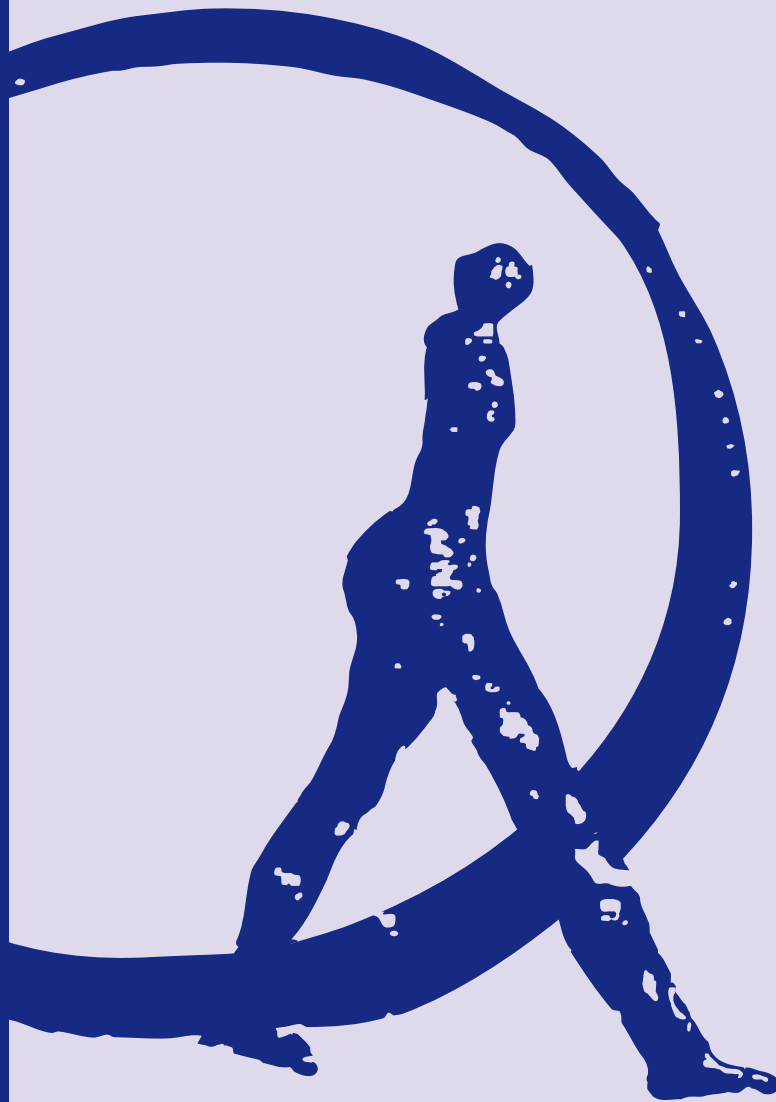


# Property Derivatives: A Primer

Excerpts of the EDHEC European Real Estate Investment  
and Risk Management Survey

November 2007



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# Property Derivatives: A Primer

## 1. The property derivatives market

We examine below the derivatives of property equity, which have heretofore been based on REIT or direct real estate indices.

### 1.1. Emergence of a market for swaps on commercial real estate indices

#### *History and development of the market for swaps on IPD indices*

##### The failures of FOX and REIM

The property derivatives market got off to a false start in the United Kingdom with the London-based futures and options exchange (FOX). The volume of transactions was modest for the brief existence of the exchange—from May 1991 to October 1991—which was closed when it became clear that the bulk of its activity was simulated.

The late 1990s saw the failure, for want of government authorisation, of a plan for an over-the-counter futures market backed by a score of institutional investors and known as the Real Estate Index Market.

##### Barclays' experiences

A modest market was reborn when Barclays had its investment bank help it reduce its exposure to commercial real estate. Medium-term fixed-income products matching the total yield of the IPD—Property Index Certificates (PICs)—were first offered in 1994. In late 1996, the bank offered two futures contracts—Property Index Forwards (PIFs) on the capital component of the index; in 1999 it listed Property Index Notes (PINs), fixed-income products paying the current yield of the annual IPD index and with a redemption value linked to changes in the capital component of the index since the issue of the note.

##### Birth of a modern property derivatives market

In the late 1990s, at the urging of PruPIM, the real estate investment managing arm of Prudential, the property derivatives users association (PDUA) was created. This association did significant work

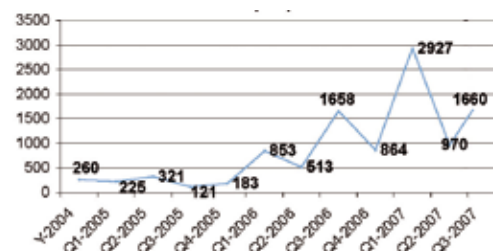
educating professional associations and potential users of these products in an effort to win their support and to lobby the regulatory authorities to lift the obstacles to the viability of this market.

In late 2002, with the decision of the FSA to allow life insurance companies—which hold a very large proportion of the stock of invested real estate—to include real estate swaps and forward contracts as admissible assets in the computation of their solvency ratios, a new era for property derivatives began in the United Kingdom. The 2004 standardisation of the taxation of property derivatives lifted an additional obstacle. Since June 2004 twenty-one investment banks have acquired licenses to use IPD indices to offer property derivatives, and an active over-the-counter market for total return swaps has sprung up in the UK.

##### Acceleration and internationalisation of the market

2006 was the year that the market shot up in the UK (exhibit 1); it was likewise the year it was exported to France. The first quarter of 2007 saw the volume of UK transactions at nearly £3 billion and the first transactions in Germany; at the end of the third quarter, Switzerland joined the club of European nations with a market for credit derivatives linked to IPD indices. Asia posted its first transactions (Australia, Japan) in the second and third quarters of 2007.

*Exhibit 1: Notional value of IPD UK derivatives for quarter of reference (£bn)*



Source: IPD, November 2007

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## Size and liquidity

At the end of the third quarter of 2007, the cumulated volume of transactions on British IPD index derivatives had reached £10.5 billion. This figure may be modest in view of the total value of investable commercial real estate (which a late-2006 IPD estimate puts at £350 billion), but it must be kept in mind that property is usually held for long periods. In mid-2007, the liquidity of the British IPD swaps market was nonetheless still limited and characterised by seasonality. Exhibit 2 shows volumes transacted in the nascent markets of continental Europe.

