



EST 1892

**London  
South Bank  
University**

# **UK PROPERTY DERIVATIVES**

[reduced version]

for the MSc in Quantity Surveying of London South Bank University  
Faculty of Engineering, Science and the Build Environment  
Department of Property, Surveying and Construction  
By

**Helder Cardeira**  
London, March 2007

**Citation:** Cardeira, H. 2007. *UK Property Derivatives*. MSc Dissertation. London South Bank University.

# Contents

<b>1.</b>	<b>Introduction .....</b>	<b>1</b>
<b>2.</b>	<b>Property indices .....</b>	<b>3</b>
2.1.	The IPD Index .....	4
2.2.	Property indices .....	4
2.3.	Property valuations .....	7
2.4.	Characteristics of tangible property .....	9
<b>3.</b>	<b>Research questions .....</b>	<b>11</b>
3.1.	Property derivatives and risk hedging .....	12
3.2.	Property derivatives and volatility .....	12
3.3.	Property derivatives and lagging .....	14
3.4.	Property derivatives and high serial correlation.....	15
<b>4.</b>	<b>Data collection methods.....</b>	<b>17</b>
<b>5.</b>	<b>Research findings (part I).....</b>	<b>20</b>
5.1.	Development of property derivatives so far .....	20
5.2.	The future.....	21
5.3.	IPD credibility .....	23
<b>6.</b>	<b>Research findings (part II).....</b>	<b>25</b>
6.1.	Property derivatives and risk hedging .....	25
6.2.	Property derivatives and volatility.....	27
6.3.	Property derivatives and lagging .....	28
6.4.	Property derivatives and high serial correlation.....	30
<b>7.</b>	<b>Conclusion.....</b>	<b>32</b>
7.1.	Recommendations for further research .....	34
<b>8.</b>	<b>References.....</b>	<b>36</b>

# List of graphs

Graph 1: All property nominal returns (source: IPD) .....	13
Graph 2: How was the development of property derivatives so far? .....	20
Graph 3: What is vital for further development? .....	21
Graph 4: Is the IPD index suitable for property derivatives? .....	23
Graph 5: Can property derivatives be used to hedge the risk of individual property? .....	25
Graph 6: Property and low volatility; will this stop interest in property derivatives? .....	27
Graph 7: Property indices lag the property market; will this concern investors? .....	28
Graph 8: Can property inefficiencies be explored using property derivatives? .....	30

# List of figures

Figure 1: Property indices vs. other type of indices (e.g. FTSE 100) .....	6
Figure 2: Property in comparison with other type of underlying assets .....	10

# 1. Introduction

UK property derivatives have been a popular topic in the press for the last three years. Much has been said about the benefits of property derivatives and little about the inefficiencies of property indices. The high level of serial correlation and the existence of lagging within property indices, are evidence enough that the underlying asset is inefficient and prone to arbitrage.

Recent tax clarifications, as well as the acceptance of the Investment Property Databank (IPD) Index as a property benchmark have provided the platform for the development of UK property derivatives. The market has since shown signs of activity and developed an Over The Counter (OTC) property derivative based on the IPD index. This kind of property derivative is the only property derivative analysed within this dissertation.

Due to the lack of research on the use of property indices, as the underlying asset for financial derivatives, this dissertation seeks mostly to clarify the extent to which such indices are suitable as a foundation for property derivatives. In the event that property indices are inefficient, further clarifications may be required to assess the impact of such indices on the development of property derivatives. These concerns were put to all the investment banks licensed to trade the IPD index and other industry respondents. Their responses have allowed an insightful analysis of the questions posed.

Based on the foregoing the following are the main objectives set out within this dissertation:

- a. Assess if property derivatives can be used as a property hedging tool;

- b. Assess if the low volatility shown on property indices will stop investors to enter the property derivatives market;
- c. Assess if the lagging effects of property indices can be exploited by arbitrators; and
- d. Assess if the existence of high serial correlation within property indices can be exploited by arbitrators.

These objectives form the main work for this study. However, a full understanding of the IPD index was considered essential for addressing the main objectives, since the index is the underlying asset with which UK property derivatives are based upon. For a clear understanding of the chapters ahead the following is a brief description of the remaining structure of this dissertation; the inefficiencies of property indices are developed in more detail in chapter 2. These inefficiencies are then further developed in chapter 3 under four main research questions. Before the results are presented within chapter 5 and 6, a brief description of the research methods used is outlined in chapter 4.

## 2. Property indices

The recent development of property derivatives puts a considerable amount of trust in the IPD index to measure the performance of property. The index is considered to be a reliable benchmark and, as many interviewees mentioned, 'it is probably the best we will ever get'. This chapter aims to challenge the legitimacy of this level of trust.

There are two types of property index that may be used to track the performance of property. These are portfolio based property indices and notional property indices. Notional indices are those which are not constructed from aggregating the income/expenditure and capital value movements of individual properties. Instead, these indices only track general rental, capital and yield movements in the property market.

Turner and Thomas (2001) have identified that, assuming that annual changes in rents and yields feed through instantaneously to generate changes in capital value, property returns will be sensitive to short-term market movements and are incapable of reflecting the performance of the investment market. Turner and Thomas (2001) go further by arguing that notional property indices are unsuitable for portfolio performance measurement since an investor could not closely match their movement with an actual portfolio of real estate holdings.

A comparison between portfolio based and notional indices was undertaken by Turner and Thomas (2001). They found that the standard deviation is a lot higher on a notional index than on a portfolio based index. The reason for this, they argue, is mainly due to the lease structure within the UK. Since rents are signed for periods of many years, oscillations in the rent value affect only properties that are currently in the market for tenants. This means that a notional index spreads the variation across all properties while

a portfolio based index spreads the oscillations only across properties which are affected in this way.

## **2.1. The IPD Index**

The IPD index, which is the benchmark for property derivatives, is valuation based. The IPD launched the index over 20 years ago. It is computed and published at three frequencies; annual, quarterly and monthly. All three are calculated using time-weighted methodologies, with returns and price movements computed monthly and thereafter for the purpose of index construction.

The IPD annual index covers approximately 11,000 directly held UK property investments in over 240 portfolios, with a market value in December 2005 close to £150 billion. The index tracks back in full to December 1980 and, for a much smaller sample of assets, to December 1970 (IPD, 2007).

It is estimated that the current coverage represents just over 75% of the total combined value of the property assets held by UK institutions, trusts, partnerships and listed property companies, and just under 50% of the total professionally managed UK property investment market (IPD, 2007). Nevertheless property indices, like the IPD index, are prone to inefficiency due to the peculiarities of individual property. The following sections seek to illustrate these inefficiencies.

## **2.2. Property indices**

One of the major issues with constructing a property index based on actual properties is in guaranteeing that the sample contributing to the index is a fair representation of the wider market. Brown (1987) suggested that it was necessary to create a portfolio containing 200 properties for which the market explains in excess of 95 per cent of the variation in returns. However due to the heterogeneous nature of tangible property, it is difficult to hold a fully diversified portfolio and eliminate property specific risks since it is very unlikely that the property market will support sufficient properties of a similar nature.

This has enormous implications for the creation of property market indices, particularly

when financial derivatives are built around such indices. Unless the actual market index contains an adequate sample size of properties, it will be influenced by the effects of individual properties to an unacceptable degree making the index inappropriate proxy for the wider market (Morrell, 1991). In relation to the property indices available Morrell (1995) argued that there are differences between composition, construction, desegregation and results. Schiller (1993) argued, in support of this, that property return indices may not be the best method to describe the current state and performance of the property market.

Although property returns are to a certain extent produced from rental income, the capital growth of the building is identified through valuations. Unlike equity market indices, which are transaction-based, operating on dividends and actual prices paid in the market, property market indices are valuation based. We will look at the problems embedded within property valuations in more detail later in this chapter.

We are concerned to demonstrate that the lack of accuracy of property valuations is bound to create difficulties for the construction of property performance indices. Recent academic literature as already identified that valuations smooth the results of property indices, thereby making property market returns appear more stable than they are in reality.

Additionally, it is important to note that the aggregation existent in property indices is contradictory to the information available for different areas of the UK. The accuracy of property returns in London is more precise than the accuracy of valuations of property in some other cities. This spatial aggregation will undermine the real property performance of any building asset (Dunse et al. 1998). The significance of this, and the need for accurate measurement, may have implications for the development of property derivatives which are based upon property indices.

