IPF Research Programme 2006-2009

# RISK WEB 2.0
# An Investigation into the Causes of Portfolio Risk

## Summary Report

November 2010

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IPF Investment Property Forum

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# AN INVESTIGATION INTO THE CAUSES OF PORTFOLIO RISK

Summary report

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November 2010

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# 1. INTRODUCTION

This study is concerned with the causes of risk in property portfolios, specifically the factors at work that cause portfolio returns to move away from the norm. The extent to which portfolios over or underperform benchmarks, indices and absolute return targets for example of perennial interest to investors and managers alike especially as it is frequently associated with their remuneration!

Traditionally the property industry has defined portfolio risk in terms of the tracking error of portfolios, the extent to which through time the portfolio return deviates from benchmarks. However these variance based measures of risk suffer from a number of drawbacks:

- They are nondiagnostic; a tracking error gives no indication of what caused it.
- They are retrospective; measures of variance depend on long strings of past data which in all probability relate to properties no longer in the portfolio.
- The underlying assumptions of using standard measures of variance frequently imply a market which is much more efficient than empirical observation has found it to be.
- Past volatility is a poor predictive guide to future relative performance; the past is not a good guide to the future.

It was to overcome these problems that, in 2003, the idea of a Risk Web was launched. The Risk Web is a diagram that charts portfolio scores on 12 risk factors relating to tenant quality, lease length, stock concentration for example. All were factors that one would intuitively associate with risk in portfolios. Each portfolio had a profile on the Risk Web which could be compared to its benchmark so the relative risk exposure of the portfolio across a range of measures could be seen at a glance.

The Risk Web, which had been used internally by LaSalle Investment Management for several years previously, proved to be popular with investors and was subsequently adopted by IPD in their investor services.

The advantages of the approach were that it was clear what factors were behind the risk; it looked forward, not backwards; and it dealt in terms that managers could use to adjust their portfolio's risk. The selection of the factors was partly justified by the analysis of how the factors correlated with subsequent differences in portfolio returns, but owing to the absence of data was in part conjectural.

An eventful seven years on, the genesis of this study was a desire to update "Risk Web 1.0" with the benefit of more data and resources under the auspices of the Investment Property Forum's research programme. Since 2003 we have seen a major leverage fuelled boom, the growth of indirect vehicles, and the belated advent of REITs, just as the market toppled over from boom to bust. The period may not be a typical property cycle, if such a thing exists, but it does provide an unprecedentedly effective stress test of the hypothesised sources of risk.

The objectives of this study are three fold. Firstly, now that longer and more extensive time series are available, it aims to update the original 2003 analysis with a view to developing a better understanding of what causes portfolio risk and how these causes vary through the cycle. It also aims to introduce factors such as leverage that were not included in the original study.

Secondly, the study develops quantitative models of portfolio risk based on these potential causes of risk to see how much can be systemically explained. It should be noted that this is not a forecast of market risk *per se;* it is an attempt to predict how a portfolio will behave relative to the market's ups and downs. This is a harder task than merely predicting the direction of the market because portfolio managers will have diversified away a proportion of risk as they have built their portfolios, leaving only that consistent with the style and objectives of the fund. In this study portfolio risk is defined as this residual difference in performance between the portfolio and the market; the greater the difference, the greater the risk.

Thirdly, with so many potential sources of risk any predictive model is likely to vary its components through time; the study aims to identify those evergreen risk factors which are usually present through the cycle. It then uses these findings to illustrate how a risk scoring methodology could be developed, thereby enhancing the original Risk Web concept which did not provide an overall portfolio score.

# 2. APPROACH

The study identified 43 factors potentially pertaining to portfolio risk and drawn from the Investment Property Databank's records. They related to some 250+ portfolios over the 11 year period from 1998 to 2009. The basic idea was to observe which factors significantly correlated with portfolios' relative returns in subsequent periods.

The factors are listed in the table on page 10. They fall into eight groups. The first five groups measure the diversification in the portfolio in different dimensions. In each of the five cases four alternative measures of diversification are tested. The other 23 factors are broadly classified under growth, income and manager activity. All of the factors included in Risk Web 1.0 are included plus a number of tenant related factors that could not be analysed in 2003. More detailed definitions are to be found in section 2 of the main report and Appendix 1.