It is advisable that an index used for a credit derivative be representative (coverage, property-type composition) as well as reliable (regular appraisals of buildings contracted to outside appraisers rather than done in-house, diversification of contributors) and that it have a sufficiently long track record. From this perspective, the European IPD indices that are most mature for use as an underlier are those for Ireland, the Netherlands, Finland, and France.

## *United States—behind Europe*

### The two starts of NPI swaps

Following in the footsteps of IPD, CSFB and NCREIF partnered in mid-2005 to create an over-the-counter market for real estate swaps on the appraisal-based quarterly NCREIF Property Index (NPI); CSFB obtained an exclusive license to use the index through April 2007. With only six months to go to this expiry date only two small transactions had been reported.

Some may argue that these lags in the US are linked to the fact that the NPI cannot be considered a representative index of direct real

estate as (i) it tracks the investments of only one class of investors—tax-exempt institutions—(ii) its coverage of the universe is limited—\$247bn worth of properties or circa 10% of the investable investment grade stock—and (iii) its property mix, with a concentration in core prime properties, is peculiar when compared to the underlying stock of real estate. However, whether or not the NPI is representative of the commercial real estate universe, it is the oldest index available and is established as a benchmark for direct real estate investments by institutional investors.

A likelier explanation for the lack of transactions may be the business model adopted by NCREIF, which, by awarding a monopoly to CSFB, did not favour goodwill on the part of the investment banks that could have fostered market development through marketing and liquidity provision.

Reluctant to enter an uneven playing field, other investment banks apparently forced CSFB to renounce its exclusivity in the fall of 2006 and NCREIF announced new licenses had been awarded in March and April 2007. Transaction volumes have increased with the arrival of these new market participants, but the market is still in its infancy; these volumes, after all, have reached \$300 million over the semester following this second start to the market.

### Beyond NPI: direct real estate indices competing to serve as underlier for derivatives

Appendix 1 lists the new US commercial real estate indices created to bolster the derivatives markets. Their shared goal is to provide a more faithful and more current image of changes in the property markets than does the NPI, which is subject to lag, smoothing, and seasonality. They differ in

*Exhibit 2: Notional value of swaps initiated (number of transactions) on IPD France and Germany indices (€m)*

Amount	Quarter 1—2007	Quarter 2—2007	Quarter 3—2007
France	400 (11)	186 (17)	108 (19)
Germany	-	158 (20)	109 (20)

Source: IPD, November 2007—totals of bids and asks

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their methods for treating (or not treating) the quality and liquidity fluctuations observable in the market. S&P/GRA offers transactions indices based on the moving averages of prices per square foot, MIT/RCA (Moody's/REAL) uses the repeat-sales method to produce constant quality indices, and REXX provides indices for the offices market from local market data and from macroeconomic analyses—it positions itself as a local specialist.

In September 2006, the Chicago Mercantile Exchange (CME) and Global Real Analytics (GRA) announced a first-quarter 2007 launch of real estate futures and options on GRA Commercial Real Estate Indices. The CME was endeavouring to create exchange-based derivatives markets in commercial real estate just as it had created an organised market for housing derivatives. In November 2006, Standard & Poor's partnered with GRA to publish the re-branded indices and in January 2007 Charles Schwab took over GRA. S&P/GRA re-launched their indices in August 2007 with the CME blaming the delay on the merger and organising a late-October 2007 launch.

According to MIT/RCA, a consortium has been working on developing a forward market on their indices. Early estimates referred tentatively to Q1-2007 for a launch. At the end of September 2007, Real Estate Analytics—one of the three original partners of the MIT/RCA index—announced it had reached an agreement with Moody's. The rating agency will compute the index in place of MIT and will provide analyses, while Real Estate Analytics, proprietor of the computation method and holder of the rights to use the RCA database, will be in charge of developing and structuring—in association with the intermediaries—the derivatives based on these indices, now renamed Moody's/REAL Commercial Property Price Indices.

REXX is present both on the OTC market, where it is courting intermediaries, and on the organised market since the International Securities Exchange

announced at the end of April 2007 that it was launching REXX derivatives.

## *Attempting a forecast*

Having a diversity of indices vying to underlie property derivatives poses difficulties and creates opportunities. Brokers may find pitching property derivatives challenging as the number and heterogeneity of underlying indices could puzzle investors and reinforce a wait-and-see attitude. The US market is liable to fragmentation and could be stillborn if deals are distributed among indices in a way that prevents the emergence of a pool of liquidity large enough to support a sustainable market. On the other hand, and provided scale could be achieved in multiple derivatives markets, diversity would provide investors with a range of options and create opportunities for arbitrage between indices as highlighted by Clayton (2007).

Nevertheless, we consider this flurry of indices detrimental to market development. Faced with a brokers' alliance to develop NPI derivatives and lacking the status of benchmark in a crowded marketplace, the various non-NPI transaction-based indices are likely to be hard-sells. At this very early stage of the US property derivatives market, the prospects may be better for niche players than for head-on challengers to the NPI.

## **1.2. Housing derivatives**

### *Halifax index derivatives*

Residential real estate is not a core sector for institutional investment in the United Kingdom, and for this reason it is absent from IPD indices of commercial real estate. An over-the-counter market for options and futures on the hedonic Halifax (HBOS) housing price index—with a cumulative notional volume of as much as £2 billion by mid-2007, according to Reuters—has developed concurrently with the IPD index-linked swaps markets.

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## *Derivatives based on S&P/Case-Shiller indices*

The S&P/Case-Shiller indices are single-family US home-price indices that use the repeat sale pricing method to measure housing markets. In September 2007 the twenty metropolitan region indices were supplemented by two composite indices (aggregates of ten and twenty regions) and one national index.