Particularly relevant for the scope of this dissertation is the existence of lagging within property indices. This lagging effect is known as smoothing. It is embedded within any property index based on valuations. Clayton et al. (2001), trying to understand the causes of it found evidence that appraisers valuing the same property in consecutive periods



anchor onto their previous appraised values, resulting in more lagging than first-time appraisals. Clayton et al. (2001) advise that investment managers should rotate appraisers in order to not allow the same appraisal firm to consecutively appraise the same property.

McAllister et al. (2003), acknowledging that there is a substantial literature arguing that appraisals are smoothed and lag the true value of prices, undertook a qualitative interview survey of the leading fund managers and owners in the UK to assess their appraisals and the changes on the IPD monthly index. Their findings are much in line with the discussion so far. However, in addition, there is evidence of appraisals been carried out which have adopted different methodologies. Some firms prefer hard transaction evidence while others act on so called 'softer' signals. This inevitably raises questions as to the consistency with which the IPD index is put together.

Generally, property indices show evidence of high serial correlation and lagging. Furthermore the information used in the build up of any property index is sourced through a decentralised market. Based upon the academic literature referenced so far, the following figure aims to compare the main differences between property indices and other type of index used in financial derivatives (e.g. FTSE 100).

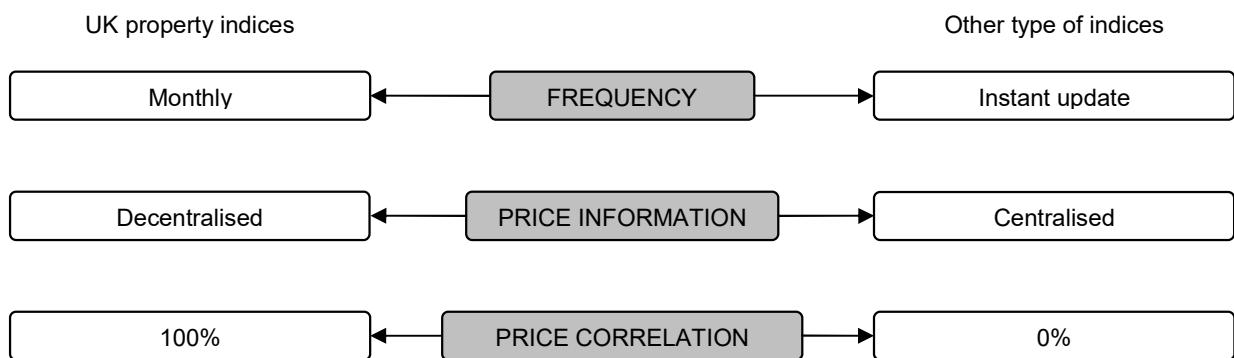


Figure 1: Property indices vs. other type of indices (e.g. FTSE 100)

As figure 1 shows, UK property indices are in a class of their own if compared with other financial indices such as the FTSE 100. In order to understand the reasons behind these differences it is important to understand the characteristics of property as well as the way with which the valuation process is carried out. The following two sections will expand on this.

## 2.3. Property valuations

As highlighted in section 5.2, property is valued more often than it is transacted, and any valuation will be based on prices previously achieved by a similar asset class in the market. However, the details of most property transactions are not disclosed to the public, and unlike most of the underlying assets for derivatives, there is no centralised exchange to reflect supply and demand. This makes property information biased and hard to obtain. Certain locations such as, for example, the City of London, generate abundant information, and transactions are more transparent than for some other locations. Arguably, issues can be raised about the reliability of property performance reported in the IPD index for the more remote areas of the UK.

This relationship between the value of property and the valuer is not in line with the development of most financial derivatives where the underlying asset cash market is traded in exchange. Generally, the value of a derivative will depend upon the spot price of the underlying asset, time and other variables that are taken to be known constants. The Black and Scholes (1974) model set the standard of how to price derivatives. However the lack of information available in the property markets makes the pricing inaccurate and highly correlated.

The accuracy of valuations is based upon the availability of comparable data. Comparables are the cornerstone of market valuation and are perceived to be the most reliable evidence of any property valuation (Crosby, 2000). A valuation process which is based on comparables will always raise questions regarding the accuracy of the process. What follows is a list of issues embedded in the production of valuations which affect the accuracy of any property index:

- a. **Uncertainty** – Any property valuation has a degree of uncertainty which is covered through assumptions. The number of assumptions that the valuer needs to make, partly based on his or her experience, seriously increase the chances of error in any valuation (Millington, 2000). As Baum et al. (1997) noted valuers will always be faced with the problem of finding comparables. The more unusual the patterns of income, the more difficult it will be to make the right assumptions. Uncertainty arises when the valuer is forced to look into the future. Some valuers assume the future is certain and

known. However, the more the future is assessed the less certain it becomes. How the valuer is going to apply the impact of such report within its valuation will be entirely based on his or her experience (Crosby, 2001).

- b. **Lagging** – As already identified above property index valuations lag market movements. In rising markets, valuations would be expected to be lower than prices and vice versa. The lagging effect of valuations upon property plays a very important role in the development of property derivatives. A fundamental financial premise is that efficient markets will eliminate arbitrage opportunities. However, due to serial correlation, the lagging effects of property valuations will have an affect on property indices. Therefore, if the lagging effect on valuations is explored in full, investors may be able to take full advantage of it. This possibility makes property derivatives inefficient within the market it operates and is subject to further development in the next chapter.
- c. **Recording of data** - There are serious concerns that the process of recording the data is riddled with inconsistencies, (Raftery, 1991). The way data is collected is through a process whereby the real costs or resources are converted on unit rates. These unit rates are afterwards used in property valuation, but due to the heterogeneous characteristics of property the use of this data can be considerably biased. Hendershott et al. (2002) added that property transactions prices, if disclosed, may not reveal the true valuation of the transaction as well as noting the peculiarities which will lead onto erroneous recording of data. The availability of different data suggests that firms have access to a range of different figures which can be used to report the value of their property stock according to their own interests. This may give to property firms arbitrage opportunities.

These issues are evidence that the value of property that feeds property indices is inconsistent. This is contradictory to most kinds of financial derivatives. There is academic research available which suggest improvements to property valuations. Monte Carlo Simulations and Discounted Cashflows are some of the suggestions proposed (see Byrne 1995; Kelliher and Mahoney 2000; Fraser 2004). Nevertheless the accuracy of simulations will always depend on the quality of the data used in the models.

One of the key principles of derivatives products is the pricing mechanism used upon the underlying asset. We have highlighted in this section the extent to which property valuations are based upon comparables, and concluded that due to the heterogeneous characteristics of property these comparables are prone to valuation errors. The inefficiency of valuations will be embedded into any property index based upon property valuations.

## 2.4. Characteristics of tangible property

So far, we have highlighted the characteristics of property valuations and the effect of these on property indices. What follows is a list of property characteristics which aims to illustrate the intrinsic differences between property and other types of derivatives, such as, for example, oil, in order to understand why property value is assessed through valuations.

- a. **Spot price** – As already discussed property value is identified through valuations. Consequently, unless the property is bought or sold, there is no real confirmation of the margin of error of the valuation. A report published by IPD/RICS (2005) shows that the average price-value difference in 2004, irrespective of whether the sale was above or below valuation, was 9.5%. This raises serious concerns as to the reliability of the performance of property reported by the IPD index.
- b. **Heterogeneous characteristics** – As a major contrast to commodities such as oil, sugar etc, which are homogeneous, property is heterogeneous. Every building, when it is put together, is intrinsically dependent on the views of the developer, the design intent of the architect, the funding available, the planning regulations and any number of other issues which are constantly evolving throughout time.
- c. **Illiquidity** – Selling and buying property involves transaction costs and an undefined amount of time to carry out the transaction. This makes property markets very illiquid. The ability to sell or buy tangible property swiftly, efficiently and within acceptable pricing tolerances is by no means guaranteed.

d. **Indivisible** – Property, unlike other investment assets, is indivisible. A portfolio of properties will be made up of a certain amount of properties which can not be divided into a different number without forcing the owner to incur in construction works. This characteristic also relates to the location of property. Property is a tangible asset which will be, throughout its life span, associated with the land on which it was built. The supply and demand for property is therefore local driven rather than global.

