IPF Research Programme

Long-term Value Methodologies in Commercial Real Estate Lending

COMPARISON OF PROPERTY MARKET INDICES

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Long-term Value Methodologies in Commercial Real Estate Lending: Comparison of Property Market Indices

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This Programme supports the IPF's wider goals of enhancing the understanding and efficiency of property as an investment. The initiative provides the UK property investment market with the ability to deliver substantial, objective and high-quality analysis on a structured basis. It encourages the whole industry to engage with other financial markets, the wider business community and government on a range of complementary issues.

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Long-term Value Methodologies in Commercial Real Estate Lending: Comparison of Property Market Indices

Report

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Foreword

This working paper, whilst a stand-alone report that may be read separately, forms part of a larger study, *Long-term Valuation Methodologies for Commercial Real Estate Lending*, conducted by the authors together with the University of Cambridge, which follows on from the Property Industry Alliance's 2017 report, Long-term value methodologies and real estate lending.

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Long-term Value Methodologies in Commercial Real Estate Lending: Comparison of Property Market Indices

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COMPARISON OF PROPERTY MARKET INDICES

1. Introduction

Commercial real estate indices are essential for monitoring the performance of commercial real estate markets and can be used in models to test how such markets are affected by conditions in the economy and financial markets. Most indices available are based on appraisals of commercial properties rather than transaction prices and this reflects some of the core characteristics of real estate investment markets; they are thinly traded and comprise assets that are heterogeneous in terms of their physical, legal and location attributes. The appraisal basis of such indices is often seen as a drawback, since appraisals arguably lag market conditions and smooth the peaks and troughs of changes in value (see Geltner, MacGregor and Schwann, 2003; Crosby and Devaney, 2019). However, unlike in residential markets, the development of transaction-based alternatives has been slow and none in the UK exhibit a long enough time series for the type of research being conducted here. While other, statistical solutions have been proposed to address the issues with appraisal-based indices (termed desmoothing techniques – see Key and Marcato, 2007), the focus of this research on identifying significant episodes of under- and over-valuation, and potential market corrections over medium-term horizons, has led to the use of appraisal-based indices in their reported form for much of the analysis.

This working paper discusses the indices used in the *Long-term Valuation Methodologies for Commercial Real Estate Lending* project, which have been sourced from MSCI, JLL and CBRE respectively. Given the focus of the project on exploring sustainable levels of rental value and capital value, the series of most interest are those that relate to capital growth, rental growth and yields, rather than indexes of total returns from real estate investments. As explained within the full report, emphasis is on high level indicators for use in monitoring portfolios of loans or lending to the commercial real estate market overall. Thus, while some sources allow disaggregation of the market into detailed property types and regions, analysis in this report is conducted primarily using all property ('All Property') and sector level series, with the three principal sectors of offices, retail and industrial being where much CRE lending is concentrated. Hence, this working paper reviews the characteristics of the all property and sector level indices published by the different data providers. Different indices exhibit different strengths and weaknesses, and using multiple sources allows the results based on one to be checked against those based on others. Nonetheless, it is important to know how consistent the series are in describing how UK commercial real estate has performed and this comparison is conducted after considering the availability of appropriate data both in the UK and internationally.

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2. Availability of Real Estate Performance Measures Worldwide

The long-term value project is based on the UK commercial real estate market but may have implications for non-UK real estate markets. Analysis of the behaviour of rental and capital values for real estate in other countries requires that reliable long-term datasets are available in those countries, so this working paper starts by identifying and reviewing potential datasets for such analysis both in the UK and overseas.

Crosby and Devaney (2019) set out the history and basis of commercial real estate appraisal based indices. They identify the link between the increasing ownership of commercial real estate by the financial institutions and the drive to produce commercial real estate performance measures so that the developing real estate portfolios could be measured against the existing assets, for example bonds and equities, in a multi-asset portfolio. The first indices were developed in the US and the UK and so these two markets have potentially the longest running datasets to undertake this analysis.

The UK market has three major well-established long-term datasets and these are examined at length in this paper as they form the core of the analysis. The largest UK dataset is produced by MSCI but long-term data is also produced by both JLL and CBRE. The project team has investigated also the possibility of extending any analysis to other, non-UK real estate markets. Long-run data on rent, yield and capital values is needed to undertake the analysis and the authors have investigated whether this data with a sufficient length of time to estimate the various sustainable rent, cap rate and capital value models exists outside the UK. A subsidiary question in the case of econometric models is whether there is sufficient and adequate input data, be this demand drivers and stock estimates in the rent case or risk free rate and growth proxies in the cap rate case. This note focuses on the real estate data only.

The research has focused on non-UK data reported by MSCI rather than data reported by real estate advisory firms. Unlike in the UK case, the authors believe that real estate advisors generally report only prime series and do not attempt to construct investment performance indexes of the kind that JLL and CBRE produce in the UK market. There may be data of similar nature to the CBRE rent and yield monitor, though the authors are not sure that this would merit any extended negotiation and payment, particularly as they could only create synthetic capital value indexes on the back of such data. This is why discussion is mostly confined to MSCI series. The MSCI methodology is fully explained in MSCI (2019a; 2019b).

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The following markets were considered in detail, given the length of time series available for total return rates in each case:

United States

MSCI data only dates back to 1998 Q4. However, NCREIF compile performance data at quarterly frequency back to 1977 Q4. This includes a capital value index, while capitalization rate series can be accessed via the query tools on their website. It appears that capital value series can be run on an asset value growth basis or a capital return basis (in other words, either including or excluding capital expenditure from the capital side of the calculation). There is no series for rental value growth, only for net income growth. Net income growth could be analysed, but this tends to be a noisy series and would not be consistent with the analysis performed for the UK. Nonetheless, the US perhaps offers most options in terms of some replication of methods and results.

Canada

MSCI data only dates back to 1999 Q4. Interestingly, although annual data used to be published for years back to 1984, it appears that MSCI no longer release this. The project team has access to the longer run data courtesy of old downloaded spreadsheets. These data only relate to total returns, capital returns and income returns. There is no long run data on cap rate or rental value growth as far as the authors can ascertain. In the more recent data, cap rates are not available for all quarters, but net income growth is more consistently available. Given the lengths of the estimation windows for AMV and econometric approaches, the series are not long enough to produce any meaningful results for analysis and comparison.

Australia

MSCI data dates back to 1984 Q4. It is described as an annual index, even though quarterly figures can be extracted, and this is likely to relate to issues with input data. Not all properties in the sample are reappraised each quarter as per historical IPD documentation (older NCREIF data suffers similar issues). The capital growth and net income growth series are available for the full history, but there is no rental value growth series and there is mixed availability for different yield measures (earliest run from the mid-1990s). Some restricted analysis may be possible, but may not add much value if the rent and yield elements cannot be studied.

New Zealand

MSCI data dates back to 1993 Q4. It is described as an annual index, even though quarterly figures can be extracted, and this is likely to relate to issues with input data. Like in Australia, not all properties in the sample are reappraised each quarter. The capital growth and net income growth series are available for the full history, but there is no rental value growth series and yields are not available for the full period. Given the lengths of the estimation windows for AMV and econometric approaches, the series may not be long enough to produce any meaningful results for analysis and comparison.

Ireland

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MSCI data at quarterly frequency dates to 1994 Q4. There are also annual data back to 1984. Ireland offers capital growth, rental value growth, equivalent, initial and reversionary yields, and net income growth series. The series offer the best match to the UK MSCI and JLL data used in the study, though the horizon would be shorter.

Other nations

Other non-UK markets do not appear to offer the same length of time series either for total return rates or any of the component measures. This can be verified from access to the MSCI platforms, but also with reference to the following article, which reviews appraisal-based real estate performance measures across international markets:

3. UK Property Performance Measures

In the UK, in the absence of public domain data, private organisations initiated the first attempts to measure property performance during the 1960s and 1970s. These included a mixture of indices based on actual properties (or actual funds) or on hypothetical properties in stated locations. Initially these indices were published by individual organisations such as major surveying/consulting firms (for example Jones Lang Wootton and Hillier Parker May and Rowden). Morrell (1991) and Crosby (1988) gives further details on the composition and construction of these early UK market measures. A common feature of these measures were that they were appraisal rather than transaction based and this feature has continued into the present.

Early initiatives based on actual properties that have been continuously published ever since include the Jones Lang LaSalle UK Property Index, which commenced in June 1967 and the CBRE Monthly, which commenced in March 1987 (annually from March 1979).

Investment Property Databank (now MSCI) was founded in 1985. The UK annual index was back-dated to December 1980, the quarterly index commenced in December 2000 and the monthly index in December 1986. MSCI also produced long-term annual indices for the Office/Retail/Industrial segments back to 1971 (total return, capital gain and income return only; rental growth from 1976).

The longest running continuous data based on hypothetical properties in stated locations is the CBRE Rent and Yield Monitor that commenced in the 1960s but has a continuous quarterly dataset from March 1972 onwards.

There are three main performance measures; income return, capital return and total return. Other important measures include the level of rental value change and the level of capitalisation rates. Capitalisation rates are often called equivalent yields in the UK and include the effect of the unexpired terms of leases (or time to next rent change) and any differences between rental value and rent passing under the lease.

The returns can be measured as either money-weighted rates of return or time-weighted rates of return. Money-weighted rates of return are the internal rate of return of the cash flows. A time-weighted rate of return consists of a return measured over a period linked to the return over the next period. A money-weighted return means that the timing of money invested or withdrawn during the period affects the return. As the timing of injections and withdrawals does not affect time-weighted returns, these are normally used to measure the performance of markets.

