funds typically have a much higher exposure to central London offices than smaller balanced funds and the range in individual property returns tend to be greater in central London than in other market segments (see Table 3.1 in Section 3).

4.4 Longitudinal simulations: risk reduction at the All Property level 1994 to 2004

In order to investigate further the relationship between the number of properties in a portfolio and volatility, it was decided to create a large number of hypothetical portfolios composed of actual properties and measure their standard deviation in returns over the 10 years to end-2004. The approach relies upon identifying a sample of actual properties in the IPD which had been held continuously between 1994 to 2004 and then randomly combining them to create thousands of hypothetical portfolios of different sizes. The simulations were run firstly for single properties and then for portfolios with two properties, portfolios with three properties and so on, up to portfolios with 500 properties (see Methodology).

The left-hand chart below shows the range in the volatility of returns for balanced funds of different sizes. Some portfolios with only a handful of properties saw relatively stable returns – recording a standard deviation of 4% over the 10 years. But some small portfolios had very volatile returns – recording a standard deviation of more than 12%. What the chart demonstrates is that as the number of properties in portfolios increased, so the incidence of funds with very volatile returns decreases.

Figure 4.3: Standard deviation in total returns 1994 to 2004 for simulated portfolios



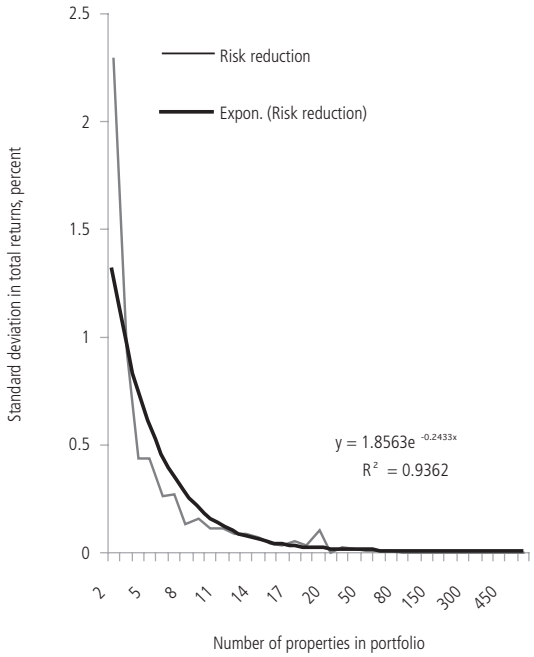
Note: The gaps in the lines reflect changes in the intervals at 20 and 100 properties.

The right-hand chart above shows the average of the standard deviations in 10 year total returns for balanced funds of different sizes. The chart also shows the standard deviation in annual returns on the IPD Universe of 4.5%.

- On average, portfolios with one property had a standard deviation in total returns over the 10 years to end-2004 of 11.0%. (See Table 3.4 in Section 3).
- Adding a second property to create a two property portfolio produces the single biggest reduction in risk. On average, the standard deviation in total returns for a two property portfolio was 8.8%.
- On average, the standard deviation declined to 6.9% for a portfolio with five properties and 6.0% for a fund of 10 properties.
- At 20 properties, the average standard deviation in total returns over the 10 years to end-2004 was 5.5%, half that for a portfolio of one property. The standard deviation declined to 4.9% for a fund with 50 properties and 4.7% for a portfolio with 100 properties.
- On average portfolios with 250 properties had a standard deviation in annual returns of 4.5% between 1994 to 2004. While this was equal to the volatility of the IPD Universe over the 10 years, their returns still differed from the IPD Universe in individual years, so that the funds still recorded a tracking error.

The left-hand chart below shows the reduction in the average standard deviation in returns which occurred as each extra property was added to the hypothetical portfolios. It underlines the fact the marginal rate of risk reduction diminishes as more properties are added to portfolios. (The data has been adjusted for the change in intervals at 20 and 100 properties. Increases of one property at a time were used for portfolio sizes of one to 20 and then the simulation increased in steps of 10 up to 100 properties and of 50 up to portfolios of 500 properties in size).

Figure 4.4: Risk reduction: The change in the standard deviation in total returns 1994 to 2004



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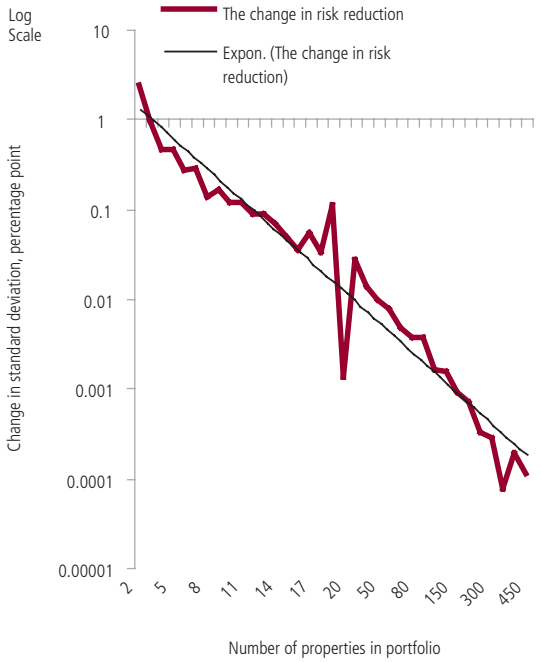
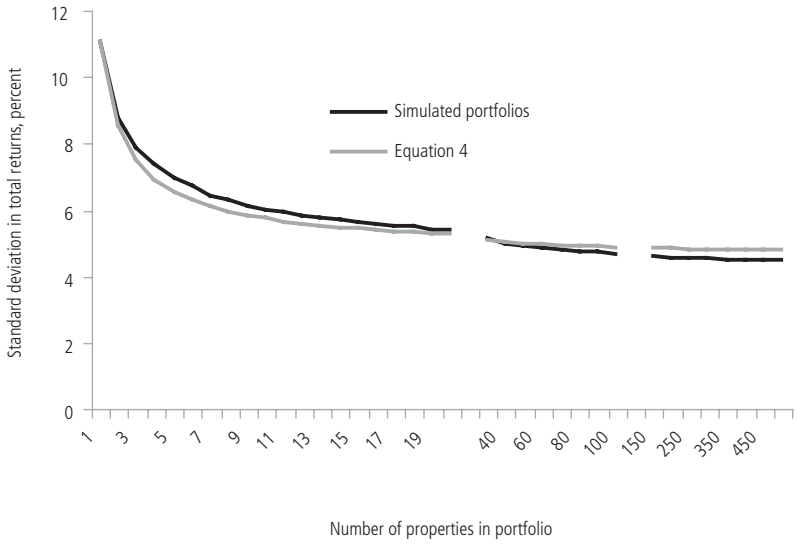


Yet, although the marginal rate of risk reduction diminishes as more properties are added, it never reaches zero. Adding another property is always beneficial. The right-hand chart above measures the change in the change (i.e. the second differential) by plotting the rate of change in the standard deviation on a log scale. The chart reveals that the rate at which the marginal rate of risk reduction slows is relatively constant and it does not suddenly slow once a portfolio reaches a certain number of properties. It is therefore not possible to identify a single threshold at which a portfolio can be said to have reached critical mass in terms of risk reduction.

