COMMERCIAL PROPERTY AS AN INFLATION HEDGE: AN AUSTRALIAN PERSPECTIVE

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ABSTRACT

There is ongoing interest in assets with inflation hedging capabilities, as many investors' liabilities are linked directly or indirectly to inflation, which cannot be assumed to be forever benign. Numerous studies have shown that equity and bonds are poor at hedging inflation. In contrast, property presents itself as a candidate for this task, by virtue of rental structures that are linked to inflation.

Though the intuition for property as an inflation hedge sounds encouraging, overseas experience has been mixed, and there is limited evidence for Australia. This paper applies established analytical approaches to Australian data for commercial property in examining its inflation hedging capabilities. It finds that Australian property at an aggregate level can provide a good hedge for both expected and unexpected inflation, even after allowing for the effect of tax in reducing investors' returns.

INTRODUCTION

During the last decade, inflation has been generally benign, thanks in part to Reserve Bank independence and intervention. But there is no guarantee that inflation could not again become a concern, due perhaps to the effect of easy monetary conditions overseas, resource constraints, or cost pressures within or imported to the Australian economy. Hence, it is still of interest to identify those asset classes that are natural hedges against inflation, particularly for superannuation fund trustees who see their liabilities expressed in this way. The obvious asset classes are those whose cash flows have evident links to inflation, whether by tradition or by design.

Though there is considerable evidence against other asset classes (such as equity and bonds) providing this benefit, this paper has a narrow and special focus. It considers only the empirical evidence for direct commercial property in Australia, as a likely (and perhaps most accessible) candidate for an inflation hedge. Moreover, the calculations use the IPD Property Investors Digest (IPD, formerly Property Council of Australia) indexes, which seek to measure returns and yields across property sectors and locations. The heterogeneity of individual assets within each property sector, and the typical size of each investment, means that the property portfolios of most investors contain significant specific risk. Thus the returns experienced by individual investors may diverge markedly from that of the sectors and the market, depending on the composition of their property portfolio.

There is an extensive literature (most of which is based on overseas data), investigating the relation between property returns and inflation. This paper employs some of the analytical techniques established in those papers. In addition, it introduces a few innovations in addressing the question. One is in considering the effect of tax on asset returns, for investors are concerned with whether after tax returns provide an inflation hedge. Another is in specifically allowing for the role of real interest rates in setting appraisal valuations, an aspect suggested by the above formulation of capitalisation rates.

BACKGROUND

For property to be an inflation hedge, it is clearly not enough for asset returns to exceed inflation over the long run. Ideally we would like asset returns to respond almost instantaneously to changes in general prices, so that if there is a bout of inflation, we can be reasonably sure that asset prices will respond accordingly.

There is no class of financial assets that meets this requirement perfectly. To use the terminology in the literature:

- Some asset classes provide a *partial* hedge in the sense that the response of asset prices is generally lower than required or else the asset prices sometimes respond, but sometimes do not;

- Some provide a *complete* hedge (same order as required); and a few provide an *effective* hedge (more than required);

- Other asset classes evidently provide no hedge, or even a *perverse* hedge (with returns being the opposite of what is required).

There is much intuition in thinking of property as a hedge against inflation. The benefits derived from holding property are known with a high level of confidence and take the form of accommodation, an essential ingredient for all economic activity. This paper focuses on direct property (rather than that held through investment vehicles), which is mostly valued using an appraisal process.

It is reasonable to suppose that rents should be driven by general economic conditions, such as inflation and interest rates, rather than the other way around. It is also reasonable to suppose that this feature holds much more strongly with property than with equity investments in general, as property is less heterogeneous and a fundamental requirement for all economic activity.

It may be expected, however, that the relationship will vary for different property types. Rents in the retail sector are often linked to turnover, whether explicitly in lease arrangements or indirectly via the demand for retail tenancies. The office sector is subject to long-term leases with rent reviews and other terms that may delay rental increases. This may lengthen the time needed for office appraisal values to respond to inflation, as current rental arrangements have to be factored into reversions. On the other hand, the industrial sector might be seen as providing the weakest link with inflation, as this type of property is not constrained to be located near population centres (but requires suitable infrastructure access) and is the easiest to construct.