In May 2006, the CME created housing options and futures contracts<sup>1</sup> based on a version of the S&P/Case-Shiller indices calculated monthly on a rolling sample of two months. Initially, the contracts—settled to a composite index and to markets in ten major cities—were offered for one year and on a quarterly cycle. Trading volume has remained modest: a few dozen transactions per day and, according to the CME, a cumulative notional volume of approximately \$350 million as of midpoint of the year (2007). In September 2007, in response to demand from investors for longer terms, the CME began offering contracts extending to eighteen months on a quarterly cycle; to thirty-six months on a biannual cycle; and to sixty months on an annual cycle.

## *Derivatives based on RPX indices*

The Residential Property Indices (RPX) created by Radar Logic use transaction prices in an attempt to measure daily changes<sup>2</sup> in the price per square foot of residential real estate. Twenty-five metropolitan area indexes and a composite are offered. An over-the-counter market for RPX index derivatives, centred around six broker-dealers and three inter-dealer brokers, was launched in September 2007; the first transaction was a total return swap.

### **1.3. Equity REIT index derivatives**

#### *Dow Jones U.S. Real Estate Index futures from the Chicago Board of Trade*

In February 2007, CBOT launched a futures contract based on the Dow Jones U.S. Real Estate Index, an index comprised primarily of REITs.

The contract has a quarterly expiry, a multiple of \$100 and a tick size of \$10; it is typically settled in cash.<sup>3</sup> It is traded on the CBOT electronic trading platform and benefits from market maker and liquidity provision programmes. This contract has so far attracted little interest; in an effort to boost participation the exchange has extended its waiver of trading fees—as of the beginning of Q4-2007 open interest was extremely low and volume extremely thin.

## *FTSE EPRA/NAREIT Indices derivatives*

For several years, investment banks have been offering options based on the EPRA Euro Zone index.

In October 2007, Liffe launched on the Paris market two futures contracts based on the FTSE EPRA/NAREIT Europe and on the FTSE EPRA/NAREIT Euro Zone indices. The FTSE EPRA/NAREIT Europe Index covers approximately 100 listed property companies in fifteen countries. The FTSE EPRA/NAREIT Euro Zone Index covers approximately fifty property companies in nine countries. These contracts have a trading unit of €10 per index point and a tick size of €5. They are offered with quarterly expiry dates and contracts are available for the three nearest quarterly maturities; they are settled in cash and benefit from market maker contracts.

## **2. Standard contracts and transactions**

Total return swaps (TRSs), property linked notes based on IPD UK indices, and Halifax housing-price index derivatives account for the bulk of real estate derivatives traded in Europe—and thus in the world.

### **2.1. Total return swaps**

#### *Global real estate index swaps against LIBOR (or EURIBOR) + premium*

The most common swap has a buyer (seller) of real estate exposure make (receive) periodic payments of the LIBOR or EURIBOR plus a designated

1 - The advantages highlighted by the CME are: exposure to real estate values without direct ownership of properties, lower transaction costs than incurred in buying and selling individual homes, opportunities for hedging, portfolio diversification, access to a unique asset class, a way to make trading real estate a liquid and short-term investment, and an opportunity to benefit from down markets.

2 - The transactions serve to estimate the parameters of the power laws found to be characteristic of price distributions; the indices are extracted using a proprietary formula.

3 - CBOT accepts exchanges for physical transactions against securities for which price dynamics are "reasonably" correlated with price dynamics in the DJUSRE index. Such securities might include portfolios of stocks or ETFs such as the iShares Dow Jones U.S. Real Estate Sector Index fund and the streetTRACKS DJ Wilshire REIT fund.

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premium and receive (pay) the total return on the IPD All Property index (exhibit 3). For swaps on IPD indices, payments on the property leg on the contract are typically made annually, while payments linked to the inter-bank market are made quarterly (exhibit 4); this mismatch is an impediment that legitimises the growing use of quarterly indices.<sup>4</sup>

All payments are based on the notional amount agreed to by the parties. This notional principal never changes hands; the impact of a default is thus greatly curtailed. The use of a financial intermediary with an excellent credit rating as a counterparty to all transactions reduces credit risk even more (exhibits 3-4).

For the buyer, this transaction is economically equivalent to the borrowing of the notional amount at the floating inter-bank rate plus the spread and the subsequent investment of this principal in the assets underlying the index.

Derivatives promoters emphasise this similarity with the physical market and the advantages of derivatives over bricks-and-mortar transactions: stamp duty and other legal and agent fees can be avoided, operations can be executed and unwound swiftly, there is no need for parties to exchange principal or upfront cash flows or for a buyer to deal with property management of the underlying assets, and a covered seller can retain ownership and operational management of its properties.

### Other swaps on IPD indices

Sector for all-property swaps appeared in the third quarter of 2005, in an attempt to meet the readjustment needs of real estate portfolios. Sub-sector for all-property swaps appeared in the third quarter of 2006. As of mid-2007, sector and sub-sector swaps were very rare. Likewise, some market participants have expressed interest in swaps of various components of the total return, but as of mid-2007 no such transactions had been made public.

4 - A high-quality quarterly index implies a high frequency of outside appraisals of capital values.