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This project has access to three main datasets; the JLL Property Index, the CBRE Rent and Yield Monitor and the MSCI. Initially access to MSCI was denied due to incomplete contract negotiations between MSCI and IPF even though the data had been freely available for Phase 1 of the project. This meant that alternatives had to be investigated and JLL and CBRE were chosen as the best actual property and hypothetical property series respectively for this project. Towards the end of the project access to MSCI was finally approved after modelling was completed using the other datasets. Additional analysis was undertaken so the results are now based on all three datasets. This paper investigates the relationship between these three datasets and compares their benchmark outcomes; in particular rental growth and capitalisation rates.

4. The Indices Used to Assess and Test LTV

Jones Lang LaSalle Property Index.

The JLL index is the longest running set of continuous UK individual property data covering the three main segments of Office/Retail/Industrial. Given the nature of the analysis, if representative of the market, it gives the longest set of observations before the first major point of interest in the analysis, the 1989/90 downturn. The start date of 1967 predates any other actual property index still published. The downside is that the analysis has been carried out using quarterly data in the main and the JLL index was annual from 1967 to 1977. The index was first published in 1978.

Data on the make-up of the index in the early years is partial and no electronic records of the whole index remain (or the authors have failed to access them despite some extensive searching). JLW (1978) sets out the underlying philosophy behind the construction of the index. They aimed to mimic the developing purchase and property holding patterns of financial institutions to enable those institutions to benchmark the property portfolios against other assets. JLW (1978) reveals that they 'purchased' an initial portfolio of 10 properties in 1967 and then added about 8/9 properties every year so that it reached around 100 in 1978. The initial book cost was £3 million in 1967 increasing to £58 million by 1978. The purchases aimed to add 50% offices, 25% retail, 20% industrial and 5% agricultural (from 1971 onwards).

Table 9 in Annex 1 sets out the number of properties in the index based on annual assessments from 1978 onwards. The results are illustrated in Figure 1.

From 1978 onwards the portfolio grew steadily reaching 200 in 1992 and peaking at 228 in 1993. The approach was set out in a technical note (JLW, 1984) and the additions were added at a rate of 1% of new institutional investment in property in that year. The small number of agricultural properties added in 1971 were discontinued in 1992. Between the end of 1993 and 2000, the number of properties fell to 174. The merger of JLW and LaSalle in the late 1990s did not interrupt the publication or the form of the index. However, a major overhaul of the size of the index was undertaken and in 2001 the number of properties increased from 174 to 800. Booth and Marcato (2003) note that there is a new philosophy on sector breakdown, which is to match IPD within a margin of 3%.

There is a longer run of historic information available regarding the relative make-up of the index based on capital value. Table 10 in Annex 1 sets out the breakdown between segments from 1968 onwards and this is illustrated in Figure 2.

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Figure 1: JLL Index by Number of Properties

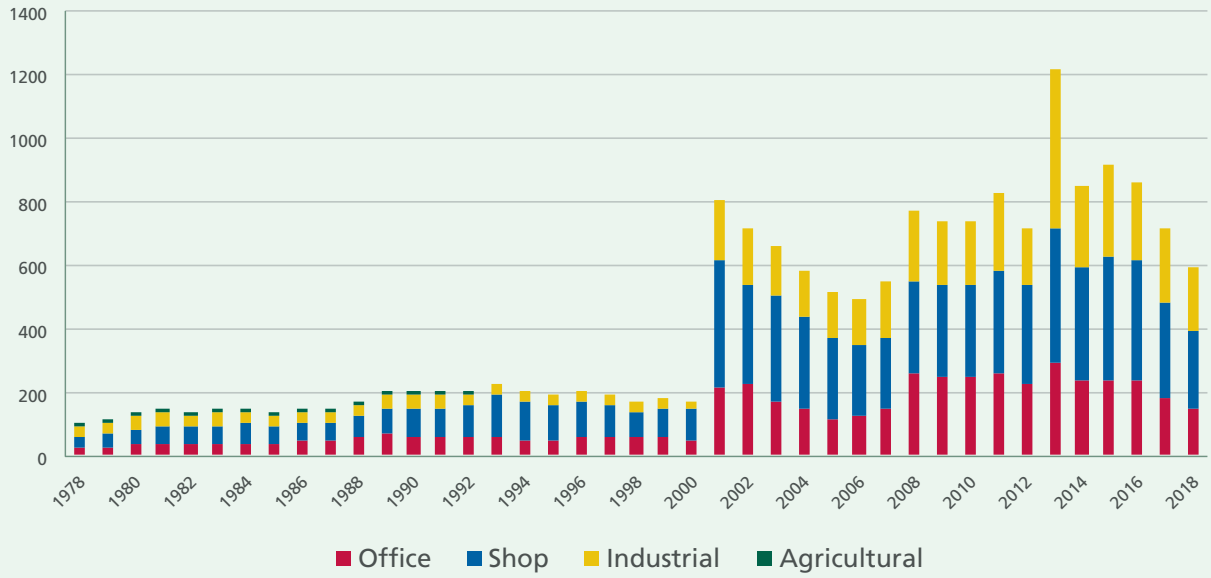
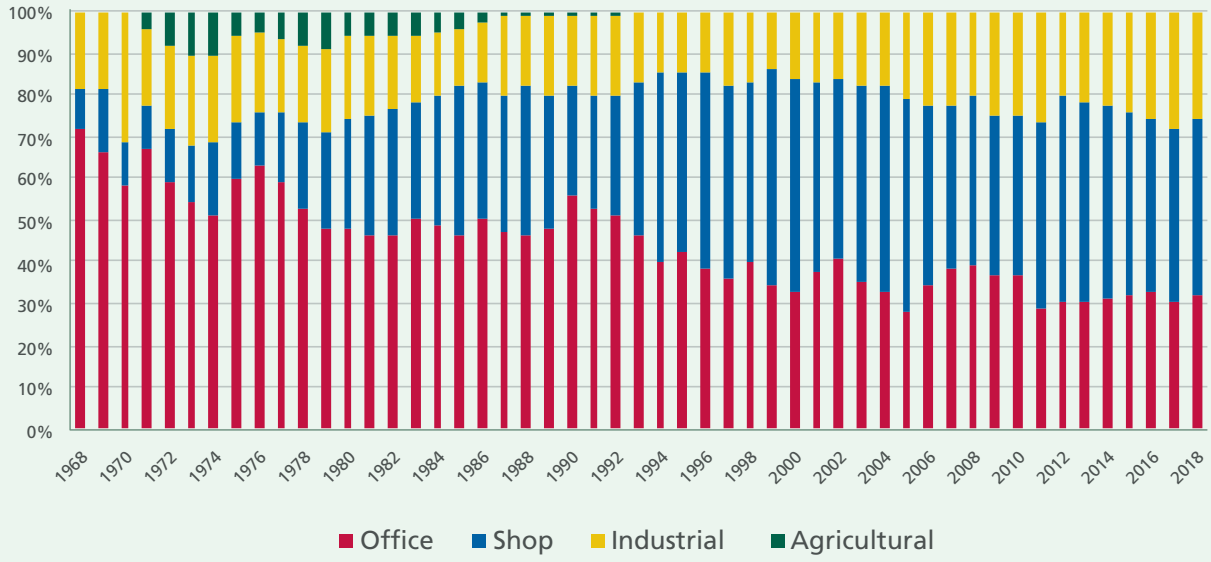


Figure 2: JLL Index Breakdown by Capital Value



The JLL index measures total returns, capital value change, rental value change and net income change reporting both quarterly and annual returns and creating an index for each one. The data is annual from June 1967 to June 1977. The quarterly data commences in June 1977.

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MSCI Quarterly Property Index.

The MSCI, formerly IPD, index suite is the largest, most disaggregated data set measuring commercial real estate in the UK. The quarterly index has the shortest history only commencing in December 2000. However the monthly index started in December 1986. The quarterly index has been backdated to that time using the monthly index. The make-up of the index used in this project therefore also has a major change during the analysis period.

Table 11 in Annex 1 sets out the segment breakdown by number of properties and the capital value in the monthly index by quarters from 1986 onwards. These are illustrated in Figures 3 and 4.

From 2001 onwards, the numbers increase significantly with the establishment of the quarterly index. Between 1986 and 2000, the number of properties in the monthly index rose steadily from around 1500 to 3000. With the establishment of the quarterly index the total rose to 10,000 and has remained at around that number; peaking at 11,418 in the early part of 2007 just before the downturn and now currently standing at around 9,000.