The general intuition outlined above can be brought to a somewhat tighter focus by applying a more formal structure to the argument. The typical appraisal process for valuing property can be formulated as follows:

$$A_t = D_t / K_t + reversion \tag{1}$$

where A_t is the appraisal valuation of property at time t, D_t is the market rental, and K_t is a capitalisation rate (as supplied by a property valuer). In practice, reversion is the adjustment made by the valuer to allow for the time taken for the actual rental to revert to market rentals. This is a function of the lease arrangements, which can differ markedly between markets or between different property types.

The capitalisation rate K_t is thus central to the appraisal process; this can be modelled as a sum of components (Baum & McGregor, 1992):

$$\begin{aligned} K_t = {} & \textit{nominal risk - free rate} \\ & + \textit{risk premium} \\ & - \textit{expected inflation} \\ & - \textit{expected real rental growth} \\ & + \textit{expected depreciation} \end{aligned}$$

Thus the capitalisation rate is essentially a risk- adjusted discount rate allowing for income growth, net of depreciation, similar to that used in the Gordon growth model for equities

Appraisal values can, therefore, respond to changes in inflation in two ways:

- First, inflation can have a direct effect on rental levels D_t. It is reasonable to suppose that rental levels respond, perhaps with a lag, to changes in actual inflation.

- Second, there may be an indirect effect of inflationary expectations on valuations. Among the components for K_t there is the term:

nominal risk-free rate – expected inflation = real risk-free rate.

This may appear to suggest that no role is played by the level of expected inflation. However there may be delays in the way that inflationary expectations are reflected in capitalisation rates applied by valuers (especially in the risk premium), so that in practice expected inflation may affect property valuations.

Based on this simple model, if rental levels D_t rise in line with actual inflation, appraisal values should be protected, given stable economic conditions. If rental levels are not free to respond in this way, then there is still the possibility that capitalisation rates (and thus rental yields) can respond to changes in expected inflation.

Though inflationary effects on capitalisation rates are the main concerns of this paper, it may be observed that risk premiums and expected rental growth rates, net of expected depreciation, can also be important. However there is no evidence in the litertature to suggest that these factors interact to any significant extent with inflation, or with any other observable factor. Thus, they will be treated as part of the background 'noise' masking the true behaviour of appraisal values.

Whether property markets in practice follow the behaviour described above is determined by the way that rentals are reviewed, inflationary expectations are formed, and by other external factors that drive property valuations. It is thus an empirical question to be addressed in this paper.

LITERATURE REVIEW

The questions raised in the previous sections, and to be considered in this paper, have a very long history. So it is useful to summarise how it has been answered in the past for different regions and time periods. Two types of property research are evident – short term and long term.

Short term relationships

The leading paper on this issue is that of Fama and Schwert (1977), who investigated the inflation-hedging characteristics of various asset classes in the US for the period

1953-71. They found that only residential property provided a complete hedge against both expected and unexpected inflation; US bonds were a hedge against only expected inflation. Perversely, US equity was negatively correlated to both types of inflation. The Fama-Schwert (1977) paper introduced the methodology whereby asset returns are regressed against both expected and unexpected inflation. This approach is consistent with the Fisher hypothesis that the real and monetary sides of the economy are disconnected.

Numerous subsequent studies [Brueggerman *et al* (1984); Hatzell *et al* (1987)] confirm the basis proposition of Fama and Schwert for commercial property and expected inflation.

Wurtzebach *et al* (1991) took a different approach. They adopted a survey-based measure of expected inflation[1], and incorporate vacancy rates to model the imbalance between the demand and supply for commercial property. Their findings complement earlier work by demonstrating that property acts as an effective inflation hedge with respect to both office and industrial property, and for periods of both high and low inflation. These results are supported for Australian property by Newell (1996).

