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Real estate as an asset class exhibits different features when compared with traditional financial assets such as stocks and bonds. Trading in real estate is characterized by asymmetric information, high transaction costs, lack of fungibility, serial correlation, and price stickiness. Investments in real estate can be categorized into three fundamental sectors: commercial, residential, and equity. The latter is connected to the real estate investment trust (REIT) type of investments. Commercial real estate is directly linked to the real economy; by total size, it represents a significant spot market. However, it is still quite difficult for investors to hedge the risk exposure arising from investing in this important asset class (Lecomte and McIntosh [2006]; Fabozzi, Shiller, and Tunaru [2009]; Fabozzi, Stanescu, and Tunaru [2013]).

Shiller [1993a] identified the development of sustainable financial markets for trading derivatives capable of handling the risk in real estate as being a top priority for society. Yet, almost 25 years later, we are still waiting for standard derivatives such as futures and options to be established as a main contract with a healthy liquidity. The futures contracts on the IPD UK family of indexes, introduced by EUREX in 2009, present a significant step forward in introducing derivatives contracts that can be safely traded to hedge real estate risk. Thus, in this article, although some broad discussion is provided about commercial real estate derivatives (CREDs) in general, we focus in particular on those financial instruments that are traded in London, where data are available.

A CRED is used more by hedge funds and derivatives trading desks than by retail investors. Therefore, many issues related to financial markets education are smoothed and, with increased focus on managing risk in a dynamic manner, CREDs are making their way into investors' portfolios.

Although new derivatives attracted the attention of investors (Naylor and Mansour [2007]; Venter [2008]) who were optimistic about their growth, the subprime crisis seems to have put a brake on this promising financial instrument. In the absence of CREDs available in the open markets on financial exchanges, the research in this area before the subprime crisis was streamlined on the contingent-claim approach for commercial mortgage-backed securities (CMBS) contracts (Titman and Torous [1989]; Childs, Ott, and Riddiough [1996]). The CMBX contract is a credit default swap on a portfolio of CMBS. The importance of this contract was highlighted by the subprime crisis. Driessen and van Hemert [2012] found evidence that CMBX market price levels generally are in line with prices implied by an option-based CMBX model calibrated to REITs and the S&P 500 index, but over

short-term horizons, there could be CMBX mispricing due to the hedging pressure exercised by banks looking to hedge their commercial real estate exposure. It seems evident that what is missing is a direct financial derivative capable of directly hedging commercial property price risk.

ADVANTAGES AND DISADVANTAGES OF TRADING COMMERCIAL REAL ESTATE DERIVATIVES

The very first advantage of being able to buy or sell a CRED is the ability to hedge or diversify a given portfolio of spot real estate positions. Short selling being impossible on real estate spot markets, including commercial, the introduction of futures on commercial real estate indexes opens the door to the gradual introduction of more advanced derivatives. CREDs are the only financial instruments that will allow an investor to short the private commercial real estate market.

Another advantage of CREDs is speed of execution versus the spot market: The investor is able to open and close positions referenced to commercial real estate with ease. Hence, the usual costs associated with market frictions encountered in spot commercial property trades, such as structural checks and legal work that may take months to complete, as well as taxes, are bypassed efficiently.

CREDs also allow investors to obtain exposure to real estate trends in a foreign country. For example, a German investor could buy real estate certificates on the IPD UK Annual Index (Piazolo [2017]). Thus, cross-border investment in real estate is viable in a synthetic form based on the commercial real estate index derivative. After the development of CREDs on the EUREX exchange in the United Kingdom, Bond and Mitchell [2011] suggested that futures prices could be better predictors of future returns than a consensus forecast of industry experts, although they also argued that this difference may be explained by the publication delays associated with the consensus forecast.

As for disadvantages, if held for a longer period, CREDs may have carry costs that may surpass the transaction costs for the equivalent spot investment. If the derivative is traded over-the-counter, counterparty credit risk becomes a concern. Another disadvantage is that derivatives are taken into consideration for liquidity concentration calculations, so a temporarily negative marked-to-market movement may destabilize the risk profile of a portfolio that includes many CREDs.