Figure 3: MSCI Index by Number of Properties

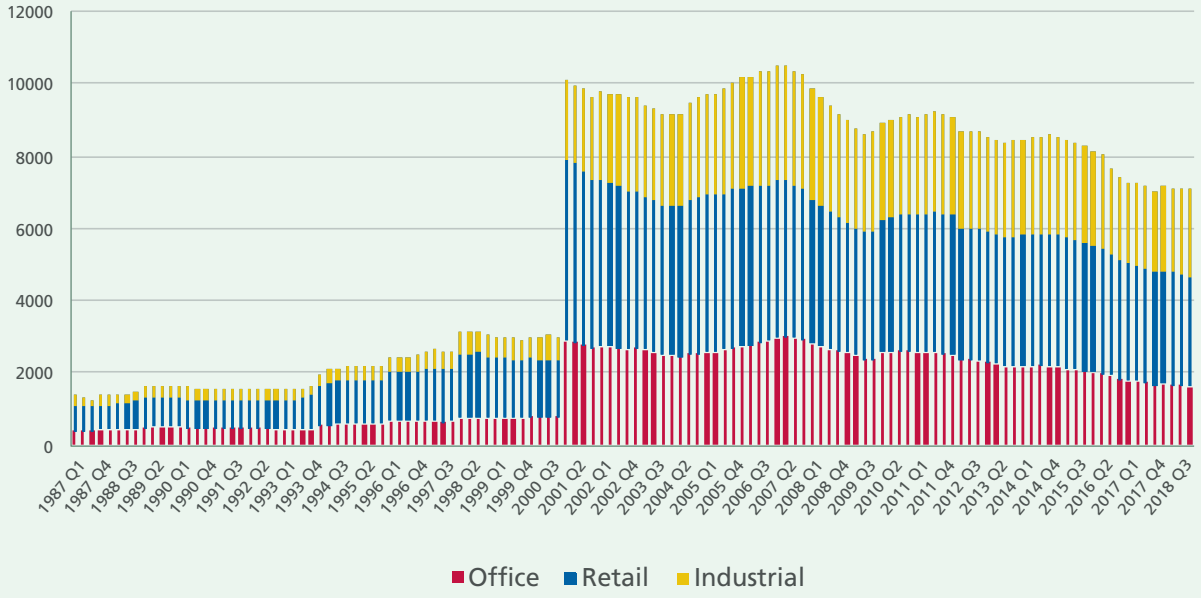

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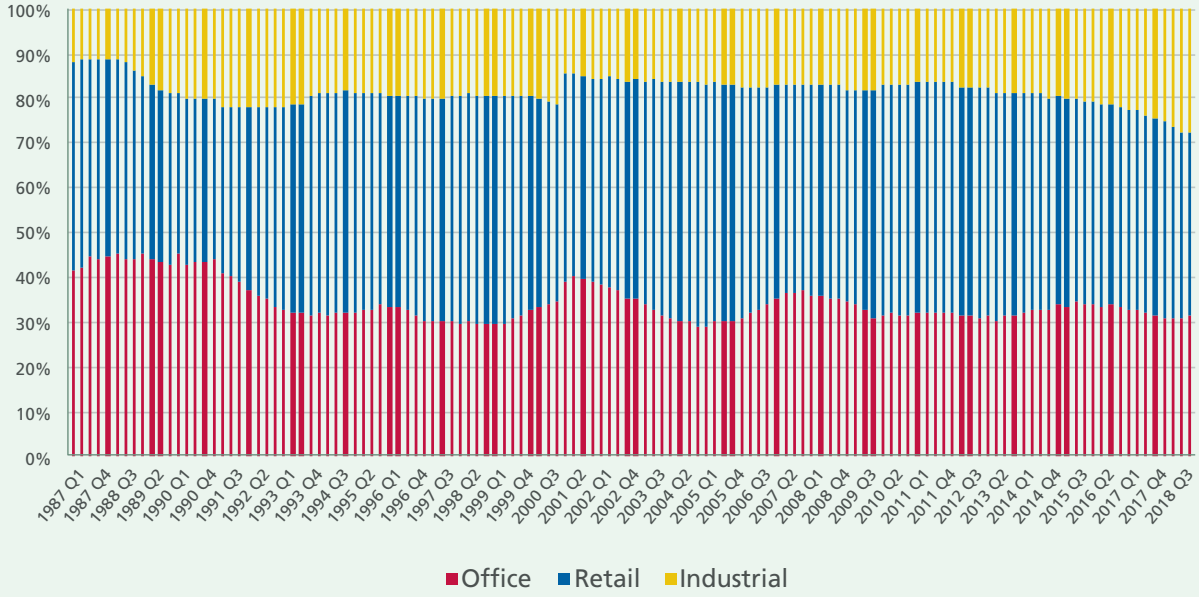
Figure 4: MSCI Index Breakdown by Capital Value



CBRE Rent and Yield Monitor

The CBRE Rent and Yield Monitor is a different kind of measure to the JLL and MSCI indices and is based on hypothetical 'prime' properties in the 100% location of a range of major cities and smaller towns across the UK. Originally the Hillier Parker Rent Index, the index covered the years 1965, 1969 and then annually from 1972 until 1976. From 1977 onwards it was published bi-annually in May and November. The indices were originally based on 189 rent points (ICHP, 1979). When a particular location within a City or town ceases to be prime, the rent point is shifted to the new 100% location. In November 1987, the index was re-launched with a significant increase in the number of rent points to 1293, with measures backdated to May 1984 (ICHP, 1987).

The weighting of the index between segments was originally determined by a survey of 19 investors to determine the ideal portfolio spread, resulting in a portfolio spread of 45% office, 30% retail and 25% industrial. In the revised index from May 1984, the portfolio spread was changed to 48% offices, 37% retail and 15% industrial by reference to other indices including IPD (Crosby, 1988).

However, although not published regularly until later, the base rental data does exist quarterly from Q3 1972 onwards and therefore it is possible to construct quarterly rental growth indices with an accompanying capitalisation rate series from 1972 to the present. The data exists for the All Property, Office, Retail and Industrial sectors with further geographical breakdowns introduced at later dates. In 2000, two additional retail segments were added: Shopping Centres (Q1 2000) and Bulky Goods (Q4 2000). Also in Q4 2000 a Key Provincial Centres category for offices was introduced and a Rest of the UK excluding London and the South east was added for offices and industrial. In 2014, a capital value index was added (CBRE, 2014).

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5. Comparison of the Indices in Nominal Terms

MSCI and JLL – A Comparison of Two Similarly Structured and Constructed Indices

The MSCI index allows for both performance with capital expenditure included and excluded in the capital growth total return indexes. The index excluding capital expenditure is called the Asset Value Growth index. Where capex is included in the formula, it is called the Capital Growth index.

There is a literature on capital expenditure summarised in Crosby and Devaney (2019). In performance measurement, capital expenditure is normally allocated to the capital value component but can be a deduction from income rather than from capital value (Young et al., 1995; Young, 2005). MSCI normally deduct capital expenditure from capital value change (in the numerator of the capital return formula).

Crosby and Devaney argue that the deduction from capital return arguably means that "the full extent to which values rise over time is hidden while the income return from real estate investments appears more stable than it is in reality" (Crosby and Devaney, 2019).

This project is about markets with the indices used to analyse how markets are operating and behaving. There is an argument for using the MSCI data without capital expenditure adjustments to replicate market movements. In addition, the JLL index does not take capital expenditure into account and a truer comparison can be made between two indices that are constructed similarly.

Comparison between MSCI and JLL data can be undertaken between Q1 1987 and Q1 2018 for both capital and rental growth indices for the All Property and Office, Retail and Industrial segments. Total returns can also be compared at the All Property level for the same time period but for the segments the analysis is restricted to a start date of Q1 1990.

Table 1 sets out the mean quarterly returns and the descriptive statistics over the period for the three different measures.

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Table 1: Comparison of Quarterly Returns, JLL and MSCI Quarterly Indices, Q1 1987-Q1 2018

TOTAL RETURN*	JLL ALL	JLL OFF	JLL RET	JLL IND	MSCI ALL	MSCI OFF	MSCI RET	MSCI IND
Mean	2.051	2.129	2.028	2.376	1.965	1.816	1.916	2.327
St Dev	3.021	3.384	3.095	2.866	2.906	3.170	3.027	2.772
Skew	-1.455	-1.292	-1.249	-1.512	-1.637	-1.312	-1.500	-1.719
Kurt	6.314	4.384	6.848	5.315	6.922	3.759	7.629	6.861
FOAC	0.739	0.736	0.711	0.710	0.779	0.806	0.756	0.788
SOAC	0.471	0.495	0.447	0.444	0.512	0.577	0.480	0.524
RENTAL GROWTH	**JLL ALL**	**JLL OFF**	**JLL RET**	**JLL IND**	**MSCI ALL**	**MSCI OFF**	**MSCI RET**	**MSCI IND**
Mean	0.487	0.495	0.629	0.541	0.593	0.488	0.697	0.547
St Dev	1.926	2.635	1.749	1.899	1.620	2.446	1.234	1.620
Skew	0.330	-0.448	2.156	1.314	0.639	-0.211	1.267	1.290
Kurt	1.918	1.319	6.426	6.791	2.020	1.015	2.592	4.728
FOAC	0.862	0.777	0.835	0.781	0.940	0.898	0.921	0.857
SOAC	0.820	0.722	0.766	0.734	0.880	0.836	0.859	0.835
CAPITAL GROWTH	**JLL ALL**	**JLL OFF**	**JLL RET**	**JLL IND**	**MSCI ALL**	**MSCI OFF**	**MSCI RET**	**MSCI IND**
Mean	0.625	0.683	0.603	0.822	0.842	0.759	0.829	0.997
St Dev	3.069	3.430	3.063	3.000	2.948	3.323	2.947	3.038
Skew	-1.270	-1.070	-1.043	-1.005	-1.381	-0.932	-1.509	-0.839
Kurt	5.104	3.491	5.718	4.247	5.737	2.780	7.583	4.372
FOAC	0.760	0.751	0.744	0.713	0.790	0.820	0.750	0.807
SOAC	0.515	0.523	0.489	0.483	0.548	0.627	0.487	0.562

* Total Return form Q1 1990

Key: Standard Deviation (StDev), Skewness (SKEW), Kurtosis (Kurt), First order auto correlation (FOAC), Second order auto correlation (SOAC)

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Although indices are reported in nominal terms, the more sophisticated analysis of long-term values in this research has been undertaken in real terms, with inflation backed out of the performance measures. Inflation can hide some more fundamental influences and may indicate a spurious close relationship between the indices, especially when inflation is high. Some of the econometric tests assume normality of distributions so it is important to observe whether the distributions of the datasets are similar or not. The descriptive statistics are therefore more important for the real return and growth rate comparisons and the distributions will be examined in more detail in the section of this paper comparing the indices in real terms. They are reported for the nominal indices here for completeness.