We have highlighted the main differences between property and other types of assets such as oil. The fact that property is indivisible and illiquid may explain the lack of property transactions, which explain in turn the existence of general practice surveyors to estimate the value of property.

Based upon the issues discussed the following figure aims to illustrate the main differences between property and other type of assets.

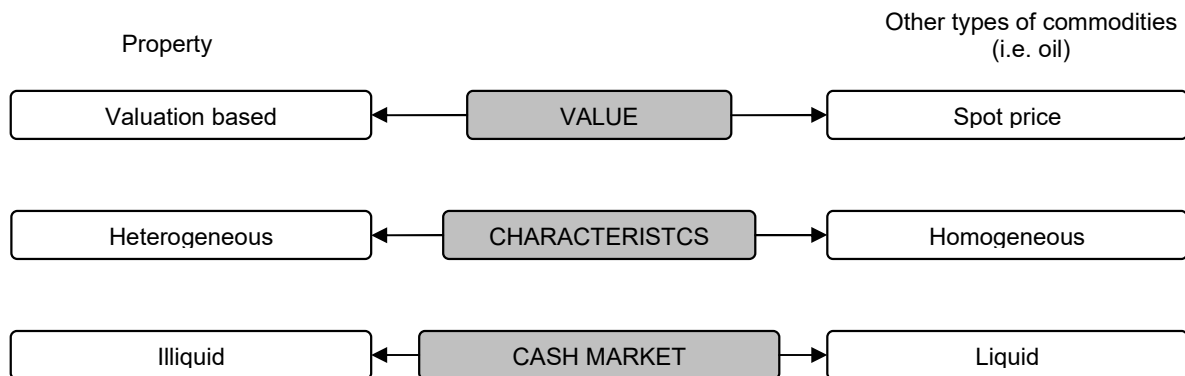


Figure 2: Property in comparison with other type of underlying assets

In summary, this chapter has put forward some of the issues surrounding property indices and has raised concerns about using property indices to track the performance of property. These concerns relate mainly to the heterogeneous characteristics of property, the underlying asset of any property index, and the effects of lagging and high serial correlation upon valued based property indices.

This chapter has presented and assessed substantial evidence that property indices are inefficient and as such may have implications in the development of property derivatives. The assessment of the magnitude of such implications is part of the scope of this dissertation and is developed further in the next chapter.

## 3. Research questions

The inefficiencies identified within property indices in the previous chapter are at the centre of the four research questions considered in this chapter. These research questions fall into two separate categories. The first aims to assess the attractiveness of property derivatives to property hedgers, while the second aims to assess to what extent the property indices inefficiencies can be explored by arbitrators through property derivatives.

Interviewees were asked two fundamental questions in order to establish a basis for an assessment of whether the current status of property derivatives fulfils the needs of end-users. The questions were: (1) How efficient are property derivatives to hedge property risk? And (2) How volatile are property indices?

Furthermore two further questions were posed to the interviewees in order to assess how property indices inefficiencies can be explored by arbitrators. These questions were: (1) Property indices lag: do you foresee arbitrage opportunities? And (2) Property indices show high serial correlation: do you foresee arbitrage opportunities?

These open-ended questions constitute the main source of data and are the support of the findings put forward later in the dissertation. This chapter aims therefore to give more information regarding the build up of the research questions. As a note of reference the information provided does not aim to answer the questions, instead, it aims to raise concerns about the full usage of property derivatives.

### **3.1. Property derivatives and risk hedging**

Chapter 2 when discussing the peculiar characteristics of property as an asset class highlighted the fact that property is heterogeneous. The pricing or the value of any property can even be more complicated to calculate if we consider lease structures, the risk of the expected tenant cashflows and so on. The performance of any one property type will differ immensely from any other.

Stoesser and Hess (2000) argued that due to the inefficiencies in the commercial real estate market, it is possible to achieve excess returns consistently without exposing the property to additional risk. The article identifies a variety of ways in which property managers can optimise the property returns of their portfolios. This is, by contrast, very different from investment in equities, where the investor can only influence their investments through share proxy voting.

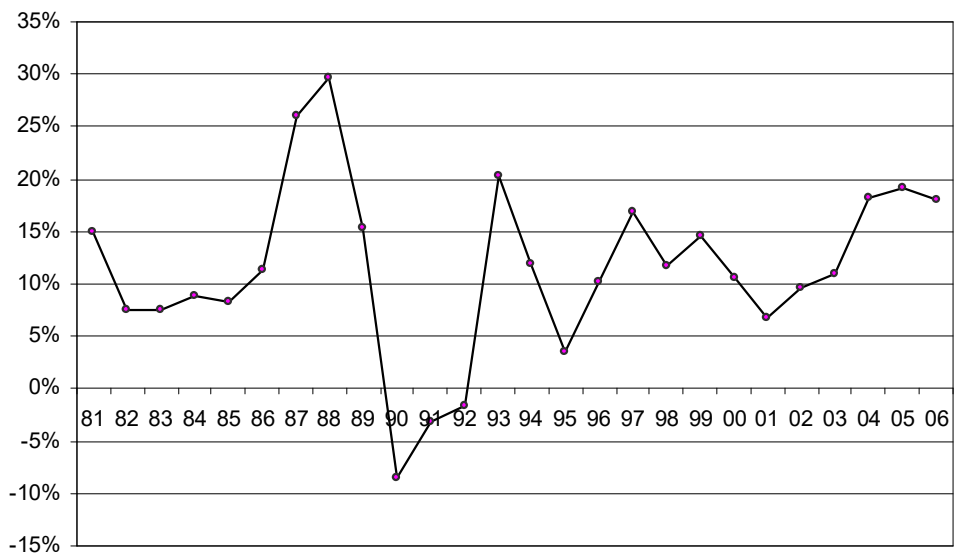
The property returns achieved by any property manager in the market will therefore vary a great deal according to his or her skills, and the value of the stock in the market. Additionally Johnston and McConnell (1989) identified that the most successful financial derivative products proved to be those which enabled efficient methods of transferring the risk of the underlying asset. This is vital in bringing to the market not only speculators but also hedgers.

Keeping under consideration these two issues, the hedge effectiveness of property derivatives and the wider span of returns that can be achieved through good management in property – the question arises as to whether it would be possible for a property manager to hedge the risks of a property portfolio through the use of property derivatives. Would the returns of a small portfolio be in line with the returns shown on the IPD index?

### **3.2. Property derivatives and volatility**

A correlation of the previous question is the assessment of the volatility of property. Holland and Vila (1997) argued that volatility is vital for the development of derivatives. It is the presence of volatility and the necessity of transferring the risks associated with it

that attract the hedger to the market.



Graph 1: All property nominal returns (source: IPD)

However, as is shown in the graph above, property had a positive performance year on year throughout the period 1981 – 2006 with only 3 years of negative performance between 1990 – 1992. The negative performance is connected to the recession felt in the UK at the time.

Nevertheless, the lack of volatility within property indices may be misleading. Newell and MacFarlane (1998) argued that, since property performance is generally based on valuations and not market transactions, there is a consensus view that the resulting estimates of property risk are too low and do not fully capture the actual volatility of property.

Gilberto (2003) when assessing real estate volatility in America on the National Council of Real Estate Investment Fiduciaries (NCREIF) concluded that the index shows a dubious 3.4% volatility. As a matter of reference the Lehman Aggregate Bond Index, for example, has a 7.5% historical volatility over the same 100 quarters. Gilberto (2003) argues that serial correlation of property valuations could be the reason to blame and uses data collected from American REITs to assess a more accurate value for property volatility.

One of the problems with property indices is that when there are infrequent comparable



transactions available the valuation process will not reflect the dynamics of a changing property market (Nanthakumaran and Newell, 1995). This may result in a lack of volatility within property indices. Notwithstanding this, the question remains: will such lack of volatility within property indices affect the development of property derivatives?

### **3.3. Property derivatives and lagging**

The pricing of property derivatives is subject to assumptions regarding the current situation of the property market. This is mainly due to the effects of lagging on property indices. There is strong evidence that valuations and property indices tend to either underestimate or overestimate the market during property cycles.

Fisher and Miles (1999), using a sample of 2,739 transactions of properties sold from the NPI from 1978 to 1998, compared the sales prices and appraised values of the same properties. The findings were that when the property markets were rising (from 1978 to 1985) transaction prices were on average 4.6% higher than appraisals. During the declining market (from 1988 to 1992) transaction prices were, on average, 4.5% below the corresponding appraisals.