The Fama-Schwert methodology was applied to UK property by Hoesli *et al* (1997) with very different results. Property was found to provide a weak and episodic short-term hedge against inflation. These results are supported to various extents by more recent studies. Sing & Low (2000) found that industrial property in Singapore provides a significant hedge to both expected and unexpected inflation, whilst retail provides a hedge only against the former. Huang and Hudson-Wilson (2007) found that in the US office property provides an effective hedge against both expected and unexpected inflation, with industrial providing a partial hedge. Retail property was found to offer no hedge. In contrast, Chu and Sing (2004) found little evidence for inflation hedging for any type of property in China.

With some regional differences, the empirical support is therefore in favour of property as being an inflation hedge. This contrasts with a large number of studies that generally suggest that equity - including real estate investment trusts (REITs) - and bonds are poor inflation hedges. In fact, in the international arena [see Liu *et al* (1997)], REITs are found to be poorer hedges of inflation than the wider equity market.

Long term relationships

The short term studies noted above focus on the value of property on an appraisal basis, which is a key differentiator between property and REITs. However the appraisal basis brings with it a host of methodological issues. Foremost among them is

[1] The Livingstone Survey, as conducted by the Federal Reserve Bank of Philadelphia.

the presence of serial correlation in returns, which may serve to understate the true correlation between real returns and inflation.

A recent innovation is to examine the long run relationship between asset returns and inflation using cointegration techniques. Chaudry *et al* (1999) were among the first to apply this technique to testing for relationships between various asset classes (including property), and between different property types (retail, office, industrial). The inclusion of inflation allows long run relationships to be identified, suggesting that inflation is indeed a significant long run factor in explaining property values. Chatrath and Liang (1999) used similar techniques in establishing a weak long run relationship between REITs and inflation, based on data for the period 1972-95. More recently, Hoesli *et al* (2006) examined the cointegration of US and UK property with inflation and several other fiscal and monetary factors for the period 1977-2003. They found a long run relationship between property and expected inflation, but not with unexpected inflation. In a similar vein, Goetzmann (2006) included macroeconomic factors (such as housing starts and unemployment), and found a weak long run relationship between property and inflation for data in the period 1992-2004. In the light of these papers, cointegration may be viewed as a robust and powerful approach to discovering relationships that may be concealed from conventional regression analysis.

Apart from the paper by Newell (1996), there is little to describe the relationship between Australian property and inflation. Westerheide (2006) suggests a weak cointegration of Australian property trusts with inflation, consistent with the international studies described above, but does not address Australian direct property.
This study therefore attempts to bridge a gap by applying both short and long run analytical techniques to examining the inflation hedging capabilities of Australian direct property, using a suitably long time period for data analysis.

DATA

Property returns

For this paper, we use index performance data sourced from IPD (publicly available from 31 December 1984 to 31 December 2008). This index is based on valuations on properties provided by 23 of Australia's leading investors and managers. It is considered the most credible index of its type, covering over 1,000 retail, office and industrial properties of total value $88 billion as at December 2008. These properties are also value-weighted to produce a composite index.

As inflationary expectations on an objective basis are available only from 31 December 2006, only index data from this date has been considered for analysis. The performance data was provided on a semi-annual basis to 30 June 1995, and on a quarterly basis thereafter. The appropriate adjustments to returns and regression modelling were made to reflect this change in data frequency.

IPD also provides property returns in terms of their income and capital components separately, but these are accessible only upon subscription. It may be of some interest to investigate the hedging characteristics of these components separately, but they were not a central objective of this paper. We try to assess property returns as a whole for their inflation hedging capabilities.

One shortcoming that might be observed in the IPD index is the fact that it is based on appraisal values, which are not necessarily the prices at which properties would transact. There are several reasons for this. The most practical is that transaction data, though arguably a more reliable measure of value, is also for property less frequent. Another is that valuations should be, almost by definition, the best approximation to transaction value for the whole range of properties (and in the long run should converge to it).

But the most compelling reason for accepting data based on valuations is that it is, paradoxically, more relevant in many circumstances than actual transaction values. For a wide range of investors, what matters is the impact of inflation on current valuations, assuming the portfolio is a going concern. Unit prices, crediting rates and asset allocation targets are not based on expected transaction values, with all the costs and uncertainties actual transactions entail. Thus the impact of inflation on appraisal values is important even if, as the purists point out, the appraisal values are a noisy estimator of the true underlying property value.