Figures 21 to 32 in Annex 2 illustrate the similarities between the nominal mean returns per quarter from JLL and MSCI. This is especially so for the total and capital returns but the rental growth variation between the indices appears to be greater.

In order to investigate this further, Figures 5 to 8 identify the differences between the quarterly returns of JLL and MSCI. A positive result is where the JLL index records a higher value than the MSCI Index and where the difference is negative, JLL records a lower result than MSCI.

Figure 5: Differences in Quarterly Total Returns between MSCI and JLL Indices, Q1 1987-Q1 2018

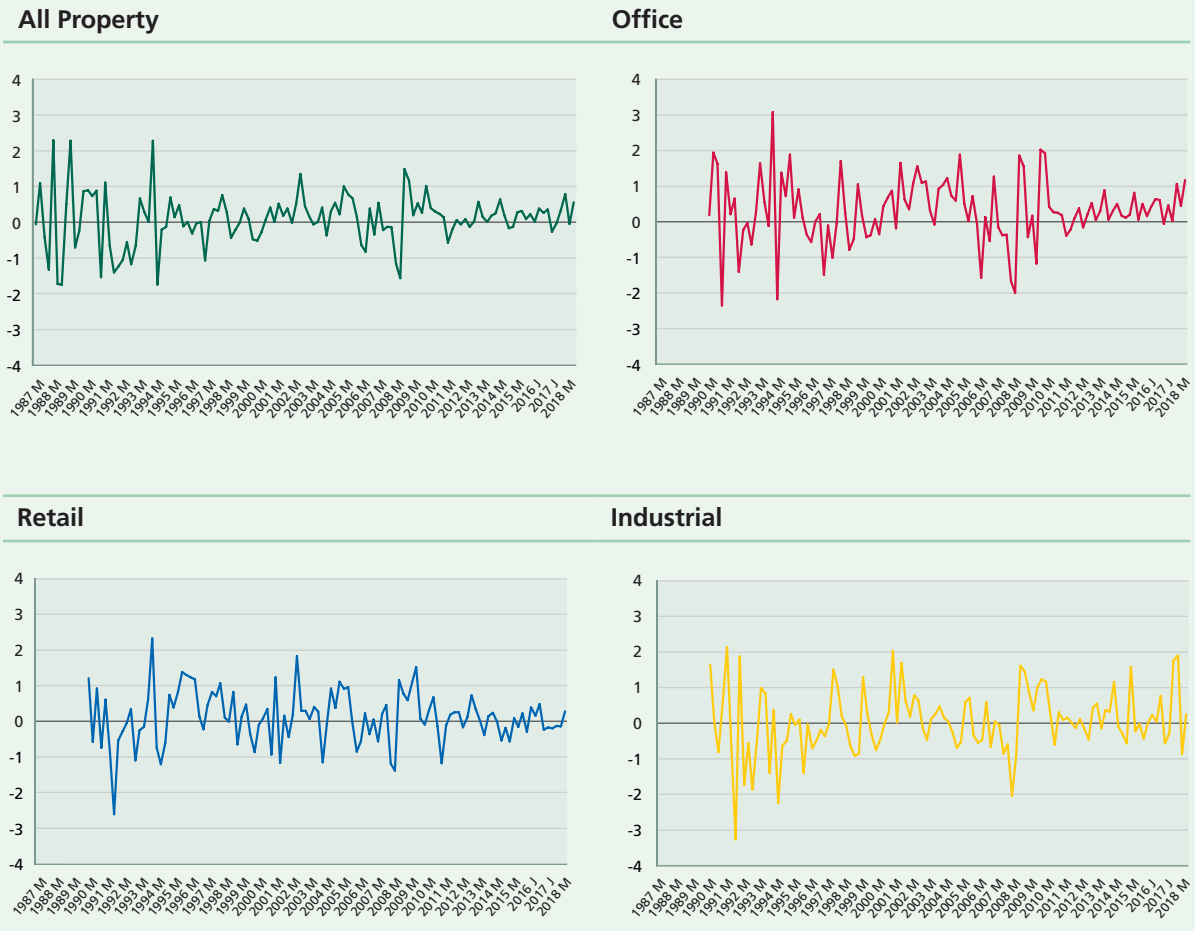

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Figure 5 Illustrates the results for total returns. The largest variations of 2% per quarter or more occur in the downturn of the early 1990s and post GFC and in the boom in the late 1980s. This is to be expected with valuation-based indices where the relative lack of transaction evidence in a downturn and the speed on movement in an upturn create well-documented difficulties for valuers tracking market and other evidence within a comparative valuation system. Some short-term variation would be expected.

These difficulties should be more apparent within the two other indices of rental and capital value change. These two indices are generated directly from valuations and do not 'benefit' from the smoothing influence of income return. However, the standard deviations of the differences do not actually show that. Figure 6 illustrates the average differences over the whole period of measurement since 1986, which are as hoped for showing minimal differences, but it also identifies the tracking error from the standard deviation of the quarterly return differences. The tracking errors are not particularly consistent within measures or between sectors as the highest differences are in the office total returns and the industrial rental growth although the two lowest deviations are both in capital growth measures; office and industrial. The average of the standard deviations is just under 1% per quarter.

Figure 6: Differences in Quarterly Returns Between MSCI and JLL Indices (Means and SDs), Q1 1987-Q1 2018

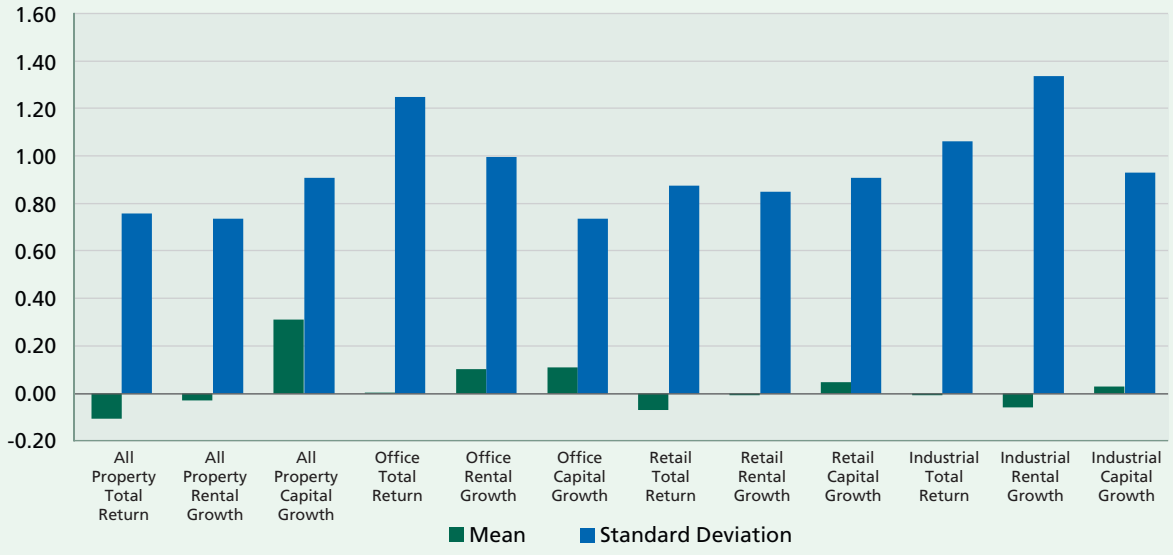

Figure 7 illustrates the variation between the rental growth estimates within the JLL and MSCI indices. The variation is very pronounced in the early period of the analysis and this mirrors early valuation variation studies, which show that the valuation variation between sale prices and valuations was significantly higher in the late 1980s than illustrated in later studies. This increasing consistency between valuers is clearly illustrated in the later years of the series, including the years before and after the GFC period boom and downturn.