WHY CREDS ARE NOT FULLY DEVELOPED

It is unclear what causes the lack of progress in the development of CREDs. One possible explanation is the lack of parsimonious models that can be easily implemented and applied. Fabozzi, Shiller, and Tunaru [2010, 2012] highlighted the important modeling issues related to real estate derivatives in an incomplete market and merged the risk-adjusted lognormal approach introduced by Shiller [1993b] with the risk-neutral approach advocated by Bjork and Clapham [2002]. It is important to realize that pricing futures is the essential piece in pricing all other derivatives on commercial real estate.

The most successful initiative so far has been the introduction of futures contracts in the IPD family of commercial real estate indexes on the EUREX exchange in London. The relative success of this contract versus other similar initiatives in the United States can be attributed to the fact that the IPD family of indexes is recognized as representative in the commercial real estate space in Europe, whereas in the United States various commercial indexes are still competing regarding which is the most representative.

Another possible reason for the failure of CREDs to fully develop is the fact that the underlying IPD index, an appraisal-based index, is calculated on an annual basis. This could have caused long periods of inactivity between March and December, when no public information on the level of the index was made available to market participants. Recent changes are seeing the underlying IPD index in the futures contract changed to the quarterly IPD index, which should provide information to interested parties more frequently.

The tenor of the futures curve with only five-years-ahead maturities did not encourage trading along the curve as in other futures markets (bonds, oil, credit default swaps). Perhaps the original idea was based on the fact that the usual commercial real estate contracts are up to five years and renewable. However, a longer curve would allow investors to organize trades along the curve, going long one maturity and short the other. In this way, the liquidity for the front maturities would be greater.

THE MECHANICS OF THE IPD UK QUARTERLY ALL PROPERTY INDEX FUTURES

Here we shall describe the mechanics of the futures contract on the main commercial real estate index in the UK and discuss its main characteristics and potential problems.

The contracts as initially launched in February 2009 are annual contracts based on the total returns of the IPD UK Annual All Property Index for individual calendar years. Contracts with a value of GBP 50,000 each could be traded at any time on five annual maturities, and they are cash settled, being payable on the first exchange day of April in the year immediately following the December of the calendar year defining the maturity. Thus, the final settlement day for the December 31, 2018 futures will be the last exchange day of March 2019.

The EUREX IPD futures contract has a percentage price quotation system rather than a nominal price level figure. The futures price is given as 100 plus the percentage total return in the year to the end of December of the relevant contract. Hence, a price of 103.65 indicates that at maturity, a yearly percentage return of 3.65% is expected; if the final futures price is, say, 105, then the buyer will profit by 1.35%. Thus, the profit will be GBP 675 per contract. If, however, the final futures price equals 101.50, the seller makes a profit of 2.15% or GBP 1,075 per contract.

A DESCRIPTIVE ANALYSIS OF IPD FUTURES

Futures are offered on IPD property indexes at a composite level (U.K. all property), sector level (U.K. office, U.K. retail, and U.K. industrial) and a subsector level (U.K. retail warehouse, U.K. shopping centers, London city offices, London west end and mid-town offices, and southeast industrial). One important change that has occurred is that, starting in 2015, the futures contracts on the EUREX began using the quarterly IPD index in an effort to provide information on the state of the U.K. commercial real estate market more frequently.

The IPD Futures Surface

In Exhibit 1, we present the IPD UK Annual Return All Property Futures surface constructed from monthly futures settlement prices for all five December yearly maturities. The forward curves were quite steep and upward trending in the aftermath of the subprime crisis in 2009, followed by a flattening between 2010 and 2013 and an inverted shape in 2014.