Inflation

For actual inflation, we use the CPI (All Groups) as published by the Australian Bureau of Statistics (ABS, 2008). However, CPI increases include the impact of the introduction of GST in 2000, which had a marked impact for the quarter ended 30 September 2000. We have suppressed the unanticipated inflation for this quarter in the short term analysis set out in this paper, as a once-off aberration. However, we have retained it for the long term analysis, on the basis that property returns in the long run should compensate for inflation arising from GST.

For expected inflation, we use the difference in nominal and indexed bond yields for 10 year bonds issued by the Commonwealth Government. Since indexed bonds pay a fixed rate on inflation-adjusted capital, their yield is equivalent to that on nominal bonds of similar maturity, less expected inflation over the lifetime of the bonds. That is, Australian indexed bonds provide an observable measure of the real yield as sought by Fama and Schwert (ibid). Yield data for both nominal and inflation linked bonds were obtained from the Reserve Bank of Australia (2008).

This measure of expected inflation differs in one important respect from those used in the short term studies described. Those studies attempt to employ a short term measure of expected inflation (i.e. as expected over the next time period). It is, however, arguable from the heuristic discussion of property returns that the relevant expectation of inflation is that used in property capitalisation rates, which is applied to the whole of rental streams. The other way that inflation can impact on appraisal values is through rental reviews – but in this instance, it is actual inflation that should be relevant, not an expectation.

A technical criticism may be mounted against using the indexed bond yield as a real yield. The supply of indexed bonds in Australia is limited, so that indexed yields may be distorted by a demand/supply imbalance. However, in the context of this paper, a recent study (NERA, 2007) suggests that the adjustment required for the limited supply of indexed bonds is only of the order of 20 bps, applying from 2004 onwards.
Unexpected inflation may then be taken as the difference between actual inflation in any time period, and its expectation at the start of that period.

REGRESSION METHODOLOGY

The Fama-Schwert methodology, as cited in many of the studies listed above, consists of examining the following model:

$$R_t = \alpha + \beta \cdot ECPI_t + \gamma \cdot UCPI_t + \varepsilon_t \qquad (2)$$

where R_t is the property return for the period ending at time t, and $ECPI_t, UCPI_t$ are the corresponding rates of inflation, expected and unexpected, respectively.

If $\beta = 1$, then property may be considered to be a complete hedge against expected inflation, and if $\gamma = 1$ a complete hedge against unexpected inflation.

This type of model is fitted to the data; there are several technical issues that must be considered before doing so:

1. The IPD data is semi-annual up to September 1995, and quarterly thereafter. Rather than omit data, we apply the model to these varying time periods. But we caution that any returns illustrated before 1995 have been adjusted to a quarterly basis for consistency.

2. All the variables used in the model have to be tested for compatibility The technical requirement is that they have the same order of 'integratedness'. This appears to hold for all variables, with the possible exception of expected

inflation. However as in Hoesli (2006), we overlook this technicality on the grounds of significance.

3. We need to consider autocorrelation in the variables, which can suggest that the model is mis-specified. In fact, all variables in the model suffer from high levels of autocorrelation. We have not attempted to adjust the model in order to maintain consistency with previous studies. Rather we deal with this issue by allowing for autocorrelation in assessing the stationarity of the model (via the error terms ε_t). In addition, the cointegration approach examined later in this paper is robust to this feature.

RESULTS

In line with previous studies, an analysis of the inflation hedging capabilities of property can be conducted on either a short term basis using regression techniques, or on a long term basis using cointegration.