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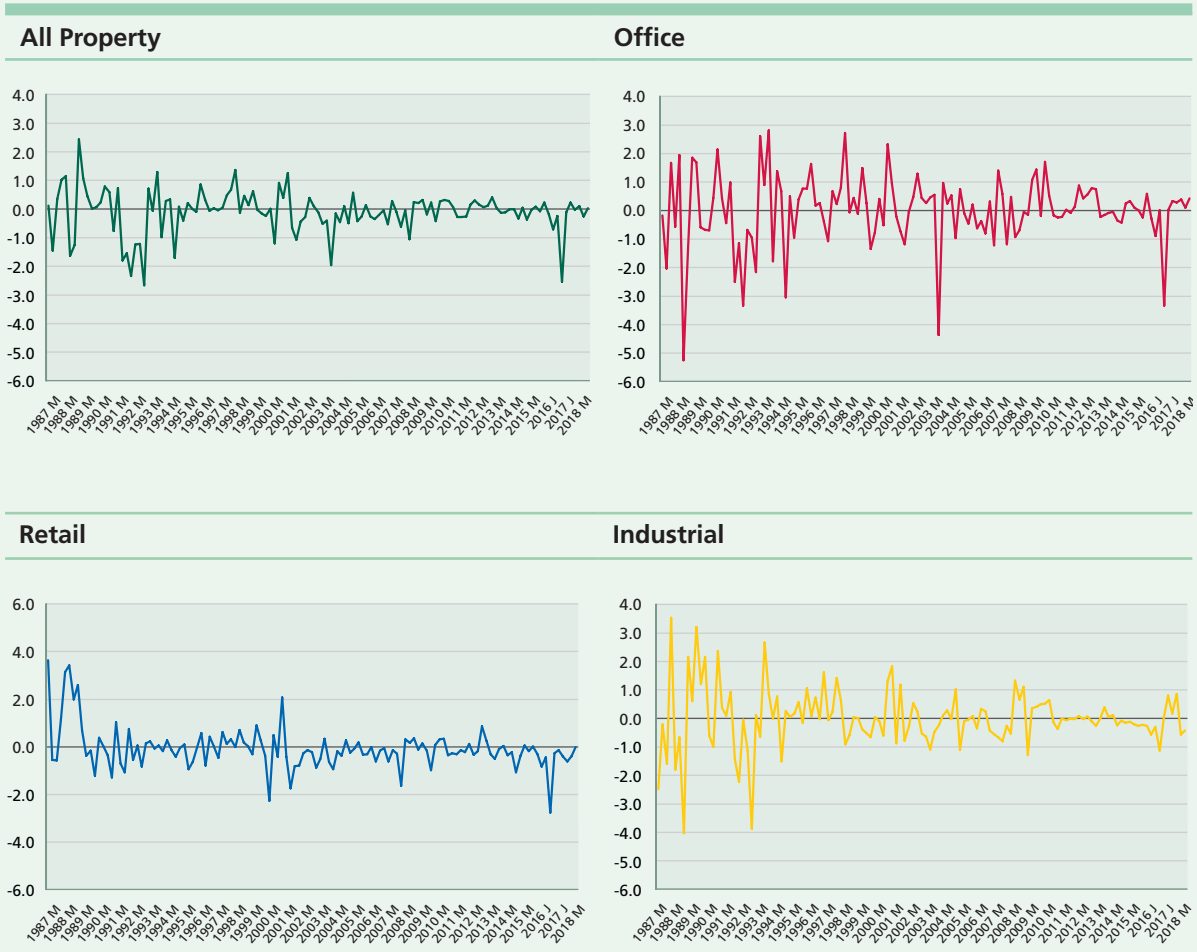
This is no doubt a function of the nature of the two major crises in UK commercial real estate markets. The 1990 crash was based on extreme volatility in rental markets while in 2007 to 2008 the rental market was stable. The increased difficulty of keeping up with quickly moving markets was not a major problem within the rental market around the time of the GFC. There is one extreme spike in Q2 2003 office markets. This was a time when rental values in office markets were falling significantly and both indices were recording falls. However, the MSCI index started to fall in Q4 2001 while the JLL index did not go negative until Q2 2002. By Q1 2003 the MSCI index had fallen from its peak by around 4% more than the JLL index. The spike in Q2 2003 was caused by the JLL index reducing by 4.4% more than the MSCI, that is 7.5% compared to 3.1%. It appears to be a 'catch-up' variation.

Figure 7: Differences in Quarterly Rental Value Change between MSCI and JLL Indices, Q1 1987-Q1 2018



The capital value indices also show more variation at the beginning of the period and that variation is significant in the run up to the 1990 downturn. This appears to be a particular issue for the industrial market. However, post 1990 the variation is much less, although in the three years following the 1990 downturn there are some differences, most notably the discrepancy in Q4 1993 in the office and retail markets. This

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was the time of a spike in capital values despite both indices recording continuing falls in rental value with cap rates adjusting downwards due to changing sentiment towards property. The JLL index reduced rental values by less and increased capital values by significantly more than MSCI in that quarter in both office and retail markets. Despite the perceived difficulties of valuation in a downturn, the indices remained quite stable against each other in the GFC period. The other major spike is very recent and involves industrial property in Q4 2017. This is a result of an increase of nearly 5% in the MSCI index against a much more modest 1% in the JLL index. However, in two previous quarters the JLL index increased by around 4% more than the MSCI index so it appears to be another corrective variation, bringing the two indices back into line with each other.

Overall, the difference in performance of the two indices over the analysis period where they are operating in parallel shows significant similarities. This similarity is borne out by the similar results from the project analysis using the two different datasets. The results are set out in Figure 8 below.

Figure 8: Differences in Quarterly Capital Value Change between MSCI and JLL Indices, Q1 1987-Q1 2018

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CBRE RYM vs JLL/MSCI - A Comparison of a Hypothetical Location Index Against the Property Indices.

Rental Growth

The CBRERYM is a hypothetical property index that measures the best property in a range of prime and secondary locations. The properties remain 'new' and do not deteriorate in either locational or physical terms. This lack of depreciation means that the index would be expected to show higher rental value growth than one based on actual properties that depreciate and cannot adjust to locational change. Locational change can have positive as well as negative impacts while building depreciation leads to either relative value loss or significant expenditure. But in the case of the CBRE index locational change is always a positive influence as a deteriorating location is replaced by the new prime location at no cost.

The average quarterly increase in rental value within the CBRERYM All Property Index between Q1 1987 and Q1 2018 is set out in Table 2 and illustrated in Annex 3, Figures 33 to 36.

Table 2: JLL, MSCI and CBRE RYM Quarterly Indices - Comparison of Quarterly Rental Growth (%) Q1 1987 to Q1 2018

	All Property	Office	Retail	Industrial
JLL Mean Rental Growth	0.49	0.49	0.63	0.54
MSCI Mean Rental Growth	0.59	0.49	0.70	0.55
CBRE RYM Mean Rental Growth	0.945	0.923	0.955	0.974
CBRE RYM St Dev	2.137	2.926	2.048	1.987
CBRE RYM Skew	0.506	-0.518	1.490	1.748
CBRE RYM Kurt	2.073	0.664	6.863	6.077
CBRE RYM FOAC	0.928	0.902	0.830	0.839
CBRE RYM SOAC	0.852	0.781	0.743	0.734

The descriptive statistics for the CBRE RYM are again given for completeness.

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The comparison with the two property based indices is interesting. The CBRE RYM indicates very consistent growth rates between sectors, all performing around 1% per quarter across the period. This is in contrast to the lower and less consistent growth rates across the sectors as measured by JLL and MSCI. It could suggest that property markets are very similar across sectors, the differences in performance are a function of the different abilities of the different sectors to combat depreciation. This observation stems from the depreciation rate studies that suggested that depreciation is greatest in offices, less significant in industrial and least significant in (high street) retail. Figure 9, in addition to setting out the average differences that are much higher than between JLL and MSCI, illustrates that the tracking errors are slightly higher than between JLL and MSCI, with an average standard deviation between MSCI and CBRERYM above 1%.

Figure 9: Differences in Quarterly Rental Growth between MSCI and CBRE RYM Indices (Means and SDs), Q1 1987-Q1 2018

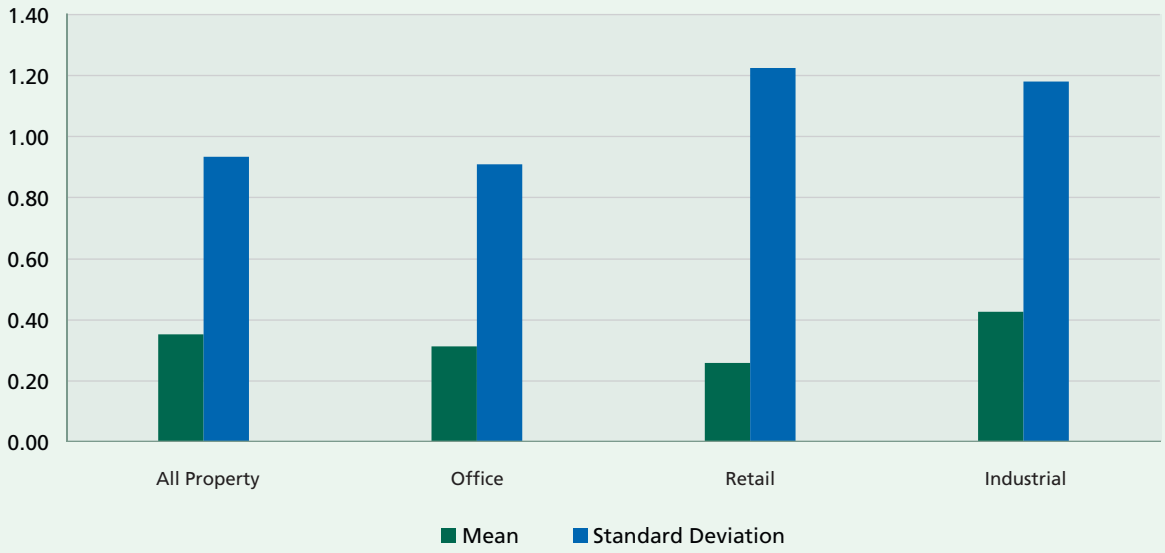

Figure 10 illustrates that, similar to the variations experienced in the run-up to and subsequent downturn in 1990 within JLL and MSCI, the largest differences between MSCI and CBRE RYM also relate to this period.