One of the main reasons to use property derivative products is the fact that the risk of falling markets can be minimised, or the returns from rising markets maximized. These features will attract end-users into the market. However, if the market is falling, and such is not reflected in the IPD index, then the practical use of property derivatives remains at large.

Moreover property indices are dubious during periods of uncertainty. This was mentioned briefly by McAllister et al. (2003: 273) as an 'interesting and illuminating case study raised initially by interviewees' and deals with the implications of thin trading for property appraisals in what is called 'stalled' markets. This was evident during October and December 1998, a period characterised by the Russian debt crisis.

This period of uncertainty about the prospects of the global economy lead to changes in investors' sentiment towards commercial property. Property appraisals during this period were rather thin in the market. Many property transactions were also cancelled during this

time. The lack of transaction evidence, as well as uncertainty in the market, generated different approaches to appraisals carried out during the period of crisis. It was evident that commercial property was out of favour during this period. However, around 80% of the monthly appraisals remained unchanged. On average, 69% of appraisals remained unchanged on month to month appraisals (McAllister et al., 2003).

This has implications as to the ease with which property forecasts can be made. Although outside the scope of this dissertation there is academic evidence that property performance can be forecast (see Gilberto 1990; Gyourko and Keim 1992).

### **3.4. Property derivatives and high serial correlation**

Connected to the effect of lagging on property indices is the opportunity for investors to identify inefficiencies in the market. Arising from the impact of valuations on property based indices the well informed investor may have the opportunity to forecast the future of the index.

Both the lagging effect of property valuations on property indices and the advantage that informed investors may have in the prediction of the future direction of the market may influence the development of property derivatives. The issue becomes even more complex if we consider the potential that some firms have to influence the value of future valuations and therefore the property index.

A firm that owns a considerable portion of the index in relation to a city or sector could influence the property returns of the index, or use their information to develop strategic property derivative positions. These positions could easily be changed according to the information the firm would feed into the market.

Kaiser (2005: 137) asserted 'a slightly more talented or hardworking manager then could easily create the appearance of some alpha performance simply by making properties perform at a higher level than the market on average, through superior management, re-tenanting or rehabilitation.' Additionally Havard (2000) shows that different types of property valuations can be applied to the same property asset and will show different

## UK Property Derivatives

outcomes. This ability, available within a property firm, to play with the value of its portfolio may lead that firm to create profitable positions using property derivatives.

## 4. Data collection methods

The data collection method was based upon interviews. The first approaches provided the structure for further interviews, as well as allowing opportunities to refine the research issues proposed for discussion. Consequently, the scope of the interview was revised four times. As a note of reference the second sources of information were approached in the beginning of the data collection. The intention was to refine the interview so a better understating and contribution could be obtained by the first sources of information.

The interview included a mix of closed end open questions and the interviewees were also asked their opinions on the questions posed in the interview. The length of the interview was kept to a minimum at the request of the interviewees.

Hannabuss (1996) warns researchers about the various obstacles embedded in interviews when after the interview the information needs to be presented and findings put forward. Therefore the close-ended questions were designed to be capable of supporting spreadsheet analysis and generating quantitative summaries. These were then converted into graphs for presentation within chapter 8 and 9. Moreover as suggested by Maylor and Blackmon (2005) all the themes arising during the interviews were coded and categorised so the qualitative data provided could be broken down into units for analysis.

The interview was made of four sections. The first section consisted of questions relating to the experience of the interviewee in property derivatives and other kinds of financial derivatives. The second section consisted of questions relating to the development of property derivatives and the IPD index. Questions in the third section were designed to identify the awareness of the interviewees about IPD index and the way it is put together. The final section was made of the four questions developed in chapter 6.

The data collection was carried out between November 2006 and February 2007. The firms interviewed were subdivided into two categories. The first category, the principal source of information, was comprised of all the banks licensed to trade the IPD UK Indices, which at the time of writing included 13 investment banks. All 13 investment banks were contacted. The resulting 12 interviews amounted to 92% of the total sampling. The following is a list of the 12 banks that contributed to this dissertation:

- ABN AMRO
- Barclays Capital
- Credit Suisse
- Deutsche Bank
- Euro Hypo
- Goldman Sachs
- JP Morgan
- Lehman Brothers
- Merrill Lynch
- Morgan Stanley
- Royal Bank of Scotland
- UBS

Outside the main group of banks but offering important contributions to this dissertation were:

- Schroders
- Abbey Financial Markets

The second group, the second source of information, was constituted of various firms that, due to a variety of reasons, were involved in property derivatives. This list included the first property derivatives hedge fund, property developers that entered the property derivatives market, inter-dealer brokers and firms of lawyers involved in the transactions as well as the IPD. The following is a list of the contributors:

Property funds:

#### UK Property Derivatives

- ORN Capital (property derivatives hedge fund)
- Morley Fund Management

#### Property developers:

- Quintain Estates & Development

#### Inter-dealer derivatives broker:

- ICAP

#### Law firms:

- Nabarro Nathanson
- CMS Cameron McKenna
- Fried, Frank, Harris, Shriver & Jacobson

#### Miscellaneous:

- IPD

The first source of information was made of the parties involved in the development of the property derivatives. It was particularly relevant to collect their views regarding the four research questions. The contribution of the second source of information was related more to their involvement and sometimes no direct link could be found to the research questions.

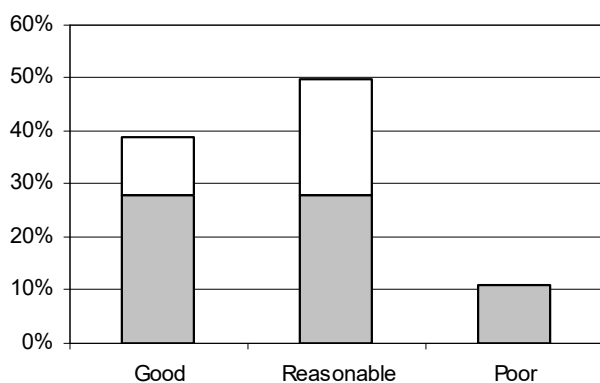
It was considered essential to account for research ethics within this project, meaning that the identity of the contributors would remain anonymous and any information obtained would be classified confidential and protected. Full details are available for audit purposes only, in order to ensure confidentiality.

## 5. Research findings (part I)

This dissertation was not restricted to the research questions developed in chapter 6. Judgements about the development of property derivatives as well as the credibility of the IPD index were also collected throughout the interviews. For ease of reading the results about such matters are reported and analysed within this chapter. The remaining results are reported and analysed in chapter 9.

As a note of clarification the different patterns of each column shown on the graphs is due to a distinction between the first group and the second group of sources of information. Meaning that the first group is illustrated in grey whilst the second group is illustrated in white.

### 5.1. Development of property derivatives so far



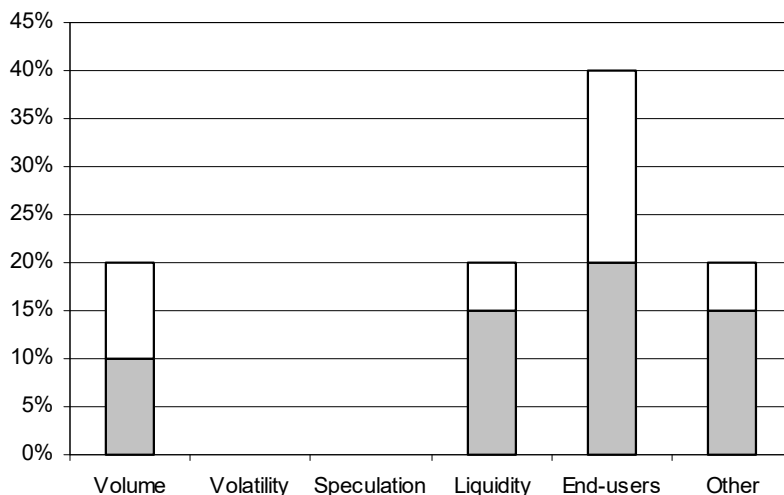
Graph 2: How was the development of property derivatives so far?

Graph 2 shows that 50% of the interviewees considered the development of property derivatives so far to be reasonable whilst 39% thought was a good development. Only 11% were not satisfied with the development so far.