Short term results

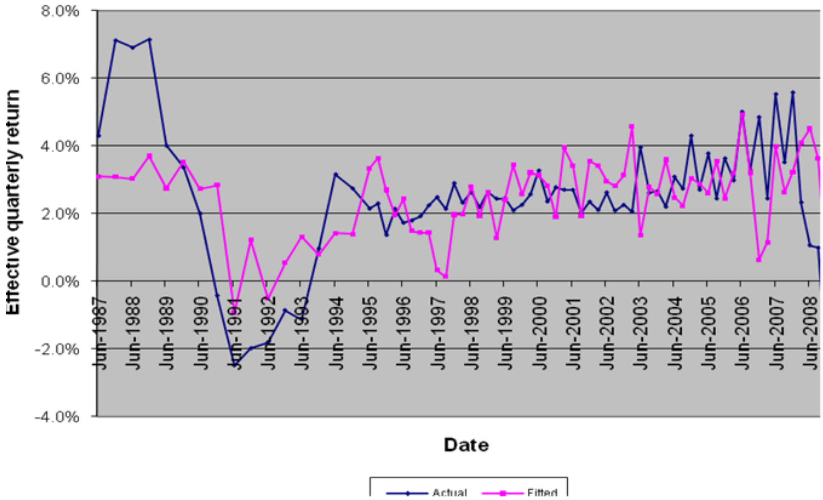
The results under the regression methodology are given in Table 1 for the property types (retail, office, industrial). The fit of the model is shown graphically below for the composite property type, and in Appendix A for the individual types.

Table 1: Short term model: Property and equity returns as a function of expected and unexpected inflation

	β	γ	R^2
Composite	1.697	3.015	0.432
	(3.40)	(10.21)	
Retail	1.924	1.054	0.541
	(5.30)	(4.91)	
Office	1.698	3.928	0.403
	(2.71)	(10.60)	
Industrial	1.022	1.830	0.222
	(2.08)	(6.28)	
ASX A-REIT	0.18	(2.63)	0.06
	(0.13)	3.21	
ASX All Ord	(0.43)	(2.64)	0.04
	0.27	2.80	

*t-statistics are shown in brackets

Figure 1: Property returns – composite type data period: 1986-2008



The goodness-of-fit, based on a visual inspection, is reasonable for all property types except industrial. Though R^2 values of between 20% and 30% may seem low in absolute terms, the many factors affecting the relative supply and demand for property preclude any strength in short term relationships. Even where such factors are modelled, such as in the vacancy rates employed by Wurtzebach et al (1991), R^2 values only in the range of 30% to 40% are achieved. This is for a study that provides the strongest evidence of a short-term inflation link for property.

In the Australian context, the R^2 values observed by Newell (1996) for the period 1984-1995 are of a slightly higher magnitude than reported above, though the roles of office and retail types appear to be reversed. It should be noted that the chart above excludes the effect of an inflation spike for the September 2000 quarter, as the result of the imposition of GST, which was not immediately reflected in rentals. Based on the short term results above, it is notable that the value of $\beta = 1$ is within a 95% confidence interval, so it appears reasonable to conclude that property is a complete hedge for expected inflation for all types, except possibly industrial.

It is even more notable that with 95% confidence, it can be concluded that $\gamma > 1$ for office properties. That is, office property is more than a complete hedge (also known as an effective hedge) for unexpected inflation. This mirrors the results obtained by Wurtzebach (1991), at least for an era of high inflation. Retail property, whilst having the best overall fit, is least impacted by unexpected inflation. This may be due to special factors affecting rentals, such as turnover in shopping centres.

As intuition would suggest, the industrial sector might be seen as providing the weakest link with inflation, as this type of property is not constrained to be located near population centres. Though the goodness-of-fit is lower than other property types, industrial property nonetheless provides some inflation hedging characteristics in its own right.

One immediate explanation for the relatively high coefficients for β and γ is taxation. The analysis has been based on before tax property returns, whereas in practice we should expect that after tax returns are compensated for inflation. The point can be made clearer as follows.

Suppose that, instead of modelling before tax returns, we model them on an after tax basis. This assumes that it is after-tax returns that need to be compensated for inflation, not before-tax returns. Thus corresponding to equation (2), we would consider a model of the form:

$$(1-T)R_t = \alpha' + \beta' \cdot ECPI_t + \gamma' \cdot UCPI_t + \varepsilon_t \tag{3}$$

where T denotes the tax rate, and α', β', γ' denote the after-tax versions of the model coefficients.