It should be noted that the simulations behind these results were based on picking properties at random from the IPD and the results therefore reflect a neutral, or naive approach to diversification. In practice, fund managers of balanced funds take an informed (sometimes termed efficient) approach and will consider the structure of their existing portfolio, in terms of sector and location, before making further acquisitions. It is therefore likely that the results understate the reduction in risk achieved by adding more properties to an actual portfolio, where fund managers deliberately avoid choosing too many properties which share the same characteristics.

Figure 4.5 compares the average standard deviation on portfolios of different sizes with the results produced by Equation 4 on risk reduction in the Literature Review. Equation 4 uses the average standard deviation in returns on a single property (11.0%) and the average correlation across individual properties (0.18). Part of the difference arises because Equation 4 assumes equal weighting of properties, whereas the properties in the hypothetical funds were weighted according to their capital value. The difference between the two lines on portfolios of over 40 properties suggests that, on balance, the correlations between large, valuable properties are weaker than the correlations between smaller, less valuable properties[1].

Figure 4.5: All Property risk reduction: Practice and theory



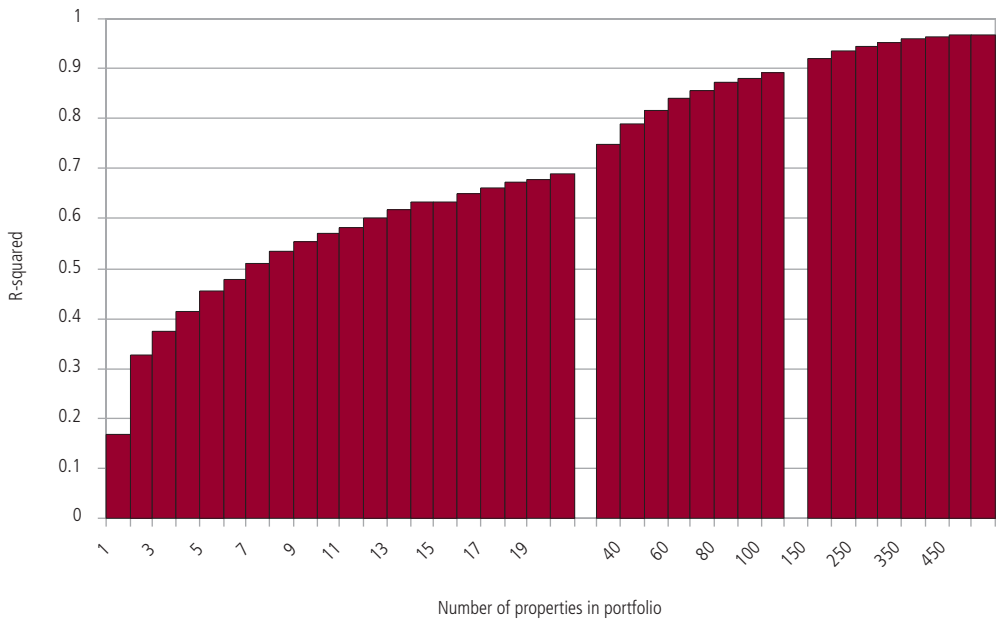
[1] Please note that while this difference may exist at the all property level, it may not apply in individual market segments. At the All Property level the set of large, valuable properties could be drawn from several different segments such as shopping centres and central London offices. The set of small, less valuable properties could include shops and provincial offices.

4.5 Longitudinal simulations: Diversification at the All Property level 1994 to 2004

The longitudinal simulations used to compile the results on risk reduction were also used to measure diversification. Whereas the former is concerned with the reduction of both market risk and specific risk, diversification is purely concerned with the reduction of specific risk. Diversification is classically measured by the square of the correlation coefficient (R^2) between a portfolio's total returns and the market's total returns over time. If all of the variation in a portfolio's returns is explained by the market (R^2 =1), then it is only influenced by systematic risk and is fully diversified because there is no specific risk left in the portfolio. (See Introduction).

Figure 4.6 presents the results of measuring diversification for hypothetical balanced portfolios of different sizes against the IPD Universe between 1994 and 2004. The hypothetical funds were created by randomly combining actual properties which had been held continuously in the IPD over the 10 years to end-2004.

Figure 4.6: Diversification at the All Property level 1994 to 2004



Note: The gaps in the lines reflect changes in the intervals at 20 and 100 properties.

Table 4.4: Diversification at the All Property level 1994 to 2004

	Number of properties in hypothetical portfolios							
	1	5	10	20	50	100	200	400
R-squared	0.17	0.45	0.57	0.69	0.82	0.89	0.94	0.96

Unsurprisingly, large funds track the market more closely than small funds, because a greater proportion of their specific risk has been diversified.

- The IPD Universe typically explained 45% of the variation in returns on a balanced portfolio of five properties between 1994 and 2004.
- A portfolio of 20 properties ought to reflect 69% of the variation in the market, while a portfolio of 50 properties should reflect 82% and a portfolio of 100 properties should reflect 89% of the variation in the market.
- In order to achieve a 95% level of diversification a fund would need 300 properties.

Another perhaps more familiar way of looking at diversification is to measure tracking error. Table 4.5 measures tracking error for the hypothetical portfolios relative to the IPD Universe between 1994 and 2004. Tracking error is defined as the standard deviation in the differences in individual annual returns between a fund and its benchmark[1]. The results are virtually the mirror image of the R^2 results in figure 4.6.