Within the 59% that regarded the development of property derivatives reasonable, 44% claimed that the poor involvement of end-users was the main reason to consider the development to be reasonable only. 33% blamed the slow process the market is going through for their discontentment. It is believed that it will take longer than expected, maybe ten years, before the property derivatives market reaches a volume of trading which can be considered successful. Only then will property derivatives achieve the mainstream desired.

The expression ‘everyone seems to be very positive at the moment’ would explain the achievement of a position in which 39% of respondents recorded a verdict of “good” in respect of the volume achieved by property derivatives so far. The £4,675m cumulative volume to December 2006 was more than expected early in the same year. As a note of reference, within the 39%, 71% of the interviewees reported that their firm was reasonable busy trading property derivatives. This may explain why 11% of the interviewees classified the development of property derivatives as, poor, since 100% of firms represented by those interviewees reported a depressed property derivatives trading volume. In some cases trading was nonexistent.

## 5.2. The future



Graph 3: What is vital for further development?

Graph 3 shows that the interviewees considered volume, liquidity and end-users



contribution to be crucial for the development of property derivatives. Volatility, which is assumed within this dissertation to be crucial for the success of any derivatives product, as identified by Johnston and McConnell (1989), was never considered relevant for the development of property derivatives by the interviewees.

Of particular interest is that 40% of the interviewees believe that the involvement of end-users in the market may help the development of property derivatives. This is quite peculiar since most financial derivative products are used by hedgers and speculators, as described by Hull (2005). Nevertheless, property derivatives are showing signs of lack of interest from hedgers. This apparent lack of involvement of end-users in the market raises concerns about the risk transfer possibilities of property derivatives.

This apparent mismatch between the financial sector and the property sector has already been identified. French and Gabrielli (2004) mentioned the lack of knowledge of general practise surveyors to means and standard deviations. McAllister (1998) reported the lack of usage of financial derivatives by the property markets. The same applies in the case of the lack of knowledge about property inefficiencies within the financial sector. This is explored in more detail in the next chapter.

Without enough weighting to be considered relevant, nevertheless interesting to the understating of property derivatives, are the answers given outside the possibilities tabled. Within the 20% of the interviewees coming forward with peculiar answers, two in particular should be noted. The first mentioned that due to the peculiar characteristics of the property market, the derivatives would not be able to work without the presence of bespoke contracts, the second regarded more contribution to the IPD index crucial for further development. Both these answers are in line with the recommendations put forward by Lecomte and McIntosh (2006) about the inefficiencies of property indices as an underlying asset.

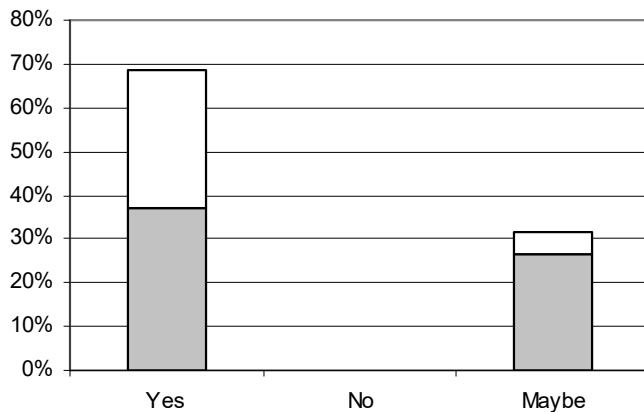
As a note of reference, 85% of the interviewees believe that property derivatives will benefit all kinds of firms. However there seems to be a perception that pension funds will be the last sector to enter the market due to their assessment of risks. Without guarantees or signs of maturity pension funds will stay way from property derivatives. This is particularly interesting since one of the milestones in the history of property

derivatives is the FSA consent regarding property derivatives as a form of investment for pension funds. Since pension funds regularly adjust their positions within equities, bonds and property, property derivatives may offer a good solution to making the property adjustment more liquid and cost effective.

Regarding the reasons for entering the property derivatives market 85% answered with a combination of reasons, depending on the stage the market at the time and the interest of the firms entering the market. The reasons proposed were to gain or reduce exposure to the property market at a very low cost, speculation, access to property returns, arbitrage and risk hedging. It is interesting to note that arbitrage, which is developed further in the next chapter, was directly mentioned by only 10% of the interviewees.

### 5.3. IPD credibility

---



Graph 4: Is the IPD index suitable for property derivatives?

Graph 4 shows that a staggering 68% of the interviewees believe that the IPD is a reliable benchmark for property derivatives. It was often mentioned to be the best available worldwide, 'I wish there were more like it' was an expression mentioned once. The sample of the market used by IPD is by far the biggest compared with others property indices, and the fact that IPD has been around for many years makes it a very reliable source in benchmarking property returns for firms. The general consensus was that the UK IPD index is probably the best index property derivatives will ever get.

However, 26% of the first group had reasons for concern. Within these 26%, 50% of the

interviewees had reservations regarding the size of the sampling for some sub-sectors. In relation to this was the weak contribution to IPD indices outside the UK. A more frequent contribution from European countries to European IPD indices would allow investors carefully to establish international property positions using property derivatives. Nevertheless, at this stage, this lack of contribution is still perceived to be a problem for the IPD index.

Regarding the remaining 50% of the interviewees the answers differ and can only be mentioned as a note of reference. The concerns were related to (1) the eventuality of the IPD index going bust, (2) the fact that IPD has been working on collaborative basis meaning it would be possible that in the future IPD contributors will withhold or fail to disclose potentially sensitive information, (3) the fact that CBRE values 40% of the index may be seen as a reason for concern as the market develops and (4) in terms of pricing, appraisal based indices can smooth volatility. This comment was in line with the findings put forward by Johnston and McConnell (1989) about the importance of volatility in the underlying asset of financial derivatives.

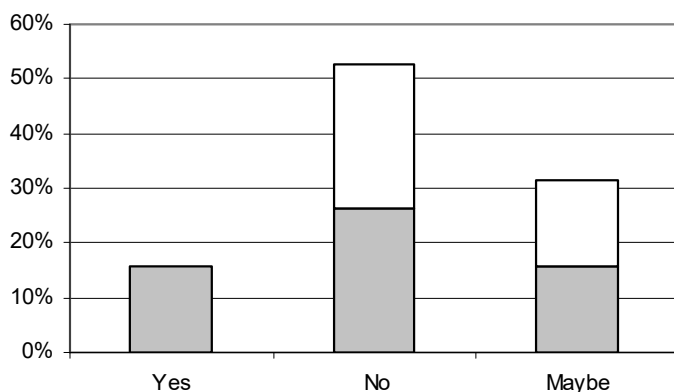
Further to the above, an issue regarding the IPD index was logged and researched in more detail. The issue was that the IPD index has been constructed to be a property market indicator rather than a hedging tool. As already discussed the concept of hedging within property derivatives is relevant to assess the potential success of the product (see Holland and Vila, 1997). Therefore, the selection of the property that constitutes the IPD index should be subject to closer consideration in order to make the index more successful as a hedging tool. Investors in bond indices, for example, are very sensitive to the build up of the index. Consequently, due to the heterogeneous characteristics of property, and the effects of such upon property indices, an assessment of the exact needs of the investment market, in terms of the type property that needs to be hedged, may help to build a more effective property index and attract more end-users to the property derivatives market. This is an issue that needs to be carefully thought through and it is therefore proposed within the recommendations for further research at the end of the dissertation.

## 6. Research findings (part II)

The objectives set out for this research work fell into two categories; the first category aims to assess the attractiveness of property derivatives to property hedgers, while the second category aims to assess to what extent the property indices inefficiencies can be explored by arbitrators through property derivatives..

To analyse the findings in the light of these two categories is a complex task for the researcher. The views collected throughout the interviews were so diverse, contradictory and dissimilar to each other that it is fair to say that property derivatives are an evolving market which, to a certain degree, is still inventing itself. Interviewees had their personal views on the current and future development of the market as well as the implications and applications of the product. Time will tell who is wrong and who is right.

### 6.1. Property derivatives and risk hedging



Graph 5: Can property derivatives be used to hedge the risk of individual property?

Graph 5 shows that more than 50% of the interviewees believe that, due to the heterogeneous characteristics of property, individual property returns cannot be hedged

using the IPD index or a similar property index. However for most of the interviewees the hedge effectiveness of property derivatives for individual property was not considered very important. This is mainly because any asset manager considering property derivatives to hedge property returns would most likely do so against a portfolio of properties, and for that the IPD index was considered a good proxy. The consensus was that the portfolio does not need to be a lot more than one single property to be in line with the IPD index.