Then it turns out that $\alpha' = (1-T)\alpha,\ \beta' = (1-T)\beta,\ \gamma' = (1-T)\gamma$, which means the coefficients in the after-tax model are precisely those in the before-tax model, but reduced by a factor of $1-T$. If the overall rate of tax allowed for is say, 30%, then the coefficients β' and γ' are much closer to 1, and therefore more realistic in their compensation for inflation. This also makes plausible the view that investors seek after-tax compensation for inflation with a tax rate in the vicinity of 30%. The regressions allowing for such a tax rate are shown in Figure 2.

Table 2: Short term model: tax adjusted regression coefficients

	β'	γ'
Composite	1.188	2.111
Retail	1.347	0.738
Office	1.188	2.750
Industrial	0.715	1.281

The above model can also be applied to Australian equities (All Ordinaries/S&P ASX 300 index) for the same period. Apart from the poor fit illustrated for the model, the coefficients β and γ for Australian equity returns turn out to be negative, suggesting that Australian equity is a perverse hedge against inflation.

Dependence on the level of inflation

It has sometimes been suggested that the level of inflation itself affects the hedging abilities of property. Wurtzebach et al (1991) considered periods of high and low inflation, and found evidence that the relationship with inflation – whether expected, unexpected or actual – was generally higher in periods of high inflation, A similar study was proposed by Newell (1996), but not carried out due to the short history of the available data.

The data for the present analysis, covering the period from 1986 to 2008 with generally quarterly returns, does make such a study feasible. However, a distinct episode of high inflation can be identified only in the first few years of the period – in general quarters with low and high inflation follow each other. Thus, it is preferable to allow for the effect of inflation levels by introducing a more general function form for the dependence of property returns on inflation.The simplest such form can be introduced by allowing returns to depend not only on inflation levels, but also on their squares:

$$R_t = \alpha + \beta_1 \cdot ECPI_t + \beta_2 \cdot ECPI_t^2 + \gamma_1 \cdot UCPI_t + \gamma_2 \cdot UCPI_t^2 + \varepsilon_t$$

The results of this type of regression are shown in Table 3.

Table 3: Short term model: more general functional dependence

	β_1	β_2	γ_1	γ_2	R^2
Composite	(0.11)	41.02	1.55	(78.96)	0.490
	0.07	(1.18)	2.13	2.32	
Retail	3.05	(25.35)	0.69	(32.03)	0.556
	(2.58)	0.96	1.26	1.25	
Office	(1.28)	67.76	2.12	(91.54)	0.468
	0.66	(1.55)	2.33	2.15	
Industrial	(0.15)	26.59	0.69	(63.21)	0.271
	0.09	(0.76)	0.94	1.84	

A comparison of the results in Table 3 with those in Table 2 suggests a slightly better goodness-of-fit for the more model (and a slightly higher Akaike Information Coefficient, after allowing for the additional explanatory parameters).

The key to the differentiation between low and high levels of inflation lies in the regression coefficients β_2, γ_2, which drive the accelerating effect of inflation on property returns. However the t-statistics indicate that they are below or just at the threshold of significance. Thus the inflation level itself has only a weak effect on property returns.

Before speculating on other reasons for these results, it is useful to consider whether they are replicated if a long term modelling approach is adopted.

Cointegration methodology

An alternative to examining relationships between asset returns is to look for relationships between asset prices (which are in a sense the accumulation of returns over time). This is ultimately the main concern of investors. The advantage of this approach is that the return dynamics are naturally incorporated into prices, however complex they may be. These dynamics may be very difficult to capture in short term regression models.

These ideas have given rise to the concept of cointegration, which has been applied to property in the studies noted above. Though it is reasonably straightforward to apply, the methodology is justified only if certain technical conditions are met.

In its simplest formulation, due to Engle and Granger (1987), the aim is to model property in terms of an asset that maintains its value in real terms (i.e. in line with inflation). In accordance with the framework of this paper, we consider expected and unexpected inflation as two ‘asset prices’, thus allowing for the effects of expectations on valuations.