EXHIBIT 1

IPD UK Annual Return All Property Futures Surface between 2009 and 2015

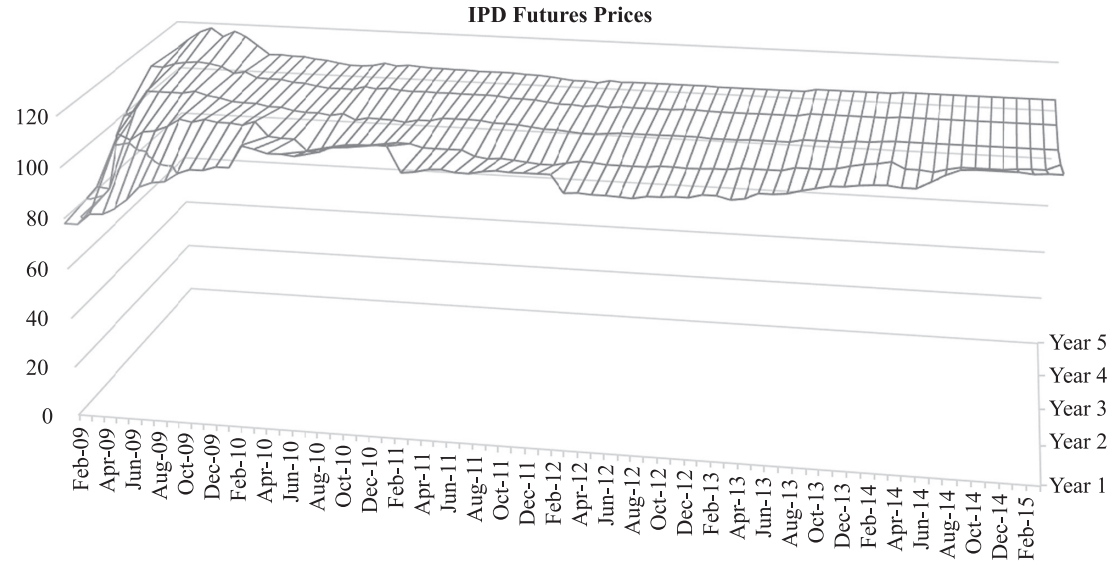


EXHIBIT 2

Summary Statistics for IPD UK Annual Return All Property Futures Prices (monthly between 2009 and 2015)

Statistic	Futures 1	Futures 2	Futures 3	Futures 4	Futures 5
Mean	105.68	103.76	104.63	105.11	105.45
Median	107.23	103.95	104.30	104.50	104.50
Mode	118.00	101.20	105.25	104.50	104.50
Sample Variance	82.83	23.79	4.90	6.58	11.68
Kurtosis	1.89	11.99	1.46	2.40	5.10
Skewness	–1.22	–2.68	1.02	1.73	2.36
Minimum	77.90	80.50	99.00	102.40	102.35
Maximum	118.00	110.80	111.00	113.00	118.00

The descriptive statistics for the IPD futures contracts reported in Exhibit 2 highlight some interesting findings. The range of values is largest for the nearest futures contract and smallest for the fourth maturity. The skewness changes from negative for the first two contracts to positive for the last three contracts, whereas kurtosis is very large for the second and fifth maturities. The most pessimistic performance of the IPD index as implied by the futures contracts was a total return loss of about 22% (annual), whereas the most optimistic was an 18% annual total return.

These findings suggest that trading the shape of the IPD futures curve should be considered by investors who already have large positions in the commercial real estate spot markets as well as by hedge fund investors who prefer to work only in synthetic space, using derivatives to maximize their directional trades and other in-house analytics.

The Relationship between Monthly IPD Futures and Monthly IPD Index Values

It would be useful to have a tool to gauge the settlement prices of the futures contracts. Although the futures contracts traded on the EUREX referred to the annual IPD spot index, the contract was marked monthly using the monthly IPD index. In Exhibit 3, we plot the monthly IPD futures versus the series of IPD total returns over the period defined by the previous March, when the IPD futures are rolled, and the current month. For example, the total return value corresponding to June 2010 is calculated by using the month-to-month total returns for March/April, April/May, and May/June. Because of the geometric character of the total return series, we are left with only the values for March to June, representing the total return from the March origin of the futures to the following June month.

There is a noticeable saw pattern attributable to the reset before each April due to the rollover of the futures contracts and the rebase of the calculation of the IPD index to the value of 100. One can also observe that the IPD futures monthly prices are fitted very well by the series of total returns derived from the IPD monthly series.

It is likely that these calculations can be improved by adjusting the IPD total return series to a December-to-December roll or by using a moving average model.