Exhibit 3: Total Return Swap All Property Index vs. Libor + Spread

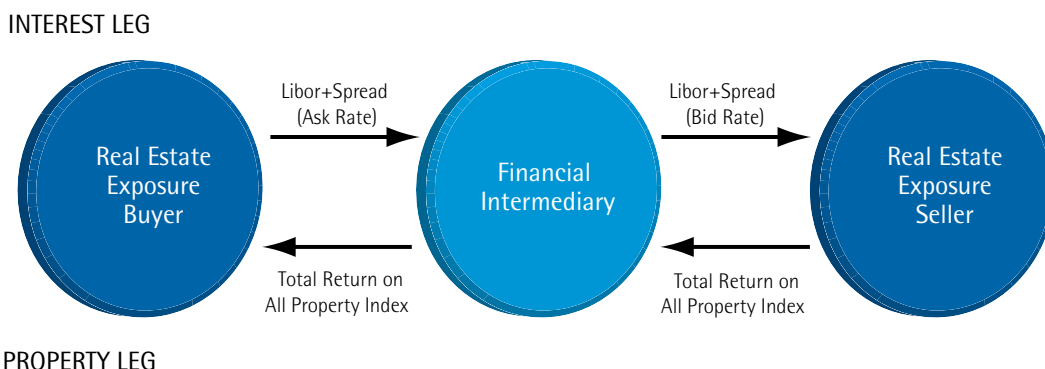
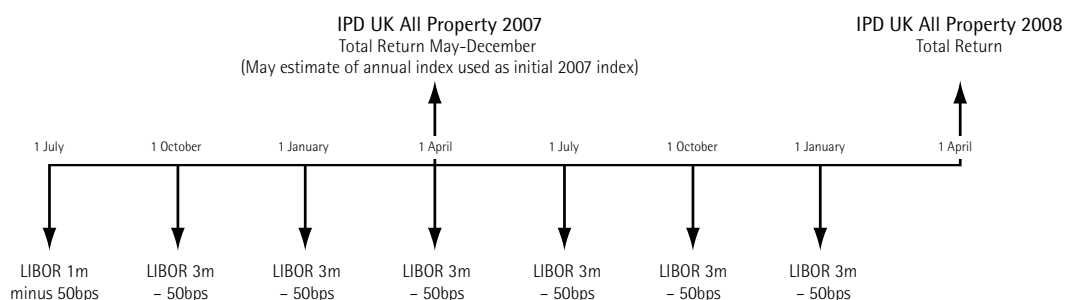


Exhibit 4: TRS Cash-Flow Chart (Buyer)

2-year (19-month) All Property vs. LIBOR swap, spread: -50bps (Ask)  
Trade Date: 15 June 2007 Swap starts 1st June 2007 and ends 31st December 2008



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## *Swaps on NPI*

The products offered by CSFB were comparable to those available in the UK markets, but at the outset the all-property swap concerned only capital value (the return on which is more volatile, making it an underlier more suitable for a derivative) and the only swaps involving property types were those of one property type for another; a swap for the overall return on the all-property index has since been made available.

## 2.2. Property linked notes, property investment certificates

Property linked notes (PLNs) or property investment certificates (PICs) are debt securities whose coupons and redemption value are linked to the performance of a real estate index. Unlike total return swaps, these bonds require the buyer to pay when they are issued.

For the buyer, the transaction is economically equivalent to a cash investment of the amount of the issue price in the assets underlying the benchmark real estate index: it may not offer the leverage of swaps, but this transaction has many of the same advantages in terms of costs, execution speed, and taxation. Its status as a debt instrument may also confer an advantage over swaps, inaccessible to investors who are not authorised to invest in derivatives.

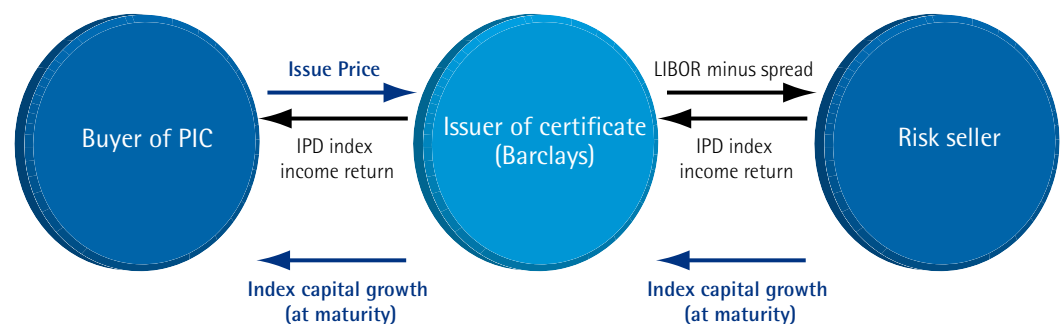
A conventional PIC has the dealing bank (Barclays-Protego) issue certificates (usually with maturities of three, five, or seven years) whose exposure is managed by transacting with a seller of real estate exposure that receives a LIBOR-spread for the duration of the certificate (this seller of real estate exposure has often been Barclays itself). The buyer of the PIC is exposed to real estate risk for the duration of the certificate. The income return of the benchmark property index is paid quarterly while the capital return (which may be a gain or a loss) is paid out at the time of redemption. The benchmark is the all-property IPD index; Barclays takes a commission of 280 basis points. Barclays and Protego are active participants in a secondary market of limited liquidity.

Since their rebirth in 2004, Barclays has issued approximately £900 million worth of PICs.

## 2.3. Housing derivatives

Halifax index derivatives are traditional forward contracts and options. The two parties to a forward contract agree in advance to a certain progression of the index and at maturity the buyer (the seller) of exposure receives (pays) the difference, whether positive or negative, between the real level of the index and that of the contract. In this way, both buyer and seller are assured of a price at which the transaction will take place. The buyer of an option, on the other hand, has the right but not

Exhibit 5: Conventional property index certificate



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the obligation to buy (call option) or to sell (put option) at a predefined strike price; the buyer of the option will exercise his right only if the terms of the options contract are more advantageous than those of the market; the payment of a premium compensates for the seller's asymmetric position.

Options and futures on S&P/Case Shiller indices are similar, but they are traded on an organised market that reduces credit risk through the intermediation of a central counterparty and through a margining mechanism.

In the United Kingdom, financial intermediaries such as Abbey, Newcastle Building Society, or Skipton Building Society have sold retail investors medium-term structured products linked entirely or in part to the Halifax index; to manage their risk, these companies are thus likely to use forward contracts based on the index.