A logical approach is to follow the process for valuations. Taking logarithms of equation (1), and neglecting the short term impact of reversions, we derive:

$$\ln(A_t) = \ln(D_t) - \ln(K_t).$$

Now suppose that rentals D_t are dependent on accumulated inflation (both expected and unexpected), and capitalisation rates K_t are a function of the real risk-free rate and possibly expected inflation, with all other parameters assumed to be constant. Then the following simple price model can be considered:

$$\ln(P_t) = \alpha + \beta \cdot \ln(EI_t) + \gamma \cdot \ln(UI_t) - \ln(\delta + RY_t) + \varepsilon_t \qquad (4)$$

where P_t is the IPD index value at time t, and EI_t, UI_t are index values, constructed to represent accumulated expected and unexpected inflation, respectively. The symbol RY_t denotes the real yield on indexed bonds at time t.

The coefficients β and γ in the above model represent the relative changes in index levels (i.e. when changes are expressed as a percentage of index levels), for relative changes in expected an unexpected inflation respectively. The parameter δ is meant to represent all the components of capitalisation rates K_t (apart from real yields) that are assumed to be held constant. These comprise:

$$\begin{aligned}\delta = &\ risk\ \ premium \\ &- expected\ real\ rental\ growth \\ &+ expected\ depreciation\end{aligned}$$

The technical conditions that need to be met for a rigorous cointegration analysis are all the index levels, and the level of real yields, have to have the characteristics of being prices. More precisely, they are integrated of order 1. This appears to hold in practice. The error terms ε_t have a stationary structure (i.e. their behaviour does not depend on time). This will be examined as part of the model output.

Long term relationships

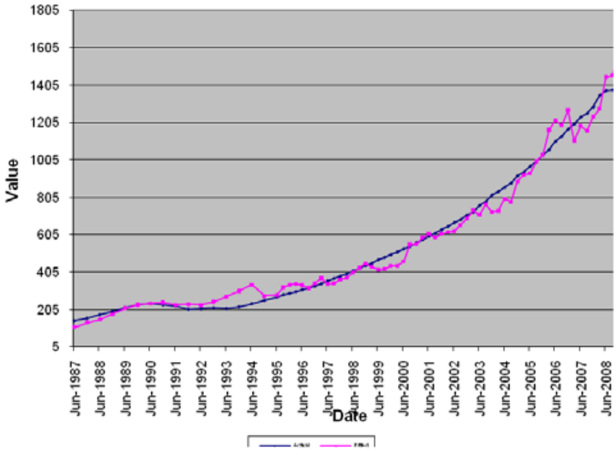
The results under the cointegration methodology are given in Table 4 for the four property types. The fit of the model is shown graphically below for the composite property type, and in Appendix B for the individual types. These relations have been estimated using the method of maximum likelihood.

Table 4: Long term relationships

	β	γ	δ	R^2
Composite	2.647 (19.83)	4.656 (13.63)	0.027 (3.46)	0.98
Retail	3.365 (31.45)	3.316 (12.32)	0.040 (4.29)	0.99
Office	2.194 (13.46)	4.948 (11.84)	0.032 (2.86)	0.95
Industrial	2.955 (16.26)	3.890 (8.05)	0.014 (2.17)	0.97

*t-statistics are shown in parentheses

Figure 2: Property accumulated value – composite type



The chart above suggests that commercial property as a whole in 1994 was severely undervalued in relation to its long term trend against inflation, and more recently overvalued in 2007. Nonetheless, it is reasonably significant that the error structure is stationary. However the real yield RY_t has an important role to play. Without it, the model does not produce stationary errors.

Though the model appears to be adequate in terms of its technical features, it is more difficult to interpret its results. Expected and unexpected inflation are almost certainly significant factors in driving property prices, as shown by the high β and γ factors in Table 4. Their impact is even stronger than apparent in the short run relationships, possibly because they are obscured in the short term by the lagged effects of inflation. Nonetheless, it appears that expected and unexpected inflation alone are not enough to explain property valuations in a systematic way: they must be combined with other factors.

It is comforting that real yields also appear highly significant in explaining valuations, which is what theory would suggest via the use of capitalisation rates. The sign of δ as found in Table 4 is positive. This parameter has the interpretation of a risk premium, net of expected real rental growth and depreciation. The estimated level varies between 1% and 4% p.a., according to property type, which seems reasonable. However, there remains the possibility that the variables used in the model, namely inflation and real yields, may be proxying other, unidentified variables that do have direct impact on property valuations (such as vacancy rates). Unfortunately, it is beyond the scope of this paper to identify and assess what would be a very wide range of possible relevant factors.