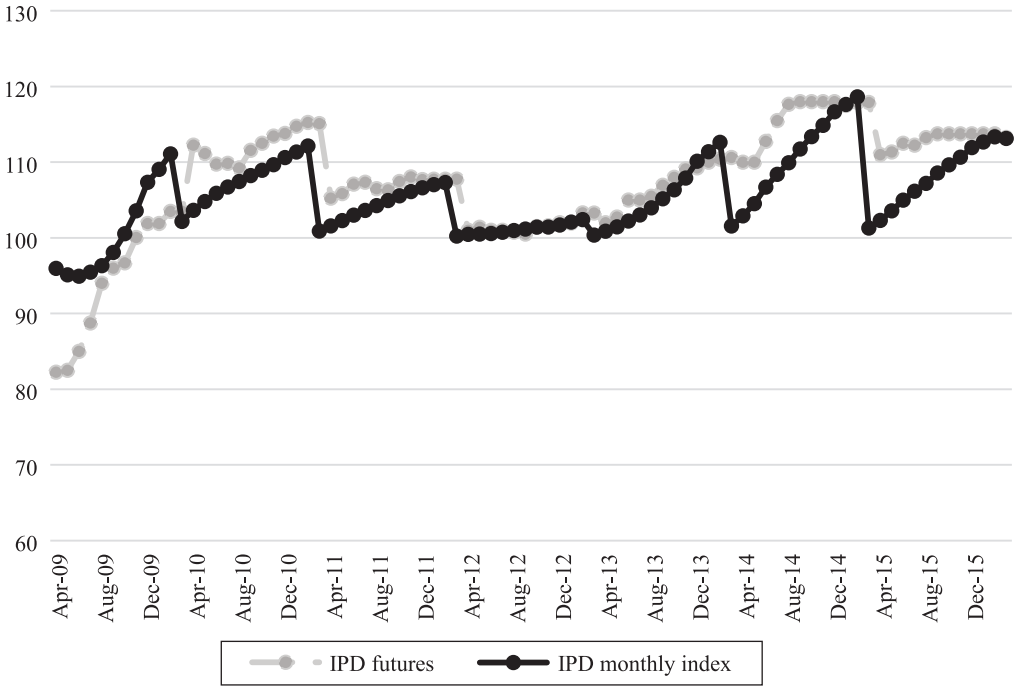
TRADING THE SHAPE OF THE FORWARD CURVE

Although many investors may look at the forward IPD curve for direct hedging purposes of spot commercial real estate positions, other trading opportunities are offered by the futures on commercial property indexes. Exhibit 4 reveals the slope of the forward IPD curve between February 2009 and March 2015 at a monthly frequency. In the aftermath of the subprime crisis, the slope was quite high in value and positive, reaching values over 30, indicating that investors were optimistic in the medium term about the recovery of the commercial real estate sector in the United Kingdom. Starting from the end of 2009, the slope time series becomes stationary, indicating that investors could try to use it for trading the shape of the curve.

One possible investment strategy that could be executed entirely using futures contracts is based on the observation that the slope was negative most of the time from 2010. This means that a statistical strategy of going long the nearest contract and short the longest

EXHIBIT 3

IPD UK All Property Futures Monthly Settlement Prices vs. the IPD UK All Property Total Returns from March to Respective Months of the Year



five-year maturity contract would have been profitable on average. Although this strategy reflects market conditions at the time, it may not be profitable in different market conditions.

The situation with the convexity of the forward IPD curve is remarkably similar. Exhibit 5 shows the convexity of the forward IPD curve monthly between February 2009 and March 2015. The convexity was approximated with the formula[1]

$$c(R_1, R_3, R_5) = R_3 - \frac{R_1 + R_5}{2}$$

Once again, the convexity was abnormally high and positive over the year 2009, but starting with March 2010 the time-series of convexity values looks stationary and closely resembles the slope graph over the same period.

The statistical observation that the convexity of the forward IPD curve is negative most of the time may suggest some interesting investment strategies that can be easily executed on the EUREX, thereby insulating an investor from counterparty credit risk. For example, a hedge fund may go long one contract in the one-year IPD futures contract and one contract in the five-year IPD futures contract and simultaneously go short two IPD futures contracts with a three-year maturity.