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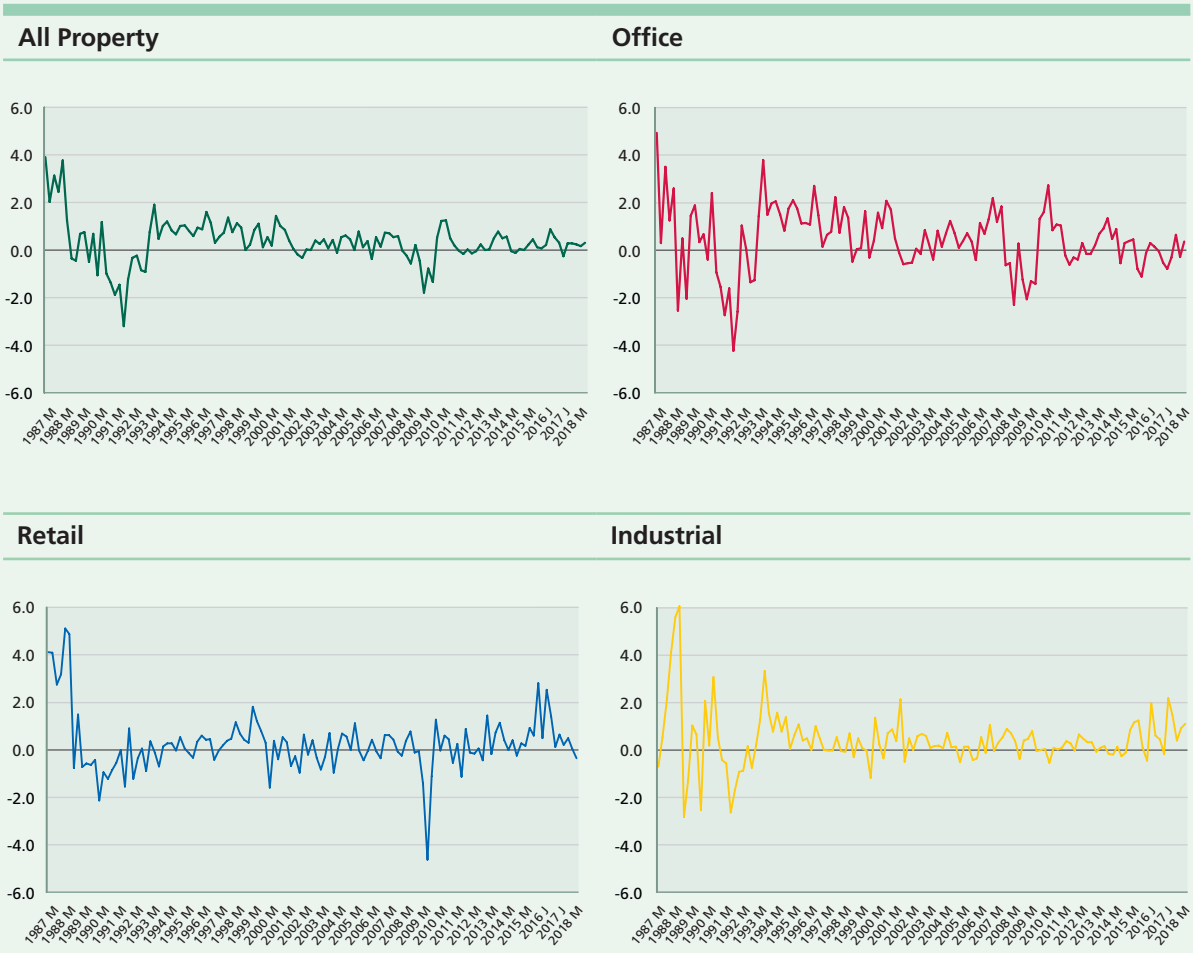
Figure 10: Differences in Quarterly Rental Value Change between MSCI and CBRE RYM Indices, Q1 1987-Q1 2018



However, in the case of the JLL and MSCI indices, although there are quarterly differences between the indices, there is no sign of one index lagging the other. Table 3 sets out a correlation matrix of the two pairs of indices with lagging. In the case of JLL and MSCI the highest correlations are in the same period and a one-quarter lag each side reduces the correlations apart from the industrial index where they stay the same. This is not so for the comparison between the CBRE RYM and the MSCI index where there is a clear lag between the movements in CBRE and the subsequent movements in MSCI. The highest correlations between these two indices is where a one-quarter lag is introduced and this raises the correlation between the two all property indices from 0.91 to 0.95. Even with a two-quarter lag the correlation improves to 0.93 and in the case of industrial rental growth is actually higher than for one quarter. This suggests that CBRE is a leading indicator for MSCI rental growth indices by one quarter and in the case of industrial, two quarters. However, the coefficients are all very high so this is a tentative conclusion revisited when the indices are compared in real terms.

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Table 3: Correlation Matrix Rental Growth Indices Q1 1987 to Q1 2018

Index	-1Q	Same Quarter	+1Q	+2Q	+3Q
JLL/MSCI AP	0.89	0.92	0.90	0.86	0.78
JLL/MSCI O	0.84	0.88	0.84	0.78	0.71
JLL/MSCI R	0.86	0.89	0.86	0.82	0.75
JLL/MSCI I	0.83	0.83	0.83	0.74	0.71
CBRE/MSCI AP	0.83	0.91	0.95	0.93	0.87
CBRE/MSCI O	0.80	0.89	0.92	0.87	0.80
CBRE/MSCI R	0.76	0.84	0.86	0.83	0.77
CBRE/MSCI I	0.72	0.81	0.84	0.85	0.79

In addition to the differences between the indices regarding hypothetical versus real properties and prime versus all property, there are other differences that may be contributing to the lagging effects. It has long been recognised that from the post 1990 downturn onwards the MSCI rental growth index was a combination of both effective and headline rental values while the CBRE estimates are headline rents. Also, at the time of the most variation between the indices around 1990, CBRE were assessing both achievable and best rental value estimates within their valuations so this may have something to do with the variations illustrated here. CBRE are unconstrained by not having to prove their rental value levels for entry into the CBRE RYM but valuations for portfolio measurement and financial accounting may well have more constraints, with draft valuations having to be 'negotiated' with clients (Carsberg,1992).

The similarity with the variations between JLL and MSCI, apart from the lagging effect, suggest that for these two indices, variation is caused more by different valuer opinions concerning the level of value change in time periods when rental values were extremely volatile. In contrast, CBRE RYM valuations fell more steeply in the post 1990 period but began to adjust upwards again more quickly, with MSCI lagging and smoothing these movements. The standard deviation of the CBRE all property quarterly rental value changes is 2.4% between Q1 1987 and Q1 2018 while the MSCI standard deviation is only 1.62. This has led to some significant differences in individual quarters in this period.

The negative peak in Q2 2009 in retail is again a function of the indices moving at slightly different times. In the post GFC rental market downturn, in offices CBRE RYM moved the values down more quickly and more significantly during 2009 and in Q1 2010 they reversed this trend and in that quarter there is a higher growth rate in CBRE RYM than in MSCI, following a number of quarters where CBRE RYM fell more rapidly. In the retail sector at this time, in addition to some differences in the timing of increases and decreases between the two indices, CBRE RYM was more volatile and so the falls were greater during 2009, especially Q2, but the

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index went positive in 2010 before MSCI.

Overall, the rental growth indices have behaved as expected with the hypothetical 100% property and location index illustrating higher rental growth, higher volatility and leading the indices based on real properties in actual locations. The two individual property based indices show greater similarity but there are individual quarterly differences between them reducing the correlations to around 90%. The greatest divergence is in the industrial market.

Yield or Capitalisation Rate

The CBRE RYM and the MSCI produce capitalisation rate indicators which have been used to model the yield element of equilibrium value. The MSCI Equivalent Yield series is computed from the valuation data provided to MSCI and the equivalent yield is the internal rate of return of the property cash flow with the assumption that rents are reviewed to their current market rent at the next rent change. The market rent is part of the equivalent yield calculation and also forms the basis for the rental value series discussed above.

The Average Yield for the CBRE RYM is based on the same assumptions as for the CBRE RYM average rents; a hypothetical new building in the best position in the location, and is the opinion of the valuer of the equivalent yield that would be applied to the (headline) rental value. As it relates to the best building in the best micro location of each town or city value point, it is sometimes referred to as a prime property yield. The term 'average' yield relates to the fact that it is an average across the locations, which make up the value series.

The capitalisation rates for the CBRE and MSCI databases for the period Q1 1987 to Q1 2018 are set out in Figures 37 to 40 in Annex 4.

Apart from a few instances at the start of the 1990 downturn when the CBRE yield series started to rise earlier than the MSCI series, the prime yields measured by CBRE are significantly below the MSCI equivalent yield series across all sectors. The average difference ranges from 88 basis points for the industrial market to 109 basis points for the retail sector. The all property average difference is 94 basis points.

Differences between the behaviour of the two indices is illustrated by the differences between the rate of change in each quarter. Figure 11 shows that, over the whole period, the average rate of change is close to zero but the standard deviation of the quarterly differences is relatively high. It is higher than the standard deviation of the change rates in rental growth between the two indices with the all property standard deviation at 1.5% and the three sectors all around 2%.