CONCLUSIONS

Whilst intuition would suggest that property should be a good inflation hedge, the experience in practice has been different across different locations and time horizons. Property, listed property and equities all differ in their inflation hedging capabilities. This seems as much a function of the institutional structure of markets as of the economic factors that drive these markets.

Based on the history of the IPD index, there seems little doubt that Australian property has demonstrated an inflation-hedging capability in the short term. Notwithstanding the obfuscation caused by serial correlations in returns and inflation changes, there is strong evidence of a contemporaneous relationship between property returns with both expected and unexpected inflation. The level of the inflation hedge also appears to compensate for the effects of taxation in reducing property returns in practice.
This result is largely supported by a long term cointegration analysis of accumulated property values and inflation. Real bond yields, which in theory underpin appraisal valuations, are an important factor in this long term relationship. The analysis also points to the existence of a positive risk premium in appraisal valuations.

Whilst the cointegration analysis is technically justified and produces results similar to other cointegration studies, it is to some extent intellectually unsatisfying. There are no doubt other, as yet unidentified, factors that drive property valuations, such as vacancy levels, GDP or even money supply, which may have been proxied by the variables used in this study.

Further, the analysis also shows that there may be long periods when property values may depart from the values suggested by inflationary trends. This is important because inflation hedging is concerned ultimately with the speed at which asset prices respond to inflation, and not simply an ability to compensate for the erosion of real value caused by inflation over the long term. Hence the cointegration analysis must be seen as corroborating, but not replacing, the short term analysis.

Whether these results would continue to apply in the future is an open question that cannot be answered definitively by studies of this type. The data used in this study was drawn mainly from a period of benign inflation. However, the analysis suggests that if economic and market conditions continue as they have been in the previous 20 years, then property should provide a reasonable hedge against inflation. Moreover, the analysis provides some support for the intuitive relationship posited in the early parts of the paper, which is itself an important input for those concerned with designing inflation-hedged portfolios for an uncertain future.

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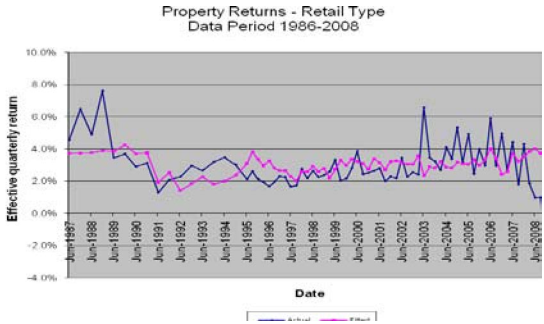
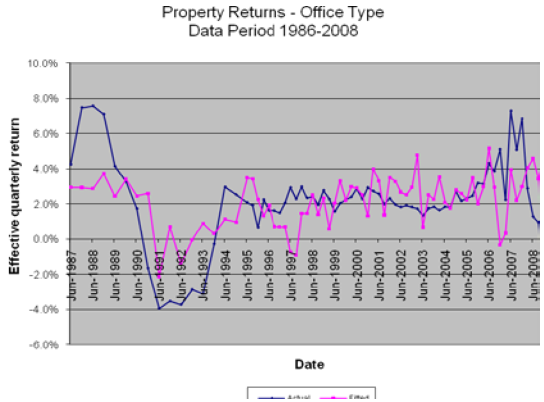
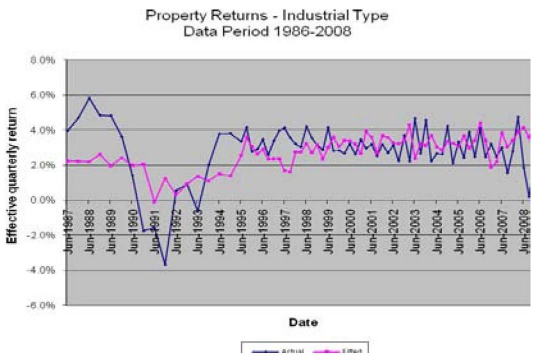
Appendix A : Short term relationships







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