## 3. Uses of derivatives and their limits

### 3.1. Theoretical uses

Derivatives allow exposure to real estate risk to be managed much more efficiently—in terms of liquidity, cost, granularity, swiftness, or flexibility—than in the underlying market (when an investable underlying asset is available). They can be integral to investment/diversification, to hedging, or to arbitrage (exhibit 6). For investment, the advantages of direct real estate derivatives are particularly clear (box 1). The underlier of derivatives of listed property companies may well be investable or easily replicable, liquid, and fine grained, but derivatives transactions nonetheless have lower transaction costs, greater flexibility (they are not subject to rules limiting the use of short selling on the stock markets), lower costs for short positions, offer greater savings on securities borrowing, and provide greater amounts of leverage. The main current users of commercial real estate derivatives are insurance companies, pension funds, and investment banks

Exhibit 6: Advantages and theoretical uses of real estate derivatives

Advantages	Uses
<ul style="list-style-type: none"> <li>• Diversified exposure without physical ownership of underlying asset</li> <li>• Opportunity for negative net exposure</li> <li>• Lower transaction costs</li> <li>• Swiftness of execution</li> <li>• Lower minimum investment</li> <li>• Higher liquidity than that of the physical market</li> <li>• Leverage</li> </ul>	<ul style="list-style-type: none"> <li>• Hedging</li> <li>• Long or short exposure to an impracticable underlying asset</li> <li>• Diversification</li> <li>• Synthetic rebalancing</li> </ul>

#### Box 1: Reduction of costs of exposure to direct real estate

For the United Kingdom (over a ten-year period), Goldman Sachs (2006) put the annual costs of ownership of direct real estate at 248 basis points and at 295 basis points for non-listed funds. At these levels, real estate derivatives could, depending on current margins, offer advantages in terms of direct costs, advantages that are naturally greater in the medium and short term. The situation is comparable in the rest of Europe, but less so in the United States, where transaction costs in physical markets are lower. It should be noted as well that the "cost" of a swap (the spread over the inter-bank rate) is paid over time, while large acquisition costs must be paid upfront when investing in direct real estate or in non-listed vehicles. Likewise, the investor in a total return swap wins (or loses) on the change in capital values over the duration of the contract (exhibit 19), not just upon resale or settlement.

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as well as other asset management firms, hedge funds, and real estate specialists. Investment banks, which have sold housing-linked structured products, mortgage lenders, and hedge funds are active participants in the market for derivatives of housing price indices.

When it comes to investment and diversification, derivatives can help to establish a diversified exposure to real estate, they can diversify the real estate portfolio without requiring intervention in the underlying markets, and they can be used to invest in segments that were previously inaccessible as a result of regulatory requirements or for want of the necessary human or financial resources. For allocation management, derivatives transactions facilitate strategic and tactical modifications and reduce the time frames of investment in real estate.

Derivatives are likewise useful for hedging, as they can immunise a portfolio against risks inherent to the market or to a single property type and allow investment managers to focus on generating alpha through asset selection or property management.

Arbitrage strategies that attempt to profit from the imperfect integration of direct and indirect markets or of different indirect markets may also rely on derivatives.

Derivatives can be used as well to take net short positions—that is, “selling” the market or a segment in anticipation of downturns. Derivatives also permit relative strategies, the aim of which is to profit from the expected divergence or convergence of various segments of the market.

Finally, these products allow the investor to profit from leverage or to gain access to interest rates that can be more advantageous than those in direct investment; synthetic leverage, moreover, may benefit from tax treatment more favourable than that accorded more conventional forms of debt.

It should be noted that improved management of risk in general and of real estate risk in particular should have a positive impact on the broader economy. The price information generated by the derivatives market can also benefit the spot market by improving its efficiency—as the real estate market lacks transparency and is relatively inefficient, the gains could be clear, and, as Case, Shiller, and Weiss (1993) note, the economy could benefit from a lessening of the shocks caused by the boom-and-bust cycle of real estate.

Exhibits 7 and 8 list possible uses of real estate derivatives and show the likely users of property derivatives and their strategies.

The advantages of these products are limited by practical problems: limited number of data points for most direct real estate underliers, very low levels of liquidity, high levels of volatility, evaluation difficulties, short maturities, and counterparty risk. Other possible problems involve quality, representativity, and transparency, in addition to the frequency of the benchmark indices. Besides these problems with the products themselves, investors have investment policies to uphold and may need extra training in the use of derivatives; for some, there are legal, fiscal, and accounting rules that make the use of derivatives less attractive.

## 3.2. The fallacy of real estate derivatives as a hedge

In the absence of derivatives, the nature and transaction costs of investment in direct or non-listed real estate make hedging difficult or relatively inefficient just like they wipe out most arbitrage opportunities.

### *Hedging the risk of a portfolio of direct real estate with a direct index derivative*

Promoters of direct real estate derivatives often assert that index derivatives can be used to neutralise a portfolio's exposure to real estate

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Exhibit 7: Possible uses of real estate derivatives