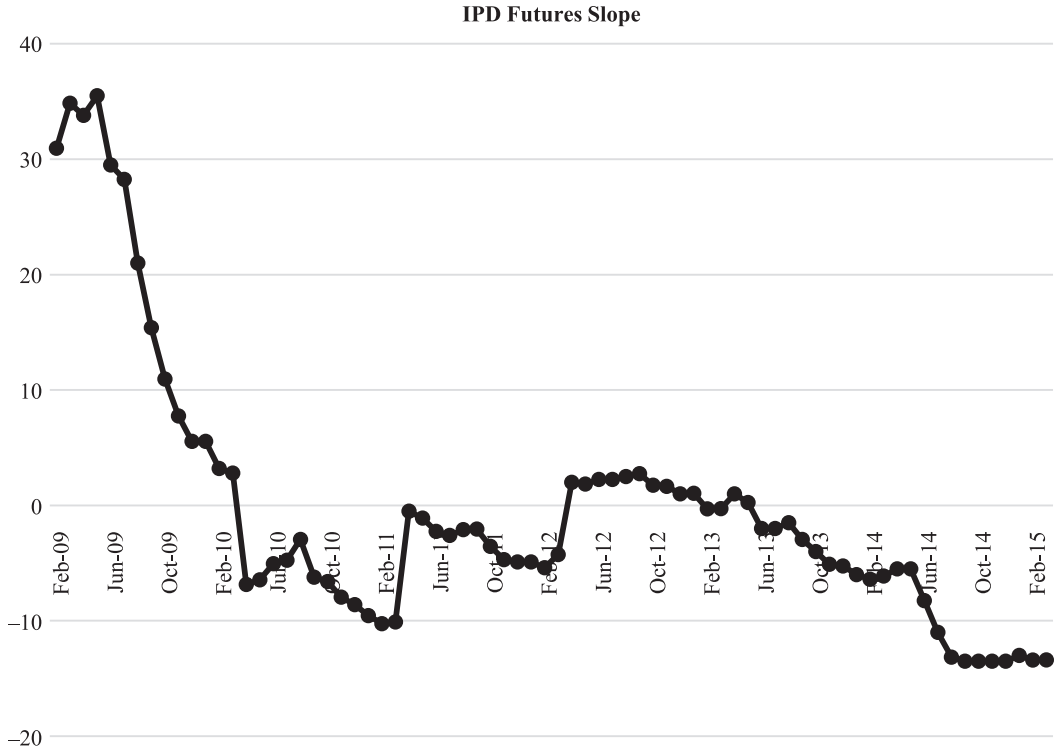
OTHER CREDS

The introduction of futures contracts on commercial real estate essentially completes the market in the sense that there is now a primary financial instrument that can be used to take long and short positions in the commercial real estate market in the United Kingdom. From a modeling perspective, this is a massive step forward because other derivatives with nonlinear payoffs can now be traded on the back of the futures contract. For example, European call and put options could be of interest to hedge funds and real estate investment houses that believe that they can expertly manage the commercial real estate risk and identify alpha investment opportunities.

The volatility of the underlying asset plays a major role in the price of European options. Given the

EXHIBIT 4

Slope of the Forward IPD UK All Property Calculated as the Difference between the Five-Year Futures Contract Price and the One-Year Futures Contract Price



March annual rolling market calendar, it is likely that any European options on the IPD futures would follow the same maturity roll to avoid maturity mismatches between the options and futures contracts that can be used for hedging the options positions. Even for over-the-counter trades, it seems plausible that options on the nearest futures contract may be used.

Regarding the volatility and other parameters that may contribute to a given pricing model, it is important to realize that parameter estimates may vary with the period covering the data used for estimation. For example, the descriptive statistics for the IPD UK Total Return All Property futures contract and the monthly IPD index are shown in Exhibit 6, calculated for two different time periods. The exhibit clearly shows that although the statistics are more or less the same for the IPD index, the standard deviation, which is indicative of the volatility, changes substantially if we include or exclude the period in the aftermath of the subprime crisis. Likewise, starting from 2010, there are signs that even the kurtosis and the skewness have changed.

One important area that has been neglected in the current literature on CREDs is hedging. Classical delta or gamma hedging needs more careful consideration in the context of commercial real estate risk management because there are long periods of time with very little new information. Thus, it is likely that investors may try to avoid dynamic delta hedging, and they may prefer a more static hedging approach in which they may try to avoid losses due to a market crash.

CONCLUSION

CREDs are a new breed of derivatives that slowly but surely are making their way as an exchange-traded product used by financial market participants. The pathway from inception to a full, vibrant CREDs market may be long and sinuous, but the road was not easy and straightforward for equity index derivatives, interest rate swaps, or credit default swaps.