Nevertheless, certain types of property will be able to be hedged through the IPD index and other types will most likely not. This is very much in line with our discussion in the previous chapter about the build up of the IPD index. More clarification about the types of buildings that make up the index will ensure that a more accurate hedging tool is embedded within the contracts.

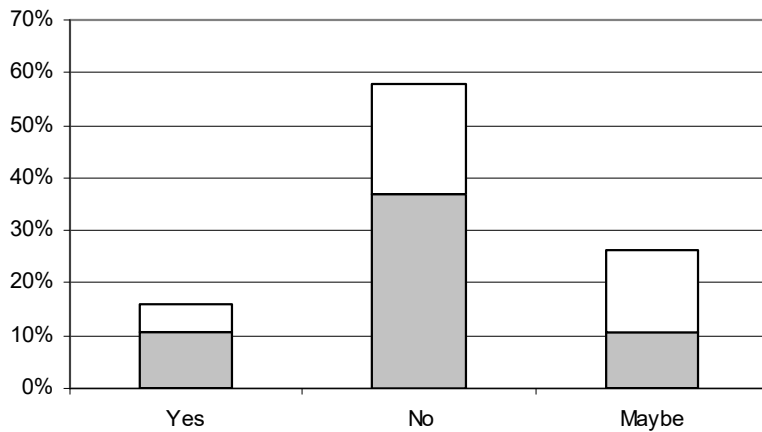
Notwithstanding the heterogeneous characteristics of property, as long as the specific risk of the asset can be identified and extracted, the IPD index will be able to hedge the systematic risk. There was evidence collected of single property being hedged through property derivatives. However, very few interviewees believed that it was possible to achieve an acceptable margin of risk transfer, in respect of single property, through property derivatives.

This is mostly due to the heterogeneous characteristics of property, which is in line with Brown (1987) regarding the difficulties in finding an acceptable sampling that could be used to track single property performance. Additionally, property offers certain advantages in relation to bonds or equities. After acquisition, for example, it can be upgraded and improved, as discussed within Stoesser and Hess (2000). The benefits of that can hardly be assessed using a property index. This means that the extra value gained will not be reflected on the IPD index and there is the danger that your hedging tool may increase your exposure to risk.

In summary property derivatives can be used to gain exposure to the property market but it remains to be seen how the contracts will be developed to incorporate hedging features. This may explain why end-users of property derivatives have so far remained uninterested in the development of the market. It remains to be seen if firms such as

property developers and property funds can hedge the risks of their commercial portfolio using property derivatives. If such is achievable, within an acceptable margin of error, property derivatives may gain the mainstream crossover desired.

## 6.2. Property derivatives and volatility



Graph 6: Property and low volatility; will this stop interest in property derivatives?

Graph 6 shows that 58% of the interviewees do not foresee the lack of volatility in property as being capable of affecting the development of property derivatives. This is mostly due to the fact that contracts in property derivatives have so far been traded by swapping property returns. This is also in line with section 8.2 of the previous chapter where volatility was never mentioned as one of the drivers to move property derivatives forward.

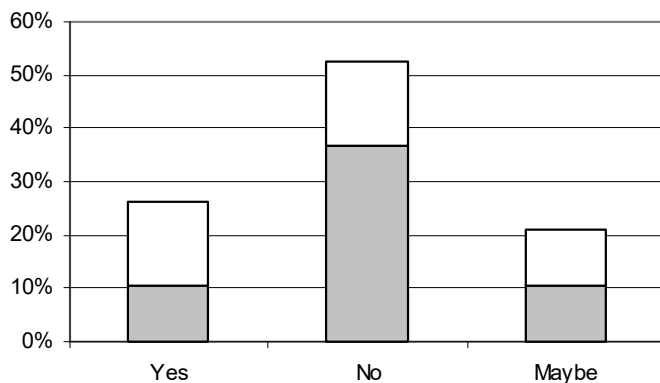
Since the performance of property is forecast ahead, any trader can have an interpretation of how much these property returns are going to be. This will inevitably differ between traders and the market in general. Property derivatives can therefore be traded based on such views. The speculative characteristics of property derivatives and other type of financial derivatives are instruments described by Hull (2005). Judging by the interviewees, property derivatives seem to be a good instrument for the achievement of speculation about the property market.

This lack of volatility of property cycles was interesting to discuss. Most of the investment banks interviewed mentioned that, after entering into property derivative contracts, it was

relatively easy to find counter parties to pass on their positions. This is particularly interesting and relevant to the scope of the research questions since it shows that although property cycles are very stable the market can still accommodate long and short positions.

Moreover, for some of the interviewees the property market is not as stable as it seems to be. More experienced property experts are well aware of the property recession in the early nineties. There is no guarantee that the property market will continue to remain as stable as IPD has reported it to be for the last decade.

### 6.3. Property derivatives and lagging



Graph 7: Property indices lag the property market; will this concern investors?

Graph 7 shows that 53% of the interviewees do not believe the lagging effects of property indices will have an effect on the development of property derivatives. The evidence is stronger if only the first source of information is considered. Nevertheless, within the first source of information, 25% of the interviewees were unsure that property indices lag the property market. This is in line with what was stated in the previous chapter regarding the lack of knowledge about the inefficiencies of property indices by the financial sector.

The interview results provide evidence that there is a knowledge gap between property and the financial markets. Though it was not possible to determine the full level of awareness of interviewees in this area as the dissertation focused more on the relationship between lagging and arbitrage upon property indices. It is worth to note that only interviewees from the second source of information were aware that the lagging could lead to arbitrage positions. This is supported by evidence of firms trying to take

advantage of such positions in the early developments of the property derivatives market.

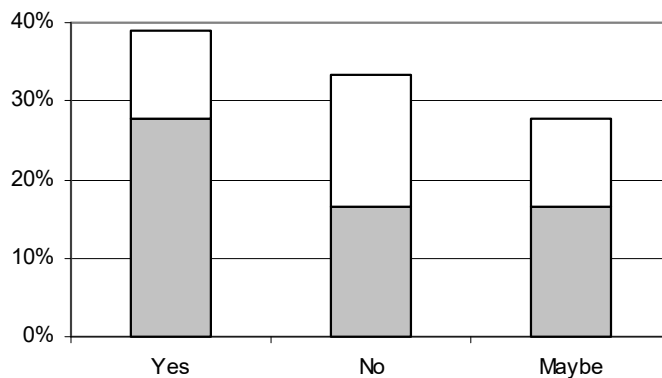
Lagging of property indices and the effects of this on property derivatives was perceived due to the heterogeneous characteristics of property by the researcher to be one of the most problematic of all the issues raised. The general consensus was that most of the traders of property derivatives are aware of it, which comes in support of the findings of Fisher and Miles (1999), Clayton et al. (2001) and McAllister et al. (2003).

It was interesting to note that, since most of the traders are aware of the issue, it was never perceived to be a problem. Whoever is involved in the property derivatives market will have to adjust the IPD index. Nevertheless, any such pricing mechanism will have to be based on assumptions about the state of the property market at the time. This is not in line with financial derivatives theory (Hull, 2005).

Additionally, there seems to be no awareness of how the effects of lagging of property indices under falling markets will be assessed by traders or reported on the IPD index. Evidence collected throughout a couple of interviews, regarding tangible property, show that property valuations under periods of recession are hypothetical. This means that property transactions in periods of recession are scarce and there are difficulties for sellers in finding a buyer. Often firms that try to sell off their assets to pay off their debt are found to be in a situation where it is not possible to match the offer price with the one shown on the valuation. How the IPD index copes with this remains to be seen. Therefore, the full success of property derivatives can only be fully assessed after the product has experienced all the business cycles.



## 6.4. Property derivatives and high serial correlation



Graph 8: Can property inefficiencies be explored using property derivatives?

Graph 8 shows that 39% of the interviewees believed that property inefficiencies can be explored through the use of property derivatives, 28% think this may be possible and 33% think it unlikely.

In general terms the interviewees gave the impression that works in theory but in practice is very difficult to achieve. The fact that CBRE accounts for 40% of the valuations could be put forward as a reason for concern. However, due to the amount of people needed to influence the market, this would probably never work.