Strategy	Motivation	Example
Synthetic investment	<ul style="list-style-type: none"> <li>To achieve diversified exposure to possibly inaccessible regions or property types.</li> <li>To reduce the tracking error of an existing portfolio.</li> <li>To guarantee terms for a future acquisition.</li> </ul>	<ul style="list-style-type: none"> <li>Investor takes a long position and pays EURIBOR+spread for yield on chosen index.</li> </ul>
Hedging an existing portfolio, alpha extraction	<ul style="list-style-type: none"> <li>To neutralise the market risk to the portfolio so that the investor can focus on producing alpha.</li> <li>To freeze a particular market situation without having to sell portfolio—real estate cycle strategy.</li> <li>To guarantee terms for a future sale.</li> </ul>	<ul style="list-style-type: none"> <li>A building owner (or developer) takes the short position on a swap: he pays the index yield and receives EURIBOR+spread.</li> <li>For a 100% hedge, the total return on the portfolio is EURIBOR+spread+(total return on real estate assets held less total return on index)=EURIBOR+spread+alpha on real estate assets held.</li> </ul>
Synthetic allocation or risk management	<ul style="list-style-type: none"> <li>Tactical modification of current exposure (by overall exposure, by property type, or by region).</li> </ul>	<ul style="list-style-type: none"> <li>An investor increases/decreases his exposure to German real estate by taking a long/short position on a swap for all-property Germany and EURIBOR+spread.</li> </ul>
Selling the market	<ul style="list-style-type: none"> <li>To achieve negative net exposure to the market to profit from an expected downturn.</li> </ul>	<ul style="list-style-type: none"> <li>An investor takes a short position on a swap: he pays the index yield and receives EURIBOR+spread. If the index yield is negative, the investor receives additional funds from the party holding the long position.</li> </ul>
Arbitrage and speculation	<ul style="list-style-type: none"> <li>To profit from spreads between direct and indirect markets, among indices from different suppliers, among different indices from the same supplier, and so on (relative value strategies, long/short strategies).</li> </ul>	<ul style="list-style-type: none"> <li>An investor shorts the IPD UK index and goes long on the FTSE/MSS index. He pockets the differential.</li> <li>An investor shorts the offices index and goes long on the retail index: he receives the differential between the yields on the retail and offices indices plus the initial difference (positive or negative) between the spreads on the two swaps. He benefits from a widening of the spread.</li> </ul>
Leverage	<ul style="list-style-type: none"> <li>To achieve notional exposure beyond direct capacity.</li> </ul>	<ul style="list-style-type: none"> <li>The investor takes a long position and pays EURIBOR+spread for the yield on the index of his choice. The notional amount is not exchanged, but all the ensuing streams, positive or negative, are calculated in proportion to this amount.</li> </ul>
	<ul style="list-style-type: none"> <li>To invest synthetically, profiting from lower financing costs.</li> </ul>	<ul style="list-style-type: none"> <li>The investor takes a long position and pays EURIBOR+spread for the yield on the index of his choice—the cost of financing may be lower in the swaps market than in the physical market.</li> </ul>
	<ul style="list-style-type: none"> <li>Synthetic leasing of real estate holdings (followed by repurchase).</li> </ul>	<ul style="list-style-type: none"> <li>An investor issues a PIC—he receives the capital and pays the index yield until the reimbursement of the certificate at issue price plus or minus movements in the capital value of the index.</li> </ul>

market risk (or beta) so that it delivers only specific performance (or alpha). However, these promoters rarely qualify the relative importance of market risk on the returns of portfolios representative of the real estate holdings of their targeted institutional clientele. Typically, hedging strategies are either only alluded to or illustrated simplistically. A recent research note on property derivatives prepared by a leading bank provides an illustration of "efficient hedging between portfolio and index return" that sees a manager of a €10m portfolio who has observed an 85% correlation with its country

index use a TRS to hedge against a fall in the market. The note assesses the impact of swapping the index return against a fixed rate, using a one-for-one hedge, by looking at TRS payments and overall returns from the hedged vs. non hedged portfolios over the life of the swap. It considers only two states of nature: a "baseline" scenario where the return of the hedged portfolio is only slightly less than that of the non-hedged position and a "risk" scenario where the hedged portfolio is much more attractive. An equal weighting of the two scenarios results in a "marked reduction

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Exhibit 8: Likely users of property derivatives and their strategies

Insurance companies and pension funds	<ul style="list-style-type: none"> <li>• Tactical asset allocation</li> <li>• Synthetic rebalancing</li> <li>• Strategic asset allocation</li> <li>• Hedging of price risk</li> </ul>
Investment banks	<ul style="list-style-type: none"> <li>• Market making (liquidity provision)</li> <li>• Hedging of price risk</li> </ul>
Property companies and property funds	<ul style="list-style-type: none"> <li>• Hedging of price risk</li> <li>• Tactical asset allocation</li> <li>• Synthetic rebalancing</li> <li>• Alpha extraction</li> </ul>
Hedge funds	<ul style="list-style-type: none"> <li>• Relative value strategies</li> <li>• Long/short strategies</li> </ul>
Mortgage lenders/investors/insurers	<ul style="list-style-type: none"> <li>• Hedging of default risk</li> </ul>

of risk" and the note concludes that "this effect is of major importance especially to institutional investors who have held out the prospect of a minimum return to their clients."

When the asset whose price fluctuations are to be hedged is not exactly the same as the underlying of the derivatives contract or when the contract expiry date does not coincide with the execution date of the spot transaction to be hedged, basis risk—cross-hedge basis risk and time-basis risk—reduces hedging effectiveness. Analysing the correlation between the values of the position to be hedged and the prices of the available derivatives can help determine the contract(s) to be used for hedging. When there is uncertainty about the timing of the transaction, time-basis risk can be reduced by using combinations of contracts surrounding the expected transaction date.

The match with the underlying of the derivatives contract may be perfect for major currencies and large capitalisation stocks on which contracts exist and near perfect for key commodities. However, derivatives markets are far from complete and managing the price risk of a given asset on which no contract is available will require cross-hedges involving close or not-so-close substitutes. Instead of identifying a substitute with a high correlation to the asset, the investment manager could identify the fundamental risks driving asset returns and then hedge price risk with derivatives

proxying for each of them. Risk not accounted for by fundamental factors—if not a result of factor omission or model misspecification—is specific to the asset and cannot be hedged; in a portfolio, however, it is diversifiable.

To hedge the market risk of a portfolio with index futures contracts—which we will assume are perfectly positively correlated with the underlying index—the optimal position to hold so as to minimise the volatility of the hedged position can be shown to be:

$$h = \rho_{R_P, R_M} \sigma_P / \sigma_M = \sqrt{R^2} \sigma_P / \sigma_M = \sigma_{P, M} / \sigma_M^2 = \beta_P$$

where  $\rho_{R_P, R_M}$  ( $\sigma_{P, M}$ ) is the coefficient of correlation (covariance) between portfolio and index returns,  $\sigma_P$  ( $\sigma_M$ ) is the standard deviation of portfolio (index) returns,  $R^2$  is the coefficient of determination of the regression of portfolio returns against market returns, and  $\beta_P$  is the slope of the regression line.

The number of contracts to hold to offset the market risk in the portfolio is then given by  $h$  or  $\beta_P$  times the ratio of the value of the portfolio to the nominal amount of the contract. Note that the naive one-for-one hedge is obtained only when the correlation between the portfolio and the index is equal to  $\sigma_M / \sigma_P$  or, equivalently, when the slope of the regression of the portfolio returns against the index returns is one.