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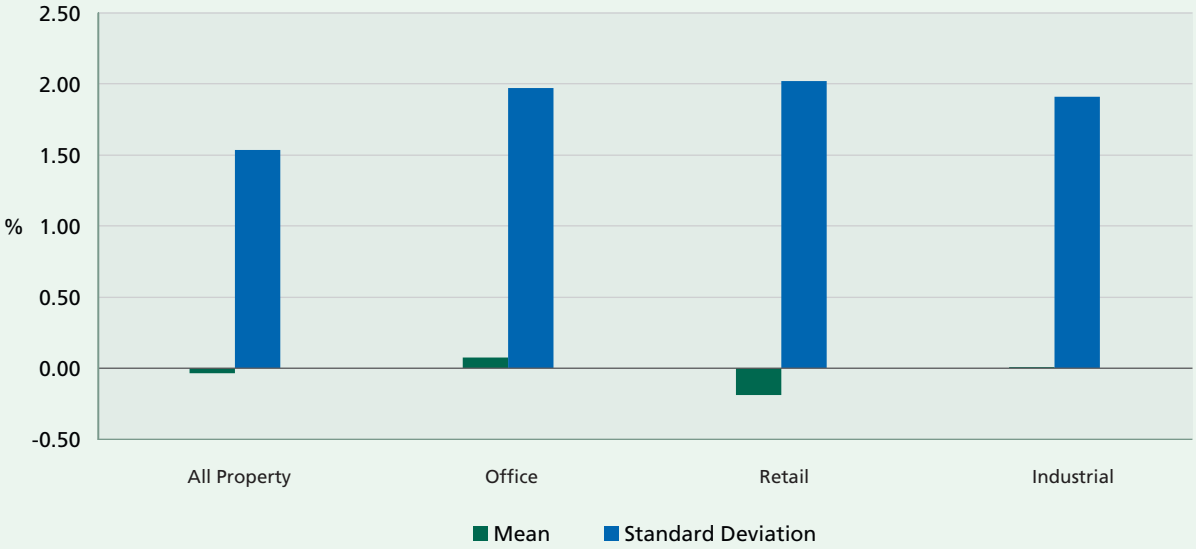
Figure 11:Differences in Quarterly Capitalisation Rates between MSCI and CBRERYM Indices (Means and SDs), Q1 1987-Q1 2018



Some of these divergences are high. Figure 12 illustrates the extent of the divergence quarter by quarter. The divergences in opinion were centred around the two major bubbles and downturns in the late 1980s and mid to late 2000s, similar to the rental value divergences. Around a quarter of the occasions where the absolute difference in the rate of change in cap rates diverged by more than 3% were allied to the GFC in the period Q4 2008 to Q1 2010. There was more uniformity at the start of the downturn in 2007.

Around half of the more than +/- 3% divergences were in the period 1987 to 1994. The 6 months from Q4 1993 to Q2 1994 appeared to be a particular difficult period to assess cap rates. The excessive spike in Q2 1994 in all three sectors was caused by a significant drop of around 10-12% in the CBRE yield series in that quarter not replicated to anything like the same extent in MSCI. But MSCI had been reporting reducing cap rates from Q2 1993, which by Q1 1994 had accumulated to a 17% decrease. CBRE had reduced cap rates by 11% in the same period and therefore the 12% reduction in Q2 1994 was partly catch-up. MSCI reduced them by only 2% in that quarter.

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Figure 12: Differences in Quarterly Cap Rate Change between MSCI and CBRE RYM Indices, Q1 1987-Q1 2018

CBRE seemed to lead MSCI as far as rental growth was concerned but yields appear to be contemporaneous although the correlations are weaker, around 80% to 85% rather than 90% to 95% as with rent. Table 4 illustrates the correlations and the lack of lagging.

Table 4: Correlation Matrix Cap Rates, Q1 1987-Q1 2018

Index	-1Q	Same Quarter	+1Q	+2Q
CBRE/MSCI AP	0.62	0.86	0.73	0.53
CBRE/MSCI O	0.58	0.79	0.68	0.55
CBRE/MSCI R	0.54	0.79	0.72	0.52
CBRE/MSCI I	0.59	0.80	0.71	0.52

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6. Comparison of the indices in real terms

Table 5 and 6 set out descriptive statistics of the three indices between 1987 and 2018 for rental growth and capital growth in real terms.

Table 5: Real Rental Growth, Q1 1987-Q1 2018

	CBRE AP	CBRE OFF	CBRE RET	CBRE IND	JLL AP	JLL OFF	JLL RET	JLL IND	MSCI AP	MSCI OFF	MSCI RET	MSCI IND
Mean	0.116	0.093	0.129	0.145	-0.336	-0.328	-0.196	-0.285	-0.232	-0.337	-0.127	-0.277
St Dev	2.007	2.751	2.015	1.853	1.835	2.575	1.673	1.739	1.519	2.310	1.208	1.519
Skew	0.395	-0.509	1.078	1.275	-0.009	-0.547	1.599	0.751	0.129	-0.378	0.529	0.643
Kurt	1.931	0.523	5.401	5.156	1.361	1.267	4.251	4.557	0.638	0.382	1.003	2.837
FOAC	0.896	0.894	0.766	0.770	0.733	0.674	0.694	0.688	0.806	0.848	0.686	0.670
SOAC	0.815	0.789	0.603	0.628	0.668	0.630	0.607	0.582	0.699	0.767	0.549	0.642

Table 6: Real Capital Growth, Q1 1987-Q1 2018

	CBRE AP	CBRE OFF	CBRE RET	CBRE IND	JLL AP	JLL OFF	JLL RET	JLL IND	MSCI AP	MSCI OFF	MSCI RET	MSCI IND
Mean	0.311	0.365	0.093	0.656	-0.202	-0.144	-0.224	-0.006	0.014	-0.069	0.001	0.167
St Dev	3.589	4.338	3.632	3.558	2.961	3.327	2.969	2.890	2.845	3.219	2.852	2.917
Skew	-0.254	-0.403	-0.065	0.342	-0.988	-0.847	-0.716	-0.786	-1.110	-0.810	-1.102	-0.684
Kurt	1.940	0.580	1.135	1.745	3.126	2.082	3.641	2.438	3.119	1.289	4.470	1.997
FOAC	0.745	0.761	0.659	0.655	0.761	0.749	0.746	0.714	0.790	0.817	0.754	0.807
SOAC	0.583	0.636	0.487	0.472	0.543	0.543	0.524	0.488	0.566	0.634	0.515	0.579

The JLL and MSCI rental growth indices have both fallen in real terms over the analysis period, JLL at 0.34% per quarter and MSCI by 0.23%. MSCI has fallen by around 0.1% per quarter less on the back of a relatively better performance in retail. CBRE RYM suggests that real rents have actually risen by 0.12% per quarter.

The skewness of the JLL All Property index is close to 0 and identifies the symmetry of the distribution of rental value change illustrated in Figure 13, although this symmetry comes from a cancelling out of the positive skewness of the retail distribution with the negative result for offices. The Kurtosis is positive representing a more peaked distribution, mainly produced from the retail and industrial results.

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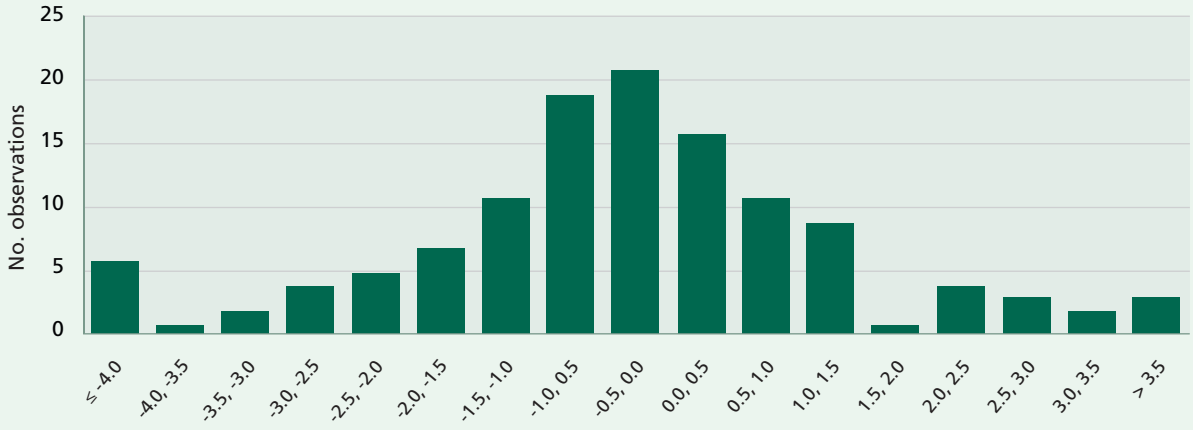
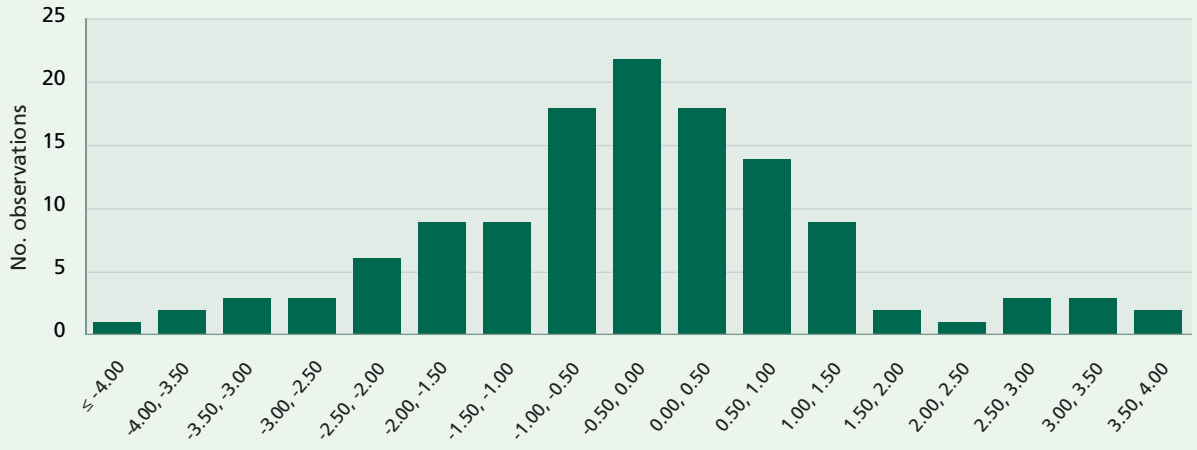
Figure 13: JLL All Property Rental Growth Quarterly Change, Q1 1987-Q1 2018