Table 4.5: Tracking error of hypothetical funds relative to IPD Universe 1994 to 2004

Number of properties	Average tracking error		Number of properties	Average tracking error
2	7.59		30	2.58
3	6.48		40	2.30
4	5.91		50	2.09
5	5.35		60	1.92
6	5.02		70	1.81
7	4.67		80	1.70
8	4.44		90	1.61
9	4.23		100	1.54
10	4.06		150	1.30
11	3.92		200	1.14
12	3.78		250	1.04
13	3.64		300	0.97
14	3.52		350	0.90
15	3.47		400	0.86
16	3.37		450	0.82
17	3.28		500	0.78
18	3.21			
19	3.13			
20	3.06			

[1] Please note that tracking error is not simply the difference between a fund's standard deviation in returns and the standard deviation in the benchmark. The vertical distance in the right-hand chart in Figure 4.3 between the average standard deviation and the IPD Universe is not therefore a measure of tracking error.

- The average tracking error for a fund with 20, 50 and 100 properties was 3.1 percentage points, 2.1 percentage points and 1.5 percentage points per year, respectively.

It is clear from both the figures on tracking error and the R^2 results that the only absolute answer to the question of how many properties are required to track the market is the entire population of all investment properties. In practice the right size for a portfolio depends on the risk tolerance of the fund's investors and the degree of importance they place on tracking the benchmark average return. Unlike in sampling theory where percentages are used to reflect the degree of confidence in the results, there is no particular significance to achieving a 90%, or 95% level of diversification.

Table 4.6: Diversification R-squared segment results 1994 to 2004

	Number of properties in hypothetical portfolios							
	1	**5**	**10**	**20**	**50**	**100**	**200**	**400**
Std. Retail –South East	0.18	0.58	0.69	0.78	0.88	0.93	0.96	-
Std. Retail – Rest UK	0.19	0.67	0.78	0.86	0.94	0.97	0.99	1.00
Shopping Centres[1]	0.13	0.65	0.74	0.80	-	-	-	-
Retail Warehouses	0.13	0.63	0.73	0.81	0.89	0.92	-	-
City Offices[1]	0.01	0.61	0.75	0.85	0.91	-	-	-
West-End Offices	0.02	0.66	0.74	0.82	0.90	0.94	-	-
Rest of S.E. Offices	0.09	0.57	0.70	0.81	0.90	0.93	-	-
Rest of UK Offices	0.01	0.47	0.59	0.71	0.84	-	-	-
Industrial South East	0.08	0.61	0.75	0.86	0.94	0.97	0.98	-
Industrial Rest UK	0.15	0.56	0.68	0.81	0.91	0.95	-	-
All Property	**0.17**	**0.45**	**0.57**	**0.69**	**0.82**	**0.89**	**0.94**	**0.96**

[1] Results for shopping centres and City offices are limited by small number of held properties.
Note that the R^2 figures for a one property portfolio are the square of the correlations for individual properties vs segment in table 3.5 in section 3.

Table 4.6 takes the analysis a step further to investigate whether diversification is easier to achieve in some market segments than others. The results should be regarded as indicative because in certain segments such as shopping centres, or City offices, the number of properties held continuously in the IPD between 1994 and 2004 is quite limited. (See table 2.2 in the Methodology).

- The results for portfolios with 10 or more properties are fairly uniform and dispel the notion that diversification should be easy to achieve in some segments and relatively difficult in other segments.
- By implication the R^2 results suggest that there should not be much variation across segments in the tracking error of specialist funds.

- The segment level results don't conform to the pattern which emerged from the analysis of the average correlation coefficient between individual property returns and their segment benchmark (Table 3.5 in Section 3). Those results implied that diversification ought to be significantly harder in the office sector than the retail and industrial sectors. It is possible, however, that the average correlation coefficients for offices were distorted by a few very valuable properties which had an undue influence on the office benchmarks.
- Although the differences are subtle, the data for offices and industrials suggest that diversification is slightly easier to achieve in the South East segment than in the Rest of the UK segment. This could simply be a function of geography. However, results for standard retail suggest the opposite.
- In general, diversification is slightly harder to achieve at the All Property level than in individual segments because the IPD Universe reflects the variation in returns across different market segments.

Table 4.7 presents the same results, but in a different format. The change in format doesn't alter the conclusion that the number of properties required to achieve diversification is fairly similar in most segments. The only segment that stands out is the Rest of the UK office market.

Table 4.7: The number of properties required to achieve diversification 1994 to 2004

	Number of properties required to achieve diversification of:				
	50%	**66%**	**75%**	**90%**	**95%**
Std. Retail –South East	3	8	16	70	150
Std. Retail – Rest UK	2	5	9	30	70
Shopping Centres[1]	3	6	12	-	-
Retail Warehouses	3	7	12	60	-
City Offices[1]	3	7	10	40	-
West-End Offices	3	6	11	60	-
Rest of S.E. Offices	4	9	14	60	-
Rest of UK Offices	6	15	30	-	-
Industrial South East	3	7	11	40	70
Industrial Rest UK	4	9	15	50	100
All Property	**7**	**17**	**30**	**150**	**300**

[1] Results for shopping centres and City offices are limited by small number of held properties.

Table 4.8: The cost of achieving diversification based on capital values at end-2005

	Average capital value	Estimated portfolio capital value £million required to achieve diversification of:				
	£million end-2005	50%	66%	75%	90%	95%
Std. Retail –South East	6.9	21	55	110	483	1,035
Std. Retail – Rest UK	6.7	13	33	60	200	468
Shopping Centres[1]	84.9	255	509	1,018	-	-
Retail Warehouses	24.9	75	174	299	1,494	-
City Offices[1]	22.2	67	155	222	887	-
West-End Offices	16.2	49	97	178	970	-
Rest of S.E. Offices	15.6	62	141	219	937	-
Rest of UK Offices	9.9	59	148	296	-	-
Industrial South East	9.4	28	66	103	375	657
Industrial Rest UK	6.1	24	55	91	303	606
All Property	**13.4**	**94**	**227**	**401**	**2,007**	**4,015**

[1] Results for shopping centres and City offices are limited by small number of held properties.