These factors were correlated against portfolio risk in subsequent years. For the purposes of this study risk is defined as the difference (positive or negative) between a portfolio's return and that of the unweighted average of the sample. This is referred to in the study as "absolute" risk and is the main measure used.

With absolute risk a positive difference (outperformance) is treated as just as risky as a negative difference. This is because risk taking should in theory sometimes be rewarded with higher returns; if risk taking always ended in failure the market would be even more inefficient than its critics claim. As well as absolute risk two others were used on occasion; nominal risk with the plus and minus signs restored, and down side only risk where only negative differences were taken into account. These proved useful in identifying factors that only kicked in when capital values were under pressure.

As well as looking at risk in terms of total return differences over one year ahead, the study also examined a number of variations:

- In addition to one year forward, two and three year time horizons were also examined to test the shelf life of the relationships given that the portfolio would be turning over through time.
- The components of return were disaggregated into capital income and income growth to test whether the same patterns of significant factors obtained.

The factors were analysed in three phases. First all the factors relating to direct properties, were correlated to differences in return based on direct properties only which effectively repeated the Risk Web 1.0 approach. Secondly indirect assets were taken into account. These are largely exposure to co-mingled vehicles of various sorts, but also include derivatives, quoted company shares and any asset not classified as a direct holding. The factor, described as "%indirect" was the only available proxy for the growing exposure of portfolios to vehicles, a factor not included in the original risk web.

## 3. RESULTS: DIRECTLY HELD ASSETS

Thirdly, leverage was introduced into the analysis, focussing on the AREF sample of 50+ portfolios and using leveraged returns as reported by PPFI. Answers to three questions were sought: How much did leverage increase risk, did its effect vary through time and what effect did leveraged returns have on the other factors?

The results of these exercises produced the basis for several models of future risk, some with interesting levels of significance. It also provided a short list of factors for a risk scorecard.

Over the 11 year period total return risk one year forward (TR1) steadily rose. In 1999 average TR1 was +/- 1.9%, by 2009 it had risen to +/- 5.2%.

The rise was almost entirely due to a rise in capital return differences (CG1), differences in income returns (IR1) being largely static at around 0.7%. It probably reflects the increase in the presence of specialist funds, as segment concentration was also rising throughout the period; while vacancy rate followed a cyclical but rising pattern especially over the last couple of years. From 2006 when real capital returns went negative TR1 and CG1 have spiked upwards as portfolios' reaction to events diverged. At the same time the portfolios' dispersion around these means has increased, especially since 2005. In 2009 mean TR grew rapidly, as did the dispersion around it. It will be recalled that 2009 saw a rapid recovery in values driven by yield compression at the prime end of the markets. Clearly not all portfolios shared in the recovery.

Why should TR and CG have jumped so much in 2008 and 2009? Inspection of average factor values reveals that by the end of 2008 several risk factors were sharply higher. Apart from vacancy rate, 2008 had seen a rapid increase in sales, net investment fell from +0.8% of end year value in 2007 to -7.2% in 2008. These factors could have caused fund returns to diverge in 2009. Although the available run of data (only 11 periods) is not long enough to attempt meaningful statistical analysis, the average portfolio dispersion (TR1) each year has a 0.68 correlation with average portfolio vacancy rate and a 0.73 correlation with segment concentration. In a few years time this may prove a fruitful line of research as mean TR is in itself a measure of risk in the market; high values of TR being associated with higher portfolio tracking error in the market as a whole.