## Property Derivatives: A Primer

The hedge ratio is directly positively linked to the importance of the market factor as an explanatory variable of portfolio variability or, in other words, to the correlation between the index used to proxy the market and the portfolio. A 2007 IPF report looked at the possibility of replicating the IPD UK index through direct investments using a sample of 1,700 properties from the IPD UK universe over the period from 1994 to 2004. Using IPD properties, the study upwardly biases correlations with the IPD index, resulting in an upward bias of the importance of the market factor and in a downward bias of the average tracking error: tracking the IPD index with properties that are not part of it will be harder.

The figures reported in exhibit 9 suggest that most portfolios will be poorly correlated with the index—taking the average value of the commercial property in the IPD UK database (€23m at the end of 2006) and assuming equal-weighting to be possible, it would take approximately €1.15bn of IPD properties to establish, on average, a portfolio which could be effectively hedged with an IPD derivative (an  $R^2$  of 80% is traditionally considered the threshold for hedging effectiveness). At this level and assuming a normal distribution for the tracking error (not a conservative assumption), a 2% deviation of the portfolio vis-à-vis its benchmark would still occur at least once every three years, and a 1% deviation almost two years out of three. Operating without these bold assumptions about equal weighting, about the possibility of obtaining the “average portfolio” and about normality of the tracking error will make the size requirement for effective hedging

significantly higher. As a result, index property derivatives will be poor hedging instruments for all but the largest portfolios of direct commercial real estate. For direct investors in property, hedging-related demand for derivatives could be limited to the major real estate investment managers and trusts. Indeed, looking for a €10m bricks-and-mortar real estate portfolio with an 85% correlation to the market index will be like looking for the proverbial needle in a haystack.

The fact that property derivatives based on large indices will be poor hedging instruments for individual portfolios has a direct impact on their accounting treatment. To use hedge accounting, hedging effectiveness must be demonstrated. For the US, the summary of statement 133 of the Financial Accounting Standards Board (FASB) states: “an entity that elects to apply hedge accounting is required to establish at the inception of the hedge the method it will use for assessing the effectiveness of the hedging derivative and the measurement approach for determining the ineffective aspect of the hedge. Those methods must be consistent with the entity’s approach to managing risk”. Appendix A of the standard requires the use of statistical or other numerical tests for hedge effectiveness, unless a specific exception applies.<sup>5</sup> Under International Accounting Standard reporting, the same issue arises with IAS 39. Failure to qualify for hedge accounting will cause the use of derivatives to increase accounting volatility... quite a sorry result for an economic hedge imperfect though it may be.

5 - Grant (2002) notes that “The high-effectiveness requirement is intended to have the same meaning as the ‘high correlation’ requirement of SFAS No. 80 (SFAS No. 133, para. 389), which has been interpreted to mean either that the cumulative changes in the hedging derivative should offset between 80 percent and 125 percent of the cumulative changes in the fair value or cash flows of the hedged item (Swad (1995)), or that the regression of changes in the hedged item on changes in the derivative should have an adjusted  $R^2$  of at least 80 percent (Lipe (1996))”.

Exhibit 9: Diversification and tracking error within a sample of 1,700 properties

Portfolio size	1	5	10	20	50	100	200	500
$R^2$	0.17	0.45	0.57	0.69	<b>0.82</b>	0.89	0.94	0.97
Average tracking error (annual, % points)	n.a.	5.35	4.06	3.06	<b>2.09</b>	1.54	1.14	0.78

Source: IPF (2007)

#### Probability of large deviations under the assumption that the tracking error is normally distributed

Probability of deviation >100bps	n.a.	85.2%	80.5%	74.4%	<b>63.2%</b>	51.6%	38.0%	20.0%
Probability of deviation >200bps	n.a.	70.9%	62.2%	51.3%	<b>33.9%</b>	19.4%	7.9%	1.0%
Probability of deviation >500bps	n.a.	35.0%	21.8%	10.2%	<b>1.7%</b>	0.1%	0.0%	0.0%

# Property Derivatives: A Primer

While the risk management argument has often taken centre stage in the promotion of property derivatives, the specificities of the class render hedging with index-based derivatives ineffective for all but the very largest traditional real estate investors. Therefore, when marketing to investors holding physical real estate, brokers and investment banks should probably emphasise the remarkable diversification benefits of index-based investments. Property derivatives provide investors in search of alternative beta and new tools for alpha generation a relatively liquid synthetic exposure to the commercial real estate market, exposure that allows the use of a range of familiar investment and arbitrage strategies unavailable in the physical real estate market.

## *Cross-hedging the risk of a portfolio of direct real estate with derivatives based on REIT securities indices*

CBOT and Liffe suggest that their derivatives based on REIT share prices can be used to manage the risk of a portfolio of direct real estate. For CBOT, REIT indices are "a good proxy for the underlying U.S. commercial real estate market" because the fundamentals<sup>6</sup> are "reflected in REIT share prices". For CBOT, the distribution requirements REITs are subject to as well as their tax status are the causes of a "direct and clear" link between the underlying market and the share prices of these trusts. Likewise, Liffe writes that REIT securities indices "are a good proxy for direct real estate investments".

CBOT fails to mention that REITs are not limited to tax-exempt activities and that—despite the effect of distribution requirements on net income—the importance of amortisation in real estate leaves plenty of room for manoeuvres that can weaken the link mentioned above. It should be noted as well that the leverage of the REIT and its public trading are fundamental elements that will distort signals from the underlier. CBOT makes no mention of studies that would back up its stance, which

might appear to make good sense to a newcomer to real estate but is anathema to more experienced professionals. Our survey has documented the low contemporary correlation of REIT securities indices and direct property indices, the reasons for this low correlation, and possible directions for future research into the substitutability of these two modes of access to real estate. In the absence of derivatives based on direct indices, those based on REIT securities indices could in the short term be used—no less than interest rate derivatives<sup>7</sup>—for cross-hedging, and long-term benefits may be greater still; the study of these subjects has yet to begin.

## *Hedging the risk of a portfolio of REITs with a REIT securities index derivative*

The creation of a highly diversified portfolio of REITs is within the means of all institutional investors; it follows that a REIT securities index derivative—though it may not fill a vacuum in terms of access to the market—can serve as a hedging instrument for a portfolio of REIT shares.