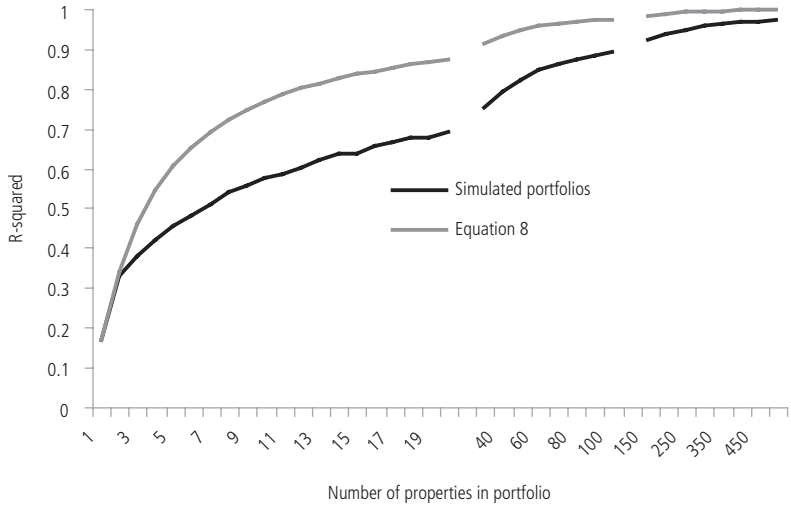
If, however, the issue is how much does it cost to achieve diversification, taking into account variations in lot sizes, then a quite different picture emerges. Table 4.8 is based upon the average lot-size of properties at end-2005.

- The cost of creating a specialist standard retail, or industrial fund which was 75% diversified against its benchmark would be around £100 million at end-2005 capital values.
- The cost of constructing a specialist retail warehouse, or office, fund which was 75% diversified against its benchmark would be significantly higher at £200 to 300 million and the cost of a specialist shopping centre fund would be £1 billion at end-2005 capital values.

Figure 4.7 compares the simulation results on diversification with the results produced by Equation 8 in the *Literature Review.* Equation 8 uses the average standard deviation in returns on a single property (11.0%) and the average correlation between individual properties and the benchmark (0.41). Both averages are unweighted. Part of the difference arises because Equation 8 assumes equal weighting of properties, whereas the properties in the hypothetical funds were weighted according to their actual capital value. The difference between the two lines implies that on balance, large, valuable properties were less closely correlated with the IPD Universe between 1994 and 2004 than smaller, less valuable properties[1].

[1] Please note that while this difference may exist at the all property level, it may not apply in individual market segments. See footnote on page 26.

Figure 4.7: All Property diversification: Practice and theory



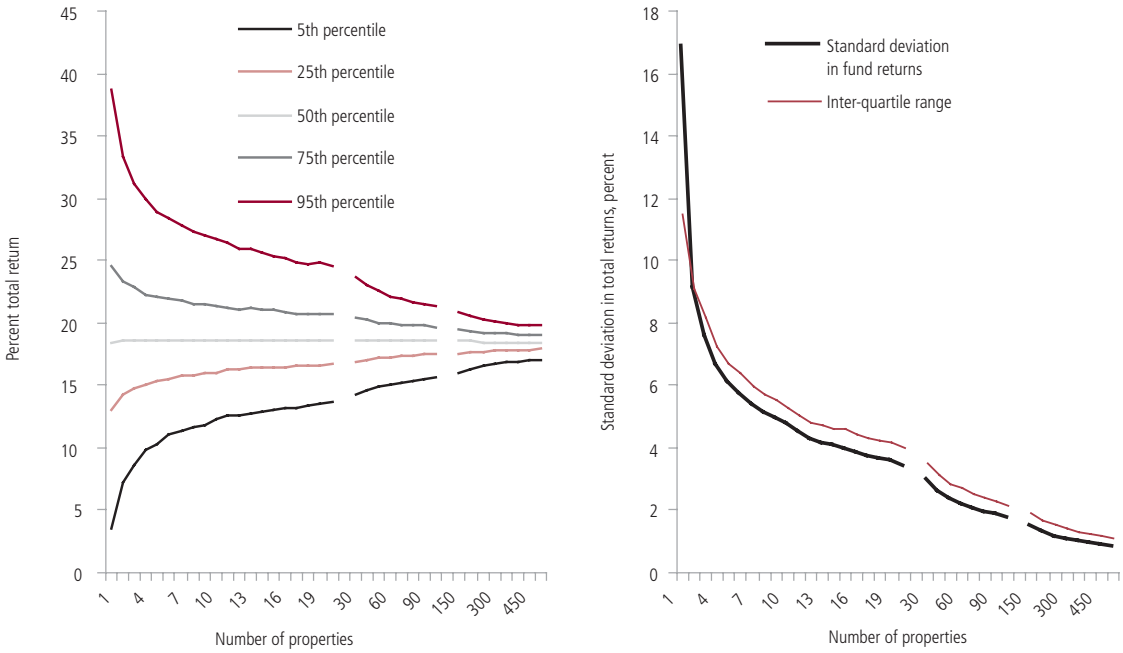
Note: The gaps in the lines reflect changes in the intervals at 20 and 100 properties.

4.6 Cross-sectional simulations: Range in fund returns at the All Property and segment level in 2004

In addition to measuring volatility over time, research was also undertaken into the dispersion of fund returns in a single year. Again the research depended upon constructing a large number of hypothetical portfolios by randomly combing actual properties in the IPD. The main difference with the longitudinal simulations is that the cross-sectional simulations could sample from all the properties in the IPD in a single year (over 10,000), rather than just those which had been held continuously for a long period. It was therefore possible to repeat the simulations for every segment of the market, as well as at the All Property level. (See Methodology).

The left-hand chart below presents the results of simulating total returns in 2004 for hypothetical portfolios of different sizes. In effect it replicates the empirical results for balanced funds in section 4.3, but in much greater detail. The average total return on standing investments in 2004 was 18.4% and even with just one property the median return from the 20,000 simulations almost exactly matched the average. The really interesting information, however, is how the range in returns around the average narrows as the number of properties in portfolios increases. The right-hand chart measures the range in portfolio returns in 2004 in terms of standard deviations.

Figure 4.8: Standard deviation in total returns in 2004 for simulated portfolio



Note: The gaps in the lines reflect changes in the intervals at 20 and 100 properties.

To a large extent, the cross-sectional results on changes in the range in fund returns in 2004 echo those on risk reduction from the longitudinal simulations. Thus, adding a second property produces the single biggest narrowing in the range in fund returns, cutting the standard deviation from 16.9% on individual properties to 9.1% for two property portfolios. Thereafter, the range in fund returns narrows as funds get bigger, but at a diminishing rate. The data in the right-hand chart are also presented at the All Property level in Table 4.7. (Although the narrowing in the range in fund returns may be thought of as a form of risk reduction, we have deliberately avoided using the term here in order to avoid confusion with longitudinal risk reduction ie the less volatile performance of large funds over time, compared with small funds – see Section 4.4).