There is evidence of firms in Europe owning 20% of the country's IPD index. Such firms can influence the property market. It was clear that such correlation would be difficult in markets such as the City of London but the full extent of influence on other cities has not yet been properly assessed. The interviewees showed awareness that the existence of high serial correlation and firms owning a fair percentage of the index can allow derivative strategies to be based around that. For example, the biggest fund in the IPD index, which owns 8% of the index, may be able to skew the market.

The issue increases in importance when the lack of contribution of the IPD index in certain areas is assessed. For instance, the Retail sector in the IPD index is largely owned by a few companies. A seller of property derivatives could build their position in the market to exploit such inefficiencies. This was accepted by most of the interviewees. What was difficult to accept was how the position could be achieved.

Together with the effects of lagging on property indices, how these inefficiencies will be explored remains to be seen. Harvard (2000) identified various ways in which such valuations can be carried out. Kaiser (2005) identified various ways in which property performance can be reported. This can without doubt create inefficiencies in the market. In summary, market manipulation is possible in theory but none of the interviewees were convinced it would be possible in practice.

## 7. Conclusion

UK property derivatives is a market still in its infancy. The products offered by the investment banks licensed to trade the IPD index are simple vanilla options. Reported figures from IPD show that despite the lack of complexity the market is growing and evolving. If property derivatives follows trends set by other derivatives markets, its potential growth is three times the underlying. However, the realisation of this growth is likely to stimulate HM Revenue and Customs to change the rules of property derivatives taxation if there is a loss of revenue within the transactions of tangible property market.

The inefficiencies of property, particularly property indices, are at the centre of this dissertation. These inefficiencies were divided into two groups of research. The first group dealt with the low volatility of property indices and the difficulties in using such indices to hedge property risk. This led the researcher to query the level of interest end-users would show in such products. The second group dealt with the high level of serial correlation and lagging existent on such indices. This led the researcher to query if such inefficiencies could be exploited using property derivatives.

Regarding the first group of research this dissertation found that property derivatives do not display the same characteristics, such as risk effectiveness and volatility, as other successful derivatives products. Though, despite the lack of such characteristics the investment banks interviewed in this study have no concerns. Ironically, at the same time, this dissertation has identified that the way forward for property derivatives, from the interviewees' perception, is partly through the involvement of end-users. Therefore an important question to ask is how property derivatives will attract the interest of end-users if property derivatives show low volatility and low potential as a property hedging tool. These are considered essential characteristics to the attractiveness of the contracts to

end-users. The researcher suggests that the banking sector may need to tailor the property derivative products according to the needs of the end-users.

Additionally this dissertation also suggests that the IPD index was built to be a property market indicator rather than a hedging index. More thought needs to be put into it to improve the hedging features of the index despite the peculiarities of tangible property. These were the main findings regarding the first group of research.

In respect to the second group of research, discussions with the interviewees proved more fertile and generated a bigger collection of findings. Firstly this dissertation found that there is a knowledge gap between the financial and the property sector. This may explain the reasons for joint ventures between inter-dealer traders and general practice surveyors (e.g. DTZ and Tullett Prebon for services within property derivatives). However, it is still difficult to assess to which extent this knowledge gap will be exploited by arbitrators. Although most of the interviewees were aware of lagging in property indices, a few were sceptical. There is evidence that the pricing of property derivatives are adjusted upon what is believed to be the state of the property market at the time. This is not in line with financial derivatives theory and may undermine the development of the market due to the lack clarity among investors.

On the other hand, in the event that the UK property derivatives market is bigger than the underlying cash market, general practice surveyors may be obliged to look into property derivatives before putting a property valuation forward. Assuming that property derivatives in the future will reflect and adjust to all the information available, general practice surveyors could utilise property derivatives in their property valuations for more accurate pricing. This is of particular interest considering the history of financial derivatives, since the value of a derivative influences, if not determines, the value of an underlying asset. Although this may not be in line with financial theory there is evidence that property derivatives are a different asset class and this may pave the way for a different kind of derivatives market.

Despite the irregularities in the pricing of property derivatives, the effects of the knowledge gap between the two sectors is more evident when the high serial correlation of property indices is discussed. A suggestion that it is possible to manipulate the market

is acceptable to the interviewees in theory and negated in practice. Nevertheless, throughout the interviews, as the IPD index was discussed in more detail, warnings were given by the interviewees regarding the physical areas and sectors of the index which are prone to property manipulation and can be exploited by arbitrators.

Additionally, this dissertation found that more research is needed to assess how property is valued during periods of recession. This is considered to be of great importance as there is evidence that the real value of the asset will be disconnected from the valuation and will be a hypothetical value that will feed property indices. This is mostly due to it being extremely difficult to find a buyer in periods of recession. Often firms need to dispose of their tangible assets to pay their debts and are faced with a very illiquid property market.

There is a serious risk, therefore, that the IPD index will not be able to report periods of property recession in an acceptable manner. Therefore, this dissertation suggests that a specific property valuation for property derivatives should be developed so the process can be standardised and brought into line with the expectations of investors. This dissertation also acknowledges that the success of property derivatives can only be fully tested after the product has gone through all the business cycles.

Despite the foregoing, property derivatives are, as reported by the interviewees, an effective tool to speculate about the property market. The ease of exposure that can be achieved through property derivatives is a major distinction to the challenges of direct property ownership.

The potential to have a position in commercial property which can easily be swapped or adjusted for a position in retail without transaction costs, is an attractive advantage and key to the attractiveness of the contracts. Furthermore the opportunity to be able to go short in the property market is only possible through property derivatives. This may allow the market to evolve without showing signs of hedging effectiveness or volatility, as has proved to be essential to the development of other types of derivatives.

## **7.1. Recommendations for further research**

The following is a list of recommendations that the researcher would suggest for further

research in the matter of property derivatives:

- a. Research the pricing mechanism used to price property derivatives. Assuming that traders are aware of the existence of lagging on property indices the pricing will reflect that. This implies that assumptions have been made. It is important to clarify how such assumptions are made, as well as considering any implications for the pricing and liquidity of property derivatives, since this is not in line with the existing theory of financial derivatives.
- b. In order to improve the hedge effectiveness of the IPD index, more research should be carried out to produce an index that is not just an indicator of the property market but is also a useful hedging tool.
- c. Further to item b indices could be produced based on certain characteristics of property which may increase the volatility of the index and consequently the interest in property derivatives.
- d. Property valuations have so far been developed for buyers and sellers of tangible assets, rather than property derivatives. Therefore a specific property valuation should be developed to be used in property derivatives. This would promote standardisation of how property value is reported.
- e. The inefficiencies of the IPD index in reporting certain areas of the property market need to be identified and clarified to avoid arbitrators to exploiting such inefficiencies at a cost to investors. Further research can be done to explore the areas where property derivatives should not be traded.

## 8. References

- Adair, A. and Hutchison, N. (2004) The reporting of risk in real estate appraisal property risk scoring, *Journal of Property Investment & Finance*, **23**(3) 254-268
- Andrew, A. and Pitt, M. (2002) The review of property appraisals, *Journal of Property Valuation & Investment*, **20**(1) 59-67
- Baum, A. and MacGregor, B. (1992) The initial yield revealed: explicit valuations and the future of property investment, *Journal of Property Valuation & Investment*, **10**(4) 709-724
- Baum, A., Crosby, N. and MacGregor, B. (1996) Price formation, mispricing and investment analysis in the property market; a response to "A note on 'The initial yield revealed: explicit valuations and the future of property investment'", *Journal of Property Valuation & Investment*, **14**(1) 36-49
- Baum, A., Mackmin, D. and Nunnington, N. (1997) *The Income Approach to Property Valuation*, London: Thompson
- Black, D. (1986) *Success and Failure of Futures contracts: Theory and Empirical Evidence*, Monograph Series in Finance and Economics, New York University: Salomon Brothers Centre for the Study of Financial Institutions
- Black, F. and Scholes, M. (1971) The pricing of options and corporate liabilities, *The Journal of Political Economy*, **81**(3) 637-654