The vicious circle of establishing liquidity in CREDs and being able to trade CREDs easily may

EXHIBIT 5

Convexity of the Forward IPD UK All Property Calculated as the Difference between the Five-Year Futures Contract Price and the One-Year Futures Contract Price

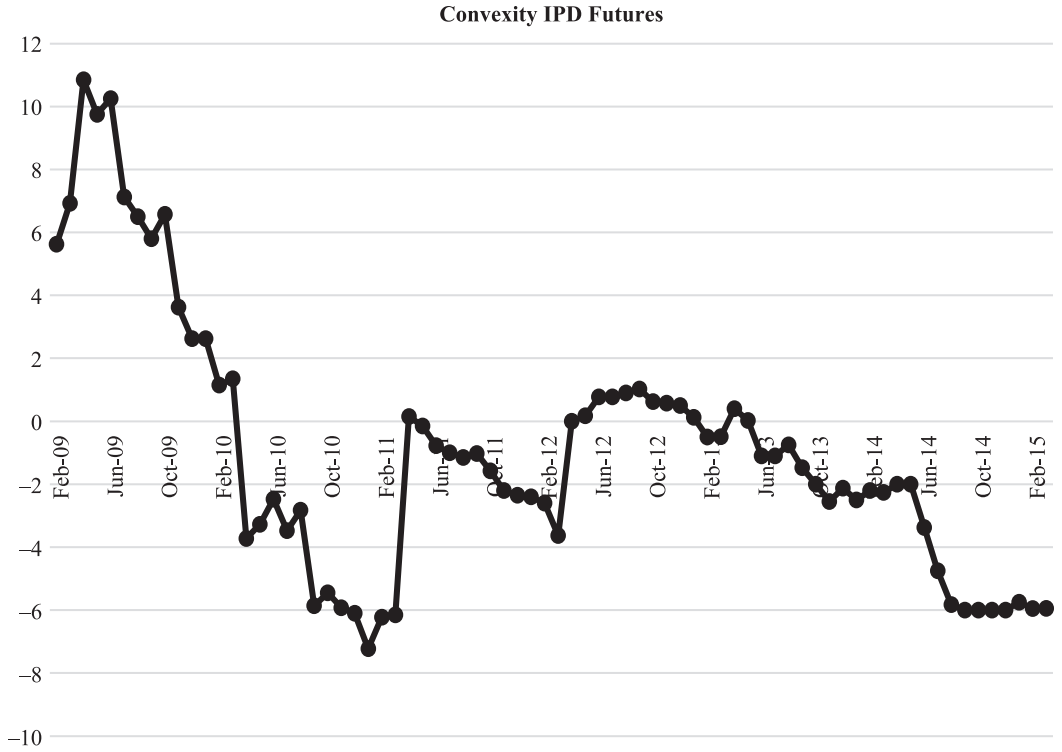


EXHIBIT 6

Descriptive Statistics of the Nearest IPD UK Total Return All Property Futures Contract and the Monthly IPD Index

	IPD Futures	IPD Index
February 2009–March 2016		
Mean	106.70	897.34
Median	107.88	849.53
Standard Deviation	8.82	197.16
Kurtosis	2.40	–0.58
Skewness	–1.42	0.55
Minimum	77.90	596.90
Maximum	118.00	1,303.72
March 2010–March 2016		
Mean	109.43	944.73
Median	109.85	864.00
Standard Deviation	5.21	174.98
Kurtosis	–0.99	–0.76
Skewness	–0.09	0.75
Minimum	100.50	713.71
Maximum	118.00	1,303.72

be given a new impetus by the wave of new financial regulations requiring systemically important banks and financial institutions to pass stress tests that contain extreme scenarios involving crashes of real estate markets.

The lack of granularity in the spot commercial real estate market, given that commercial real estate assets in the cash market are not divisible, may restrain the trading of CREDs on one side. At the same time, CREDs can be used to implement investment strategies that would be almost impossible to trade otherwise in the spot market. Moreover, CREDs are opening up new possibilities for a wide range of investors who may look at more advanced analytical investment styles based on trading the shape of the curve or using the forward markets for forecasting information.

ENDNOTE

[1]The convexity was approximated with the formula $R_3 - 0.5\ (R_1 + R_5)$, where R_1, R_3, and R_5 are the total return

rates representing the futures prices on the IPD UK All Property index for the first, third-, and fifth-year maturities, respectively, using the price quotation system utilized by the EUREX. For example, if R_3 is equal to 85, the total return rate at maturity of the third year is equal to 85%.

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