MSCI's distribution of rental value growth rates is more skewed and less peaked than JLL. The distribution is slightly positively skewed and has a kurtosis of less than 1 meaning the distribution is more spread than for JLL (Figure 14). However, the outcomes are similar, as are the segment results.

Figure 14: MSCI All Property Rental Growth Quarterly Change, Q1 1987-Q1 2018



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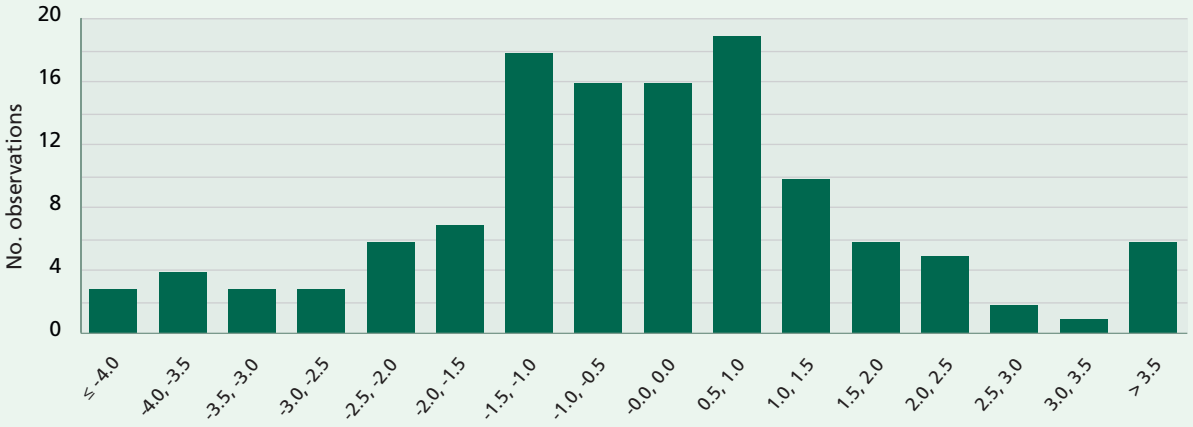
The distributions from the CBRE RYM are different and do not exhibit the same consistency as there is between JLL and MSCI. Figure 15 illustrates these distributions.

Figure 15: CBRE RYM All Property Rental Growth Quarterly Change, Q1 1987-Q1 2018



The number of observations in each 0.5% band between – 0.1% and 1% are virtually identical and the distribution is positively skewed. The standard deviation is greater than either of the other two indices and the Kurtosis of less than 1 indicates a flatter, wider distribution.

The 3-month auto-correlation (FOAC) between the observations within each database is high. It is highest in the case of CBRE, lowest within the JLL index. The same pattern emerges over 6 month periods (SOAC).

The correlation between the three indices is different when assessed in real terms. Across all indices, the highest correlations are contemporaneous and CBRE does not lead the other two (Table 7).

Table 7: Correlation between Real Rental Growth Indices

	All Property	Office	Retail	Industrial
CBRE-JLL	0.819	0.790	0.672	0.593
CBRE-MSCI	0.899	0.876	0.836	0.781
JLL-MSCI	0.905	0.866	0.851	0.802
CBRE Lead 1 Quarter				
JLL	0.709	0.744	0.579	0.478
MSCI	0.850	0.887	0.728	0.695
CBRE Lead 2 Quarters				
JLL	0.657	0.659	0.487	0.508
MSCI	0.828	0.852	0.638	0.709

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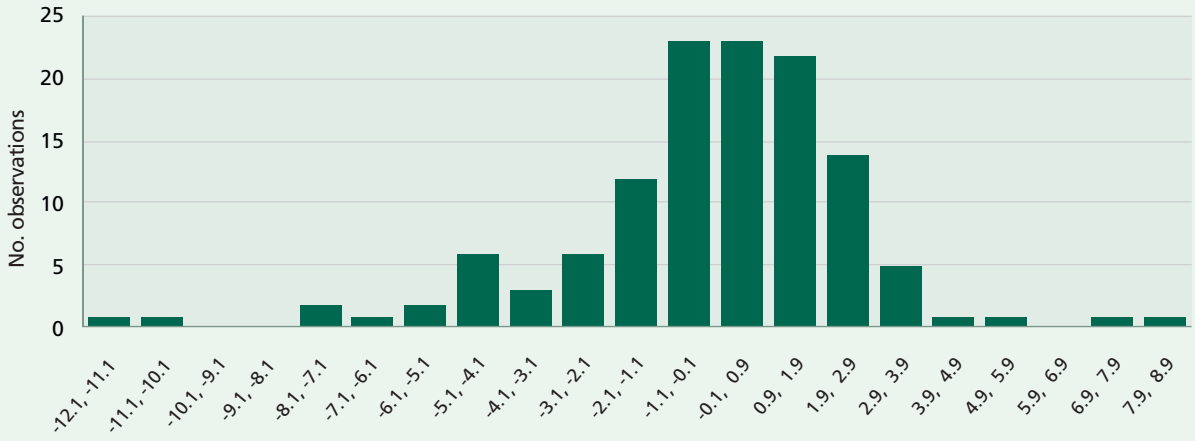
The removal of inflation from the index has also removed the lagging of JLL/MSCI to the CBRE RYM suggested by the nominal indices. As indicated previously the lagging was apparent but the differences in correlations were small and the removal of the inflation effects, which impact differentially on the indices as the lagging increases, has also removed the lagging with all segments now most closely to each other contemporaneously.

The real capital value growth index is basically a function of real rental value change and yield shift and, as such, any major variation between the results for the rental growth index and capital growth index are therefore based in the change in yields. The JLL capital growth index indicates that, similar to the rental growth results, capital values have fallen in real terms by around 0.2% per quarter over the analysis period. However, as with rental values, MSCI indicates slightly better performance and in this case a result that is marginally positive. As expected, CBRE RYM, measuring 100% locations with no depreciation, outperforms both of the other indices with a 0.3% per quarter positive real return.

However, the distributions have some particular characteristics. Figure 16 illustrates the JLL index.

Figure 16: JLL All Property Capital Growth Quarterly Change, Q1 1987-Q1 2018



The Skewness and Kurtosis statistics indicate the much more obvious negative skew and a peaked distribution. In the case of MSCI (Figure 17), the distribution is also skewed negatively and peaked. The auto-correlation differences between JLL and MSCI are less than they were for rent but JLL still has less capital value auto-correlation than the MSCI.

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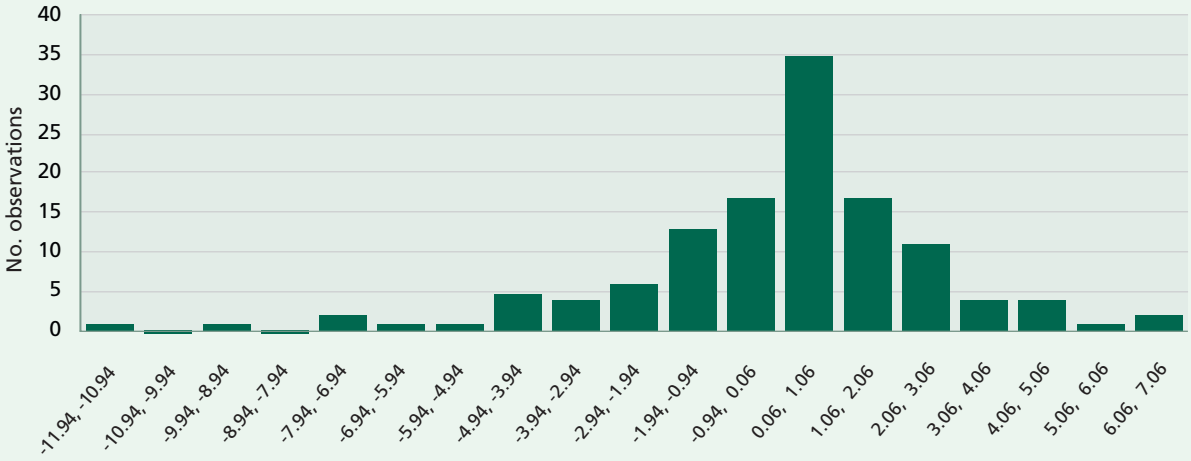