### **3.3. The challenge of hedging real estate derivatives**

#### *Hedging of direct property index derivatives*

Development of the IPD and the NPI swap markets is hampered by the fact that the underlying indices, as appraisal-based measures of private commercial real estate performance, are not tradable. Consequently, these hedging instruments are hard to hedge in a reliable, easy, swift, and cost-efficient manner. As a result, intermediaries may shy away from liquidity provision and be tempted to settle for matching up buyers and sellers (any mismatch creates gap risk, which must be managed by the intermediary and requires compensation under the form of a higher cost of derivatives to the buyer).

Because the underlying is unavailable for dynamic replication strategies, the pricing and hedging of direct property derivatives is challenging. To

6 - For CBOT, lease rates, vacancies, development costs, and property transaction values.

7 - Between 1990 and 2005, according to the CISDM (2006), the correlation of the MIT/CRE transaction-based index and the FTSE/NAREIT was 0.06%; correlation of the MIT/CRE index and the S&P500 was likewise 0.06%; the correlation of this index and the Lehman Aggregate Bond index was -0.07%.

The benefits of REITs securities index derivatives for hedging a direct real estate portfolio are not apparent, as there are stock or bond derivatives that, although equally ineffective, are much more liquid.

# Property Derivatives: A Primer

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convince financial institutions to accept the risk of derivatives underwriting and provide more liquidity to investors, advances in the hedging of property derivatives are required.

The merits, feasibility, and implementation methods of both cash and synthetic hedging of derivatives must be addressed. Cash hedging of derivatives written on non-investable indices would rely on direct property and real estate fund investments to manage the derivatives exposure of the underwriters, while synthetic hedging would use risk-factor replication to create portfolios of assets with high correlation to property. Whatever the route chosen, reducing the cross-hedge basis risk of the derivatives underwriter is the guiding light. It is perfectly feasible to establish general results on the nature of the optimal trading strategy involving the hedging proxy as well as an estimation of the tracking error caused by relying on an imperfect substitute for the underlying—this tracking error is reminiscent of that caused by using discrete hedging with tradable underliers. The difficulty in replicating a non-investable index like the IPD All Property—which we emphasised above by computing the probability of large deviations at the various portfolio sizes—not only makes cash hedging very difficult but also casts doubt on the validity of prices at which derivatives are transacted; this is because arbitrage between the physical property market and the derivatives market is challenging, making pricing by arbitrage unrealistic.

FTSE and MSS may have provided additional possibilities in the second half of 2006 by offering an index and sub-indices which they claim are representative of direct property investments and investable through fund and sub-funds with daily NAVs. These index providers hope to attract investors interested in a (largely) passive exposure to the U.K. commercial property market, but more importantly, to position themselves as

the platform of choice for investment banks that wish to offer property derivatives and real estate structured products. This is a new development and it remains to be seen whether this hybrid product is sufficiently representative and transparent to constitute an attractive alternative to the wider-based and more well-established IPD indices. Theoretically, investments in the fund can be used for cash hedging of derivatives underwritten on the associated index. Cash hedging of this sort is attractive as it minimises tracking variance/basis risk; however, it does not eliminate the need for other hedging techniques unless an active market for short-selling the underlying emerges. In practice, it will be fascinating to find out how a property fund established with a base of £100m will handle massive inflows and outflows of capital.

### *Hedging of REIT index derivatives*

The underlying of REIT index derivatives can be invested in directly (ETFs, index funds) or indirectly (the index constituents are known and have been chosen for their market float and their liquidity). Short-selling the underlying is also possible. In these conditions, the hedging of derivatives by the issuer poses no problems. Note too that for listed derivatives a part of the liquidity is provided by the market and does not require risk-taking on the part of the market makers and that the standardisation of derivatives contracts should allow the market maker quickly to offset the risks of one position by serving as counterparty to the opposing position.

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Appendix 1 : US transactions-based indices vying to serve as underlying for commercial real estate derivatives

S&P/GRA SPCREX™ CME derivatives	<ol style="list-style-type: none"> <li>1. National composite index</li> <li>2. Four national sector indices</li> <li>3. Five regional indices</li> </ol> <p>Capital return</p>	<ol style="list-style-type: none"> <li>1-3. Monthly</li> </ol> <p>Jan. 1994</p>	<p>Three month <b>moving average of per square foot transaction prices</b> (an equally weighted average price is computed for each market; reference year commercial stock-based weightings are used to derive the indices.) GRA collects over 2,500 transactions/month. Index published monthly for preceding three months (rolling window) – estimated three-month lag between transaction and reporting.</p>
Moody's/REAL (formerly MIT/RCA) OTC	<ol style="list-style-type: none"> <li>1. National composite index</li> <li>2. Four national sector indices</li> <li>3. Four sector indices for group of the 10 most active cities</li> <li>4. Twelve regional sector indices</li> <li>5. Eight metropolitan composite indices</li> </ol> <p>Capital return</p>	<ol style="list-style-type: none"> <li>1. Monthly</li> <li>2. Quarterly</li> <li>3. Quarterly</li> <li>4. Annual</li> <li>5. Annual</li> </ol> <p>Jan. 2001</p>	<p><b>Repeat sales regression:</b> the index is extracted from price changes across properties for which two or more transactions are observed. RCA endeavours to track all transactions over \$2.5m. First index estimate released two months after the closing of the period, final number reported two months later (so as to capture lag between transaction and reporting).</p>
Rexx OTC and ISE derivatives	<ol style="list-style-type: none"> <li>1. National office index</li> <li>2. Fifteen metropolitan office indices</li> </ol> <p>Total return, rent return, capital return</p>	<ol style="list-style-type: none"> <li>1-2. Quarterly</li> </ol> <p>Q1-1994</p>	<p><b>Proprietary model</b> based on observations of macro (including interest rates and inflation) and micro (including rents, vacancy, and leasing activity) economic market conditions. Rexx uses CBRE Torto Wheaton Research information and proprietary data from minority shareholders Cushman Et Wakefield and Newmark Knight Frank. Published in the second month following the end of each quarter.</p>

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