# 3. RESULTS: DIRECTLY HELD ASSETS

## Executive Summary: Risk factors significantly linked with TR the following year

| Risk factor<br>PAS Segment | No. yrs<br>absolute | Sig @ 95%<br>downside only | Years in<br>OLS | Selected |
|---|---|---|---|---|
| Weighted beta | 3 | 4 | 3 | |
| Weighted tracking error | 6 | 7 | 1 | |
| Weighted volatility | 3 | 4 | 0 | |
| Concentration ratio | 11 | 9 | 3 | |
| Region | | | | |
| Weighted beta | 7 | 7 | 0 | |
| Weighted tracking error | 4 | 7 | 1 | |
| Weighted volatility | 7 | 7 | 0 | |
| Concentration ratio | 11 | 8 | 0 | evergreen |
| Property type | | | | |
| Weighted beta | 3 | 4 | 0 | |
| Weighted tracking error | 3 | 6 | 5 | evergreen |
| Weighted volatility | 2 | 5 | 3 | |
| Concentration ratio | 11 | 10 | 4 | evergreen |
| Remaining lease length | | | | |
| Weighted beta | 4 | 6 | 2 | |
| Weighted tracking error | 2 | 4 | 2 | |
| Weighted volatility | 1 | 5 | 1 | |
| Concentration ratio | 9 | 5 | 3 | evergreen |
| Stock concentration | | | | |
| % value five largest assets | 10 | 8 | 4 | evergreen |
| % value +£100m assets | 4 | 6 | 2 | |
| No. assets | 6 | 2 | 0 | |
| Av. Lot size | 7 | 6 | 1 | evergreen |
| Growth | | | | |
| Relative eq. yield | 3 | 7 | 2 | evergreen |
| Capital/ total return ratio | 4 | 4 | 3 | |
| Reversion potential | 3 | 4 | 1 | |
| % value central london | 8 | 8 | 0 | |
| Vacancy rate | 2 | 6 | 2 | cyclical |
| Income | | | | |
| Covenant strength | 1 | 5 | 1 | cyclical |
| Covenant strength* rev pot | 0 | 5 | 0 | |
| % value top three risk classes | 0 | 1 | 0 | |
| % value top two risk classes | 0 | 1 | 2 | |
| Top 2 classes *%+10yr leases | 1 | 1 | 2 | |
| % value top 10 tenants | 8 | 4 | 4 | evergreen |
| % value sub five year leases | 2 | 5 | 0 | |
| Mean years remaining | 2 | 2 | 2 | |
| Top two classes * rev pot | 0 | 1 | 2 | |
| Manager activity | | | | |
| % development | 1 | 3 | 1 | cyclical |
| % land | 2 | 0 | 1 | |
| Cap expen | 1 | 0 | 0 | |
| Cap receipts | 1 | 1 | 1 | |
| Net investment | 0 | 2 | 2 | |
| Turnover | 1 | 0 | 0 | |
| % value indirect | 0 | 2 | 3 | |
| TR in previous year | 9 | 4 | 6 | evergreen |
| Leverage | 6 | 6 | 6 | cyclical |

**Note:** leverage is everpresent at a significant level but its strongly increased influence on the downside leads it to be classified as cyclical

## 3. RESULTS: DIRECTLY HELD ASSETS

The table of factors included opposite shows the factors which proved to be significantly linked to TR1 more years than not in the 11 year period covered by the study (denoted evergreen). Also shown are those frequently linked on a downside only basis (denoted cyclical) and the number of times a factor appears in regressions.

The majority are structural measures of various types of portfolio concentration, region, segment, property type, stock, tenant and the timing of lease termination. A consistent theme is the need to diversify in a number of dimensions to reduce risk, a key feature of Risk Web 1.0.

Outside of these concentration factors the level of TR in the previous year was found to be important, as were several measures of portfolio exposure to relatively volatile sectors, beta and tracking error.

Lease end concentration reflects the increased risk in a portfolio of a bunching of re-leasing exposure relative to the whole sample. Other things being equal, this will be reflected in an upward pressure on portfolio equivalent yield and consequent loss in value as the bunching gets closer to the present day. The significance of this reflects the importance of income to property as an asset class, comprising as it does the bulk of long run returns. It may also be picking up increased concern about lease length. At Dec 1998 the average term remaining in the sample's leases was 13.8 years, by Dec 2008 this had fallen to 9.0 years. As the mean contracts clearly increased, bunching is likely to occur.