Table 4.9 shows both the all property results for balanced portfolios and the corresponding ranges for hypothetical specialist funds in each market segment. One advantage of constructing a large number of hypothetical portfolios is that it makes it possible to investigate whether returns on specialist fund returns are more uniform in some segments than other segments. This is not possible using empirical data because some segments only have a handful of specialist funds (e.g. Rest UK offices). The averages in the middle of the table are based upon analyses for 1988, 1991, 1997, 2001 and 2004. The four earlier years were selected as turning points in the property cycle. The figures for one property are the same as those in Table 3.1 in Section 3 on individual property risk.

Table 4.9: Range in total returns for portfolios of different sizes, by market segment

	Number of properties in hypothetical portfolio					
	1	5	10	20	50	100
2004 – Standard deviation in returns on hypothetical portfolios						
Std. Retail –South East	15.4	6.3	4.7	3.6	2.4	1.7
Std. Retail – Rest UK	14.5	5.4	4.0	3.0	2.0	1.4
Shopping Centres	8.0	3.9	2.7	1.9	1.1	0.7
Retail Warehouses	11.0	5.7	4.5	3.2	2.2	1.5
City Offices	28.5	6.0	3.9	2.8	1.9	1.3
West-End Offices	28.7	6.6	4.9	3.5	2.2	1.4
Rest of S.E. Offices	12.9	5.7	4.0	2.8	1.7	1.2
Rest of UK Offices	10.4	4.7	3.4	2.3	1.5	1.0
Industrial South East	11.6	4.9	3.4	2.3	1.6	1.1
Industrial Rest UK	10.4	5.0	3.9	2.9	1.8	1.3
All Property	**16.9**	**6.1**	**4.7**	**3.4**	**2.3**	**1.7**
Average of Five Years – Standard deviation in returns on hypothetical portfolios						
Std. Retail –South East	22.4	8.3	6.3	4.8	3.2	2.3
Std. Retail – Rest UK	21.1	7.4	5.5	4.0	2.6	1.8
Shopping Centres	11.3	5.8	4.1	3.0	1.8	1.1
Retail Warehouses	16.8	7.0	5.2	3.7	2.4	1.6
City Offices	32.9	9.5	5.7	4.0	2.5	1.7
West-End Offices	26.7	9.5	6.5	4.6	2.9	2.0
Rest of S.E. Offices	18.4	8.5	6.4	4.7	3.1	2.2
Rest of UK Offices	19.1	7.6	5.8	4.3	2.7	1.9
Industrial South East	17.2	6.7	4.9	3.6	2.4	1.7
Industrial Rest UK	13.9	6.7	5.0	3.6	2.4	1.6
All Property	**23.6**	**9.3**	**7.2**	**5.6**	**3.9**	**2.9**
Average of Five Years - Ranking of standard deviation in returns (out of 10 segments)						
Std. Retail –South East	8	7	8	10	10	10
Std. Retail – Rest UK	7	5	5	6	6	6
Shopping Centres	1	1	1	1	1	1
Retail Warehouses	3	4	4	4	3	2
City Offices	10	10	6	5	5	4
West-End Offices	9	9	10	8	8	8
Rest of S.E. Offices	5	8	9	9	9	9
Rest of UK Offices	6	6	7	7	7	7
Industrial South East	4	3	2	2	4	5
Industrial Rest UK	2	2	3	3	2	3

Focusing on the average results for the five years:

- In all segments the range in fund total returns narrows as more properties are added to portfolios.
- Specialist shopping centre funds ought to have the most uniform total returns.
- The simulation results suggest that total returns on specialist funds in the retail warehouse and industrial segments should also be relatively uniform.
- By contrast, there will tend to be a greater range in fund total returns on specialist funds in the South East retail segment and in the West End office and South East office segments.
- City offices present the most intriguing results, suggesting that whereas returns on small specialist City funds ought to be relatively divergent, returns on large City office funds will tend to be quite uniform.
- In general the range in specialist fund returns was smaller than the range in balanced fund returns (ie the all property level results), because the range in balanced fund returns is stretched by variations in performance across different sectors of the property market.

Table 4.10 measures the narrowing in the range in fund returns which occurred as additional properties were added to the hypothetical portfolios. The narrowing in the range in fund returns per additional property is expressed as a percent to control for the different starting point of each segment (ie the standard deviation in returns on a single property).

Table 4.10: Percent narrowing in the range of fund returns per additional property; by market segment and based upon average of five years

	Number of properties in hypothetical portfolio				
	From 1 To 5	From 5 To10	From 10 to 20	From 20 to 50	From 50 to 100
Std. Retail –South East	15.7	4.9	2.4	1.1	0.6
Std. Retail – Rest UK	16.2	5.2	2.7	1.2	0.6
Shopping Centres	12.2	5.7	2.8	1.3	0.7
Retail Warehouses	14.5	5.3	2.8	1.2	0.7
City Offices	17.8	8.0	3.0	1.2	0.7
West-End Offices	16.1	6.3	2.9	1.2	0.6
Rest of S.E. Offices	13.4	5.1	2.6	1.1	0.6
Rest of UK Offices	15.1	4.8	2.6	1.2	0.6
Industrial South East	15.2	5.3	2.8	1.1	0.6
Industrial Rest UK	12.9	4.9	2.8	1.2	0.6
All Property	**15.1**	**4.4**	**2.3**	**1.0**	**0.5**