- Brown, G. (1987) Reducing the dispersion of returns in UK real estate portfolios, *Journal of Valuation*, **6**(2) 122-147
- Brown, G. and Matysiak, G. (1995a) Using commercial property indices for measuring portfolio performance, *Journal of Property Finance*, **6**(3) 27-38
- Brown, G. and Matysiak, G. (1995b) Sticky valuations, aggregation effects, and property indices, *Journal of Real Estate Finance and Economics*, **20**(1) 49-66
- Byrne, P. (1995), Fuzzy analysis, a vague way of dealing with uncertainty in real estate analysis? *Journal of Property Valuation and Investment*, **13**(3) 22-41
- Carlsberg Report (2002) *Property Valuation*, London: Royal Institution of Chartered Surveyors
- Clayton, J., Geltner, D. and Hamilton, S. (2001) Smoothing in commercial property valuations: evidence from individual appraisals, *Real Estate Economics*, **29**(3) 337-360
- Creswell, J (1994) *Research Design: Quantitative and Qualitative Approaches*, Thousand Oaks: Sage
- Crosby, N. and Murdoch, S. (2000) The influence of procedure on rent determination in the commercial property market of England and Wales, *Journal of Property Investment and Finance*, **18**(4) 420-444
- Crosby, N. (2000), Valuation accuracy, variation and bias in the context of standards and expectations, *Journal of Property Investment & Finance*, **18**(2), 130-161
- Crosby, N. (2001), Basis of rental value for performance measurement systems, *Journal of Property Research*, **18**(2) 123-139
- Dunse, N., Jones, C., Orr, A. and Tarbet, H. (1998) The extent and limitations of local



commercial property market data, *Journal of Property Valuations & Investment*, **16**(5) 455-473

Fisher, J (2005) New strategies for commercial real estate investment and risk management, *Journal of Portfolio Management*, Special Real Estate Issue, September, 154-162

Fisher, J. and Miles, M. (1999) How reliable are commercial appraisals? Another Look, *Real Estate Finance*, **16**(3) 9-16

Fraser, W. (2004) *Cash-Flow Appraisal for Property Investment*, New York: Palgrave Macmillan

Fraser, W., Leishman, C. and Tarbert, H. (2002) The long-run diversification attributes of commercial property, *Journal of Property Investment & Finance*, **20**(4) 354-373

French, N. (2004) The valuation of specialised property: a review of valuation methods, *Journal of Property Investment & Finance*, **22**(6) 533-541

French, N. and Gabrielli, L (2004) The uncertainty of valuation, *Journal of Property Investment & Finance*, **22**(6) 584-500

Glaser, B. and Strauss, A. (1967) *The Discovery of Ground Theory*, Chicago: Aldine

Gilberto, M. (1990) Equity Real Estate Investment Trusts and real estate, *Journal of Real Estate Research*, **5**(2) 259-264

Gilberto, M. (2003) Assessing real estate volatility, *Journal of Portfolio Management*, Special Real Estate Issue, September, 122-128

GFI (2005) *GFI Property Derivatives*, London: GFI Brokers Limited

Gyourko, J. and Keim, D. (1992) What does the stock market tells us about real estate

returns? *Journal of the American Real Estate and Urban Economics Association*, **20**(3) 457-486

Hendershott, P., Hendershott, R. and Ward, C. (2003) Corporate equity and commercial property market 'bubbles', *Urban Studies*, **40**(5–6) 993–1009

Harvard, T (2000) *Investment Property Valuation Today*, London: Chandos Publishing

Hannabuss, S (1996) Research Interviews, *New Library World*, **1129**(97) 22-30

Holder, M., Tomas, M. and Wehh, R. (1999) Winners and losers: recent competition among futures exchanges for equivalent financial contracts, *Derivatives Quarterly*, **6**(2) 19-27

Holland, A. and Vila, A. (1997) Features of a successful contract: financial futures on LIFFE, *Bank of England Quarterly Bulletin*

Hordijk, A. and Van de Ridder, W. (2005) Valuation model uniformity and consistency in real estate indices: the case of the Netherlands, *Journal of Property Investment & Finance*, **23**(2) 165-181

Hull, J. (2005) *Options, Futures, and Other Derivatives (6th Edition)*, London: Prentice Hall

IPD/RICS (2005) *Valuation and Sale Price*, London: Investment Property Data Bank/Royal Institution of Chartered Surveyor

IPD (2007) *The IPD Index Guide*, London: Investment Property Data Bank

IPF (2006) *Pricing Property Derivatives: An Initial Review*, London: Investment Property Forum

Johnston, T. and McConnell J. (1989) Requiem for a market: an analysis of the rise and fall of a financial futures contract, *Review of Financial Studies*, **2**(1), 1-23

- Kaiser, R. (2005) Analyzing real estate portfolio returns, *Journal of Portfolio Management*, Special Real Estate Issue, September, 134-142
- Kelliher, C. and Mahoney, L. (2000), Using Monte Carlo simulation to improve long-term investments decisions, *The Appraisal Journal*, 68(1) 44-56
- Lahuszewski, J. (2006) *Introduction to CME Housing Futures and Options*, Chicago: CME Research & Product Development
- Lecomte, P. and McIntosh, W. (2006) Designing property futures contracts and options based on NCREIF property indices, *Journal of Real Estate Portfolio Management*, **12**(2) 119-153
- LSE (2007) *Factsheet figures January 2007*, London: London Stock Exchange
- Markowitz, H. (1952) Portfolio selection, *Journal of Finance*, **7**(1) 77-91
- Maylor, H. and Blackmon, K. (2005) *Researching Business and Management*, New York: Palgrave MacMillan
- McAllister, P., Baum, A. Crosby, N., Gallimore, P. and Gray, A. (2003) Appraiser behaviour and appraisal smoothing: some qualitative and quantitative evidence, *Journal of Property Research*, **20**(3) 261–280
- McAllister, P. and Mansfield, J. (1998a) Investment property portfolio management and financial derivatives: Paper 1, *Journal of Property Management*, **16**(3) 166-169
- McAllister, P. and Mansfield, J. (1998b) Investment property portfolio management and financial derivatives: Paper 2, *Journal of Property Management*, **16**(4) 208-213
- Millington, A. (2000) *Property Development*, London: Estates Gazette

- Morrell, G. (1991) Property performance analysis and performance indices: a review, *Journal of Property Research*, **8** 29-57
- Morrell, G. (1995) Property indices: a coming of age? *Journal of Property Valuation & Investment*, **13** (3) 8-21
- Newell, G. and MacFarlane, G. (1996) Risk estimation and appraisal-smoothing in UK property returns, *Journal of Property Research*, **13**(1) 1–12
- Nanthakumaran, N. and Newell, G. (1995) An Empirical Evaluation of UK Property Performance Indices, published in the proceedings of the RICS Cutting Edge 1995 Conference at the University of Aberdeen, 75-92
- Pagourtzi, E., Assimakopoulos, V., Hatzichristos, T. and Frence, N. (2003) Real estate appraisal: a review of valuation methods, *Journal of Property Investment & Finance*, **21**(4) 383-401
- Patel, K. (1994) Lessons from the FOX residential property futures and mortgage interest rate futures market, *Housing Policy Debate*, **5**(3) 343-60
- Raftery, J. (1991) *Principles of building economics*, BSP Professional Books
- Remenyi, D., Williams, B., Money, A. and Swartz, E. (1998) *Doing Research in Business and Management: An Introduction to Process and Method*, London: Sage
- RICS (1995) *Appraisal and Valuation Manual (Red Book)*, London: Royal Institution of Chartered Surveyors
- Robson, C (1993) *Real World Research*, Oxford: Blackwell
- Saunders, M., Lewis, P. and Thornhill, A. (2000) *Research Methods for Business Students*, Harlow: Financial Times/Prentice Hall
- Schiller, R. (1993) Property indices, *Journal of Property Research*, **10** 1–2

Stoesser, J. and Hess, R. (2000) *Differentiating Higher Returns Strategies in Property Markets*, New Jersey: Prudential Real Estate Investors

Turner, N. and Thomas, M. (2001a) Property market indices and lease structures - the impact on investment return delivery in the UK and Germany: Part I, *Journal of Property Investment & Finance*, **19**(2) 175-187

Turner, N. and Thomas, M. (2001b) Property market indices and lease structures - the impact on investment return delivery in the UK and Germany: Part II, *Journal of Property Investment & Finance*, **19**(3) 296-321

White, P. (1995) A note on "The initial yield revealed: explicit valuations and the future of property investment", *Journal of Property Valuation & Investment*, **13**(3) 53-58

**UK PROPERTY DERIVATIVES**

Filipe Cardeira, London March 2007