TR1 in the previous year was felt to partially reflect manager style but it also in part reflects some serial correlation in capital values, which has been well documented elsewhere. To test this proposition, the correlation of this factor in nominal terms was undertaken. TR1 in the previous year was negatively correlated with next year's TR1 in 2003 and 2004, and positively correlated in 2007 and 2008. In other years the linkage was not significant, but interestingly was always positive. This represents weak evidence to suggest serial correlation of valuations although to be reflected in returns it must be acting at the level of the rate of change in values or is due to relatively permanent differences in yield that are not being picked up be valuations.

The factors in the table were, virtually without exception, also regularly significant in the downside only analysis and also over the last three years of falling real values; no other factors were, except the weighted tracking error of property types. This was therefore added to the preferred list because it had also emerged as significant over the past three years and also appeared five times in regression based models seeking to "explain" TR1.

The analysis of TR1 measured by downside only relates more frequently to several growth and income factors that the absolute analysis did not; especially relative equivalent yield, vacancy rate, covenant strength and exposure to leases with less than five years remaining on the lease term. These factors are associated with poorer relative performance over most of the years covered by the study; when was vacant possession last seen as an advantage? As a result they show up better when only downside risk is considered; there is no counter balancing upside.

In addition, development exposure was added. It was found that, at the 90% confidence level, development significantly correlated with TR1 in 2002 and 2008; both years when real capital growth had been weak for two consecutive years previously.

It seems that development exposure only really becomes a risk on the downside when it cannot be let or needs refinancing and that may be reflected in these results with it only appearing as a significant factor in times of stress after a couple of bad years. Since it is precisely times like that when risk management is of most value, development was included.

# 3. RESULTS: DIRECTLY HELD ASSETS

The extended list was then reduced because some factors were highly correlated with other preferred factors. When two factors are highly correlated they are effectively linked to the same part of TR. So including both of them is to double count their influence. One must choose one or the other and usually the one with the strongest correlation. Thus a number of factors that were significant in their own right were passed over; PAS concentration and tracking error, the weighted beta, tracking error and region volatility, and % in Central London; making a final preferred selection of 12.

These 12 divide into two groups; nine evergreen factors that are significantly related most of the time and three that are cyclical in that they become significant after periods when real capital values have been falling.

The nine structural factors are as follows:

- Property type concentration
- Regional concentration
- Weighted type tracking error
- Lease length concentration
- % value of five largest assets
- Average lot size
- Tenant concentration
- Relative equivalent yield
- TR1 in the year

Of these only relative equivalent yield was linked using a downside only definition of risk suggesting that relatively low yields may be associated with lower relative returns, but the reverse is not proven ( that high yields link with higher returns).

The three cyclical factors and the years they were significant are as follows:

- % value in development: 1999 2003 2008 2009
- Relative covenant strength: 2002 2003 2008
- Vacancy rate: 2002 2003 2005 2008 2009

The years when these factors significantly correlated with subsequent TR1 are mainly following a period when values were under pressure.

## 3.1 Components of return

The study then repeated this exercise on components of total return, capital growth (CG) and income return (IR). Little difference was observed between the results for TR and CG. In the years sampled with two exceptions, factors linked with TR were also linked with CG. IR(1) relates to a different set of factors, and this may be of relevance to investors with longer time horizons who place a greater emphasis on income and income growth than on appraisal based total returns.

The conclusion to be drawn from this is that factors affecting IR are more relevant on the downside when values are under pressure and in which case the length and quality of the portfolio's contracted income becomes

important for income risk. This effect is less marked at the TR level as IR is a small proportion of TR. Since most investors are principally concerned with total return risk it was decided concentrate on total return. It may be worth returning to the longer term impact of income risk in a later study since value and income oriented investment styles frequently take a longer term view of risk.

## 3.2 Time horizon

The study found that correlations tended to improve when a two or three year time horizon was used. A possible explanation is that property portfolio returns are frequently subject to idiosyncratic events such as a change in valuer, the addition or removal of very large assets, changes in manager or the tax environment for example. It is possible therefore that a proportion of the variance observed in portfolio returns may reflect these fundamentally random or one-off events and so be essentially unexplainable.