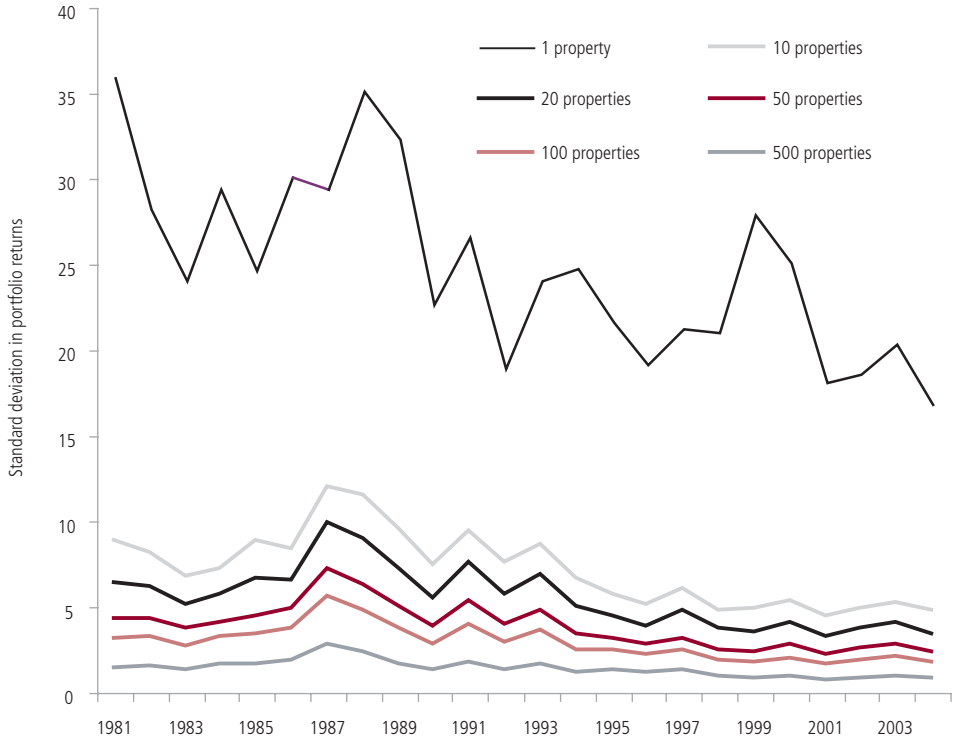
- In general the rate at which the range in returns on hypothetical specialist funds narrowed as more properties were added to portfolios was fairly uniform across segments.
- The exception was City offices were the range in returns narrowed more rapidly between one and 20 properties than in other segments.

4.7 Cross-sectional simulations: Range in fund returns at the All Property level 1981 to 2004

The cross-sectional simulations were repeated at the All Property level for every year from 1981 to 2004. The key finding which emerges from this analysis, and also from the empirical evidence in Section 4.2, is that the range in fund returns has narrowed over the long-term for portfolios of all different sizes. The main inference is that funds now carry less risk than they used to be.

- The standard deviation in returns on individual properties (the range across the middle 68% of properties assuming a normal distribution) halved from 36% in 1981 to 16.9%.
- The corresponding figures for larger portfolios show a parallel shrinking in the range in hypothetical portfolio returns. Thus the standard deviation in total returns on portfolios with 20 properties fell from 8.8% in 1981 to 4.7% in 2004. The standard deviation in returns on 100 property portfolios shrank from 3.2% to 1.7% over the same period.
- Although the long-term pattern is clear, the downward trend was interrupted in the late 1980's and again in the late 1990's.

Figure 4.9: Standard deviation in returns for hypothetical portfolios of different sizes, 1981 to 2004



4 RESULTS – PORTFOLIO RISK

Why has the range in fund returns narrowed over the long-term? The study examined six potential explanations; two are concerned with changes in the types of properties held by IPD investors (ie sampling by those investors) and four look at the possible impacts of changes in the behaviour of the overall property market and the macro-economy. Table 4.9 shows the correlation coefficient (R) and the R^2 between each of these potential explanations and the standard deviation in returns on individual properties and for portfolios of 10, 20, 50, 100 and 500 properties.

1) Fall in the weighting of offices in portfolios. The office sector's share of the total capital value of balanced funds fell from 54.2% in 1981 to 30.3% in 2004. The corollary has been the growth in the weighting of the retail sector from 27.2% to 51.0%. This change in structure may impact on the All Property results, because the analysis of individual property returns (see Tables 3.1 and 3.3 in Section 3) shows that there is generally a wider range in office returns than in retail returns. There is a relatively high correlation coefficient between the narrowing in the range in all property returns and the fall in the office weight and the R^2 figures suggest that the latter may explain 50 to 60% of the variation in the former. However, the fall in the relative importance of offices is clearly not the complete explanation and it doesn't explain why the range in returns within the office market have shrunk over time - see Figure 4.10. (Results at the segment level are only available for five selected years).

Figure 4.10: Standard deviation in returns on hypothetical office funds with 20 properties

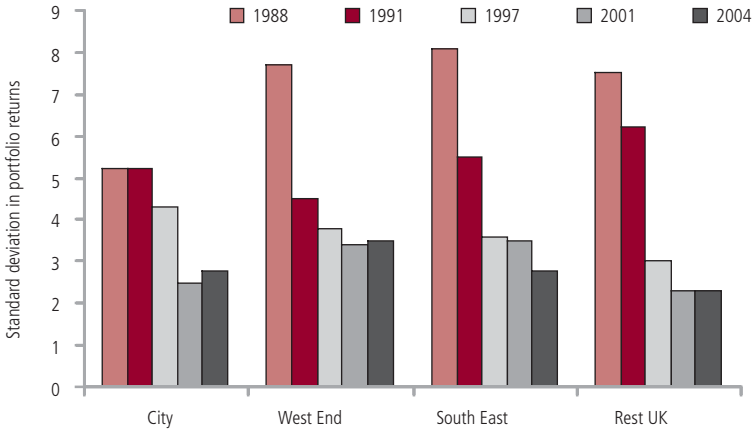


Table 4.11: Testing the relationship between the change in the range in returns on a portfolio with 20 Properties and six potential explanatory variables, 1981 to 2004.

	Correlation coefficient R	R^2
Decline in office weight	0.78	0.60
Sale of smaller lot-sizes	-0.68	0.47
Inflation	0.44	0.20
Property cycle – total returns	0.33	0.11
Property cycle – rental growth	0.41	0.17
Range in segment returns	0.67	0.45
Market transparency	0.68	0.47

Note. The R^2 figure shows how much of the narrowing in the range in total returns on hypothetical portfolios between 198 to 2004 is explained by the argument. The lot size series was adjusted for market movements in capital values.

2) Concentration on larger lot-size properties. Another possibility is that the tighter range in portfolio returns reflects the decision by funds to sell smaller lot-size properties and concentrate on more valuable properties. This would influence the range in returns because the performance of large properties tends to be more homogeneous than that of small properties. (Table 4.12) The average lot-size of properties in the IPD increased almost nine-fold from £1.3 million in 1981 to £11.4 million in 2004, way ahead of the general increase in market capital values (232%). This equates to a four fold increase in the average lot size, in constants capital values terms. The R^2 figures in Table 4.11 suggest that the weeding out of smaller properties may explain 40 to 50% of the narrowing in the range in portfolio returns.