However over two or three years there is an increasing chance that the effect of these events will self cancel, leaving a greater proportion of potentially explainable variance in returns behind. The finding was reflected in the better quality of regression results when TR2 and TR3 were the dependent variable. This lends weight to the practice of judging portfolios' relative performance and risk over several years, rather than just the latest one.

## 3.3 Summary

The research has shown that the typical tracking error in total portfolio returns is in the range of +/- 2% to 3% in any one year. In 2008/9 it has been substantially higher; greater market volatility has exposed greater differences in the way portfolios perform.

Most of the factors selected do exercise an influence on subsequent tracking error but in any one year the combination of factors has varied – there is no silver bullet in the form of a simple solution that is good for all points in the cycle (if a cycle as such exists).

Factors relating to portfolio concentration are the most reliable indicators though time and across the different components of return. Factors relating to growth (development, covenant strength and vacancy rates) are most significant when real capital value is falling.

Analysis of multi factor models on recent years' data suggests that, although 12 of the candidate factors are linked to risk, they do not readily combine into a model that could be used for predictive purposes.

One year time horizons give the weakest results, with the strength and significance of linkages consistently improving when two and three year perspectives are taken.

## 3. RESULTS: DIRECTLY HELD ASSETS

Adding indirect assets' returns to direct ones marginally increased portfolio risk. This may be a function of indirect exposure to leverage although the effect is offset by the extra diversification offered by some vehicles. However only in two of the 11 years did fund exposure to indirect assets significantly correlate with TR1. Using overall asset returns had little impact on the direct asset only results reported above.

# 4. RESULTS: THE EFFECT OF LEVERAGE

Leveraged returns produced much higher levels of TR1 than either direct only or total asset returns. It also correlated strongly, positively and significantly with TR1, with the level of significance rising considerably over the last couple of years.

What sort of funds were using higher levels of debt to enhance returns?

The study found that the level of LTV at end 2008 was significantly correlated with **unleveraged** returns, a co-efficient of 0.35. In other words funds with relatively risky portfolios had been seeking to enhance their returns further with more debt. Similar correlations were found in 2002, 2006 and 2007, years when some of this debt would have been originated. When leveraged returns were analysed these correlations rose significantly.

Using absolute return differences, the measure largely adopted by this study, LTV is positively and significantly correlated in all but one year, 2005. But the picture changes in the light of nominal measures. In the first part of the cycle LTV is positively correlated; the extra risk paid off with higher returns. This changed in 2007, the correlation turned strongly negative as capital values fell.

Effectively debt is a means of adding beta to a fund's performance. It acts like the volume control on a radio except that you can turn it more than off; by holding a net cash position (a negative LTV) a fund can reduce its fundamental risk. However, not many funds availed themselves of this facility in 2008.

As with the fundamental factors, leverage's correlations tended to rise when longer time periods were analysed, with quite large increases in some years. Because the use of leverage changes returns, a key consequence was that leverage masks the significance of other risk factors, by reducing the strength of their correlation.

The relatively few factors remaining significant in the majority of the 7 years (2002/2008) over which leveraged data were available matched those previously identified reasonably well. Region and stock concentration are less important; while covenant factors and exposure to short leases of the portfolio become important.

The presence of leverage makes it easier to forecast portfolio risk as it improves the combined effect of the factors when fitting OLS regressions Compared with the full sample and with AREF unleveraged returns, the leveraged OLS results have a much higher statistical fit. Generally no new factors emerge in a supporting role with the exception of exposure to indirect assets, (ie anything other than directly held properties) which appeared a number of times in regression models of leveraged TR1.

Adding debt to a portfolio increases its risk, a risk which rises exponentially as either debt is increased or values fall. A key band between 30% and 40% LTV seems to exist at end 2008. Below this band modest levels of debt have a limited impact on risk; above it and as LTV rises risk soars.

Because it directly affects returns, debt drowns out the effect of other sources of risk. In their absence LTV dominates the causes of risk. This explains why apparently disparate asset classes suddenly started to show high correlations during the financial crisis. Although their fundamental characteristics and risks were different, the presence of debt rendered them as one; or if not that then similar enough for the values to move in concert.

## 4. RESULTS: THE EFFECT OF LEVERAGE

As with the unleveraged sample, the changeable mix of factors appearing in the OLS regressions from year to year suggests that any forecast would have only a limited shelf life; and suggest that even on a short term basis the results (if applied naively) to portfolios could be quite misleading. However models of leveraged TR1 were developed with quite respectable "RSQ" values in the 0.52 to 0.84 range.

While the results on leverage underline the logic of distinguishing between core plus, value added and opportunistic fund styles on the basis of leverage; they suggest that other factors might be taken into account as well when defining fund style. Through time it is clear the level of gearing varies both as a function of capital returns and also as a result of management decisions. It is therefore quite possible that the level of gearing could reduce relatively quickly, revealing again the section 3 factors that had previously been masked by leverage.

Leverage amplified the downside in values in 2007 and 2008 and attention is focussed now on how to turn the "volume" down through restructuring and refinancing. While current prospects for values are uncertain it is likely that the leverage "volume control" will stay in the off position as debt is paid down, but ultimately the opportunity to increase leverage and add to returns will re-emerge. It will be intriguing to see how easily the current aversion to debt is overcome and whether more sustainable levels of gearing are adopted.

# 5. FURTHER RESEARCH

Although reliable models of risk could not be developed that were robust through time, the results of the analysis did provide enough material for the future development of a risk scorecard as a number of evergreen factors emerged as relevant in most years. In the full report several illustrative methods for compiling the 12 individual factor together into a risk scorecard are shown. The methods were backtested against the actual portfolios used in the study to ensure the overall scores emerging correlated with the actual TR1s experienced by the portfolios.

This study has focussed on risk expressed in terms of a portfolio's likely future difference from the market average. However the results suggest that the behavior of this average difference through time is in itself subject to considerable variation which may well reflect market wide factors such as the application of leverage and the level of vacancy. The evidence available to this study is too short, but with the benefit of a few years' more data, research into what causes average variance to vary might provide insights into the general level of risk in the market. Data on portfolio variance and factors such as vacancy rate go back a lot earlier than 1999, the start of the data in this study. The output from such a study could lead to a general indicator of property market risk, analogous to the VIX index for US equities.

Another avenue, touched upon above is the differences between the factors linked with capital and income. Income represents the bulk of property's long term returns. So factors affecting income should be of relatively more importance to long term investors, some of whom are relatively unconcerned by year on year vagaries in capital returns. The problem with this kind of analysis is the turnover of properties in portfolios. Long term analysis of income risk would require analysis of groups of properties which have been held in a constant state for a number of years, perhaps being put into dummy portfolios to filter out stock specific effects.

# 6. CONCLUDING COMMENTS

What does this study tell us that we didn't know before? In a way an impossible question because to test an idea it has to be imagined. Nevertheless there are two standouts.

First we now know there is an alternative approach to dealing with risk than the retrospective, non-diagnostic study of past return volatility. The study has identified a set of factors which both practical experience and statistical analysis suggest influence future risk in portfolios, and which offer managers tangible levers with which to manage at least a portion of the risk facing them.

It was striking that only one variance based factor found its way into the final 12 risk factors selected. Many of the volatility based measures failed to relate significantly in more than a few of the years covered by the study; and a number of them were strongly intercorrelated and so could not all be used. While this came as a surprise, perhaps on reflection it should not. After all if past performance is a poor guide to the future, why should the volatility in that performance be any better?

Second, the study highlights the critical role of leverage. This has emerged as a feature of markets over the past decade and it is here to stay. The importance of leverage as such was not so much of a surprise as this is well documented; rather it is the way it drowns out the other risk factors by changing portfolio returns. Whilst they retain a latent influence waiting to be seen when the volume of leverage is turned down, any risk mitigation they offer is masked while leverage is in place.

It is hoped that the analyses reported here will stimulate thinking about risk in property and throw up new lines of analysis that the authors have not envisaged. For too long risk in property has been in thrall to conventional capital market theory; it is time property developed approaches more suited to its intrinsic characteristics as a distinct actively managed asset class.

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