Table 4.12: Relationship between standard deviation in returns on individual properties in 2004 and capital value at end-2004

	Capital value end-2004			
	Smallest lot size	Second quartile	Third quartile	Largest xlot size
Std. Retail –South East	14.7	20.5	10.9	10.2
Std. Retail – Rest UK	23.3	10.8	9.7	9.6
Shopping Centres	10.2	10.8	9.0	5.8
Retail Warehouses	15.0	11.2	14.4	9.9
City Offices	54.1	11.5	10.5	7.4
West-End Offices	73.8	14.3	9.7	12.8
Rest of S.E. Offices	17.2	12.0	11.3	8.7
Rest of UK Offices	18.0	11.2	10.7	8.9
Industrial South East	15.5	12.2	9.3	7.6
Industrial Rest UK	21.1	11.0	9.7	9.4
xOther Property	77.6	26.5	11.9	14.4
All Property	**45.8**	**15.5**	**10.9**	**10.7**

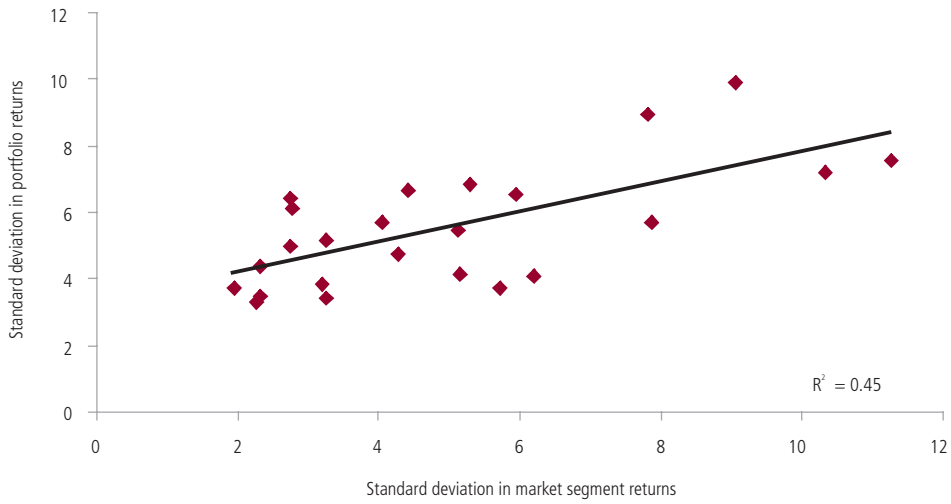
3) Disinflation. Although the long-term narrowing in the range in portfolio returns has coincided with a major slowdown in the rate of general inflation in the economy, disinflation does not appear to have been a major influence. The main reason why inflation might affect the range in returns around the average return, as well the average itself, is if there were greater uncertainty about capital values when prices in the economy as a whole are rising rapidly. Conversely, there ought to be a greater consensus about capital values when the general rate of inflation in the economy is low. However, while the hypothesis is plausible the evidence is not compelling. The standard deviation in fund returns peaked in 1988, two years ahead of the peak in inflation in 1990 and the correlation analysis in Table 4.11 suggests that the relationship with disinflation is relatively weak.

4) The property cycle. It might be argued that changes in the range in portfolio returns are related to upswings and downswings in capital values. The widening in the range of returns in the late 1980s coincided with a boom in the market and the subsequent collapse of the early 1990s saw a distinct narrowing in the range. These fluctuations in the range could be related to differences between the prime and secondary ends of the market, with capital growth on secondary properties over-taking that on prime properties during a boom as a scarcity of space forces occupiers into less attractive space. However, while there may be a grain of truth in this hypothesis, it might

also be expected that secondary properties would suffer more in a downturn, so that the range in returns would remain wide and would not narrow. The correlation analysis in Table 4.11 suggests that the long-term narrowing in the range in returns is not strongly related to either total returns, or rental growth.

5) The Range in returns across different market segments. A more powerful explanation for the long-term narrowing in the range in portfolio returns is that the performance of different segments of the property market has become more uniform. Figure 4.11 plots the range in portfolio returns for a portfolio with 20 properties against the range in segment returns. Each dot represents an individual year. The relationship is significant and the R^2 figures in Table 4.9 suggest that the range in segment returns explains roughly 40% of the long-term narrowing in the range in portfolio returns.

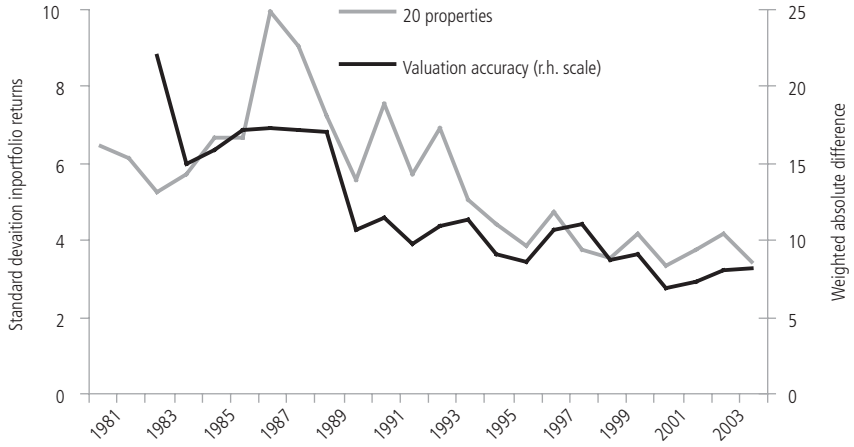
Figure 4.11: Standard deviation in returns on hypothetical funds with 20 properties



Taking a long-term view, the range in market segment returns has generally been a function of variations in rental growth and therefore variations in the dynamism of the different economic sectors which drive property demand and variations in the volume of new development across sectors. The major divergence in segment returns between 1998 to 1992, for example, was largely the result of rapid growth in financial and business services post de-regulation and then a development boom which was most extreme in the office market. This meant that office returns departed wildly from returns in the retail sector, where demand and supply stayed closer to equilibrium. By contrast, the range in segment returns has tended to be smaller when yield movements have been the main driver of performance (e.g.1993 to 1994 and 2001 to 2005), because in the short-term at least, yields in different segments have tended to rise and fall together. Looking forward, the implication is that in the range fund returns could widen in future, if rental growth again became the dominant driver of performance.

6) Greater market transparency. Another explanation for the narrowing in portfolio returns over the long-term is that the UK property market has become increasingly transparent and there is now greater uniformity in the estimates of changes in open market values made by valuers. Figure 4.12 suggests there is a significant correlation with the improvement in valuation accuracy reported in the annual RICS / IPD Valuation Accuracy Report. (The measure of valuation accuracy is the weighted absolute difference between the sale price and adjusted valuation). The R^2 figures in Table 4.11 suggest that greater market transparency could explain half of the tightening in the range in portfolio returns.

Figure 4.12: Standard deviation in returns on hypothetical portfolios



In conclusion, the overall reduction of the level of risk in funds over the last 20 years reflects a combination of both general market factors and investor activity. General market factors include the greater uniformity in returns across different market segments and the long-term improvement in market transparency. In addition, investors have contributed to the narrowing in the range in funds returns by selling small properties and reducing their exposure to the office sector. Over the long-term these influences have more than offset the impact of the increase in concentration in balanced funds.

4.8 Conclusions

1. Although the average number of direct properties in balanced funds has halved over the last 20 years, the increase in concentration has been partially offset by the growth in indirect holdings.
2. Despite the fall in the number of direct properties in portfolios, the range in fund returns has narrowed over the long-term, suggesting that funds now generally carry less risk than in the past. This improvement appears to be due to the fall in the office weighting in portfolios, a shift away from smaller lot sizes, greater uniformity in market segment returns and increased market transparency. There is little evidence of convergence in the structure of balanced funds.
3. There is an inverse relationship between the volatility of fund returns over time and the number of properties in a portfolio.
4. The rate of risk reduction diminishes as more properties are added to portfolios. However, adding another property is always beneficial.
5. There is no absolute answer to the question of how many properties are required to track the market. In practice the right size for a portfolio depends on the importance investors place on tracking the benchmark average return. There is no particular significance to achieving a 90%, or 95% level of diversification.
6. In general it does not appear that diversification is easier to achieve in some market segments than in others, in terms of the number of properties. However, differences in the average value of properties, means that the cost of achieving a given level of diversification does vary significantly across segments.
7. Diversification is harder to achieve at the All Property level than in individual segments, because the IPD Universe reflects the variation in returns across different market segments.
8. Total returns on specialist funds in the shopping centre, retail warehouse and industrials ought to be relatively uniform. There should be a greater range in returns on specialist funds in the South East retail, West End office and South East office segments.

5 FURTHER RESEARCH

The study has provided an initial insight into the level of risk on individual properties and underlined the diversity of returns across individual assets. In the process, it has demonstrated the limitations of the conventional property type/region segmentation. The study has not however, fully investigated why the returns on individual properties are so heterogeneous. Neither has it offered an alternative classification which provides a more compelling explanation of the variation in individual property returns.

Table 5.1 re-visits the sample of 1,728 held properties used for the longitudinal analysis of risk reduction and diversification (see Table 3.4). The table splits the properties irrespective of their segment into four bands according to the volatility of their total returns between 1994 to 2004. The relatively stable properties in the left-hand column all recorded a standard deviation in returns of less than 7.6% over the 10 years to end-2004. At the other extreme, the most volatile properties in the right-hand column all recorded a standard deviation in returns of more than 13.1%.

Table 5.1: Volatility in individual property total returns 1994 to 2004

	Number of properties			
	Most stable quartile std. deviation <7.6%	**Second quartile std. deviation <10.0%**	**Third quartile std. deviation <13.1%**	**Most volatile quartile std. deviation >13.1%**
Std. Retail –South East	107	99	87	75
Std. Retail – Rest UK	85	101	112	120
Shopping Centres	11	5	3	8
Retail Warehouses	29	32	30	25
City Offices	15	12	13	10
West-End Offices	38	32	33	22
Rest of S.E. Offices	46	43	36	35
Rest of UK Offices	16	14	24	34
Industrial South East	42	53	56	58
Industrial Rest UK	39	35	33	38
Other Property	4	6	5	7
All Property	432	432	432	432

The analysis highlights the need to better understand the factors which drive the performance of individual properties and the extent to which the conventional market segmentation is a simplification. For example, what were the common characteristics of the eight shopping centres with relatively extreme returns? It is, of course, possible that the performance of these individual properties was all due to one-off events which will not be repeated. However, it may be that there are some enduring characteristics which volatile properties tend to share and conversely, that there are other enduring characteristics which are common to stable properties. If this were the case, then it might be possible to develop an alternative classification for properties, akin to the core, value-add and opportunity nomenclature which is often applied to funds. This in turn could open up new approaches to portfolio construction, with investors perhaps electing to hold a subset of core properties which should provide market performance (ie beta) and hold another subset of volatile properties which should deliver out-performance (ie alpha).

APPENDIX: PERFORMANCE OF HELD SAMPLE 1994 TO 2004

Appendix Table 1: Performance of held samples in IPD, 1999 to 2004

	Properties held 1994-2004			Properties held 1999-2004	
	Number of properties	Total return % p.a.		Number of properties	Total return % p.a.
Std. Retail -South East	368	11.3		702	11.8
Std. Retail - Rest UK	418	11.3		741	11.1
Shopping Centres	27	12.6		54	11.6
Retail Warehouses	116	15.2		270	16.2
City Offices	50	11.5		125	8.2
West-End Offices	125	12.4		251	10.6
Rest of S.E. Offices	160	12.7		336	8.2
Rest of UK Offices	88	7.6		207	10.9
Industrial South East	209	13.6		459	12.7
Industrial Rest UK	145	11.1		378	12.6
Other Property	22	-		196	-
All Property	**1,728**	**12.2**		**3,719**	**11.7**

In order to address the issue of whether survivor bias might affect the results from the longitudinal analysis, the average volatility of returns on the individual held properties used in the analysis was compared with that of a larger set of standing investments held between 1999 and 2004. The results suggest that the performance of the properties used in the longitudinal analysis was not significantly smoother, or more volatile, than that of the population of investment properties and that therefore the results from the longitudinal analysis are representative. (See Methodology).

Yet, while there is no evidence that investors tend to discriminate against properties whose performance is particularly volatile, there is evidence that they tend to sell under-performing properties and retain stronger performing properties. The table above compares the returns on the 10 year held sample with that of the larger set of standing investments held between1999 and 2004. (The former is a subset of the latter). Although the difference is not consistent in every segment, on average the 10-year held sample out-performed the five-year held sample by 0.5% per year between 1994 and 2004. This finding is consistent with previous research undertaken on a set of properties held continuously from 1993 to 2003 as part of the IPF Depreciation Study. A more comprehensive discussion of survivor bias in samples of held properties in the IPD can be found in the IPF Study: Depreciation in Commercial Property Markets, Chapter 3, Section 2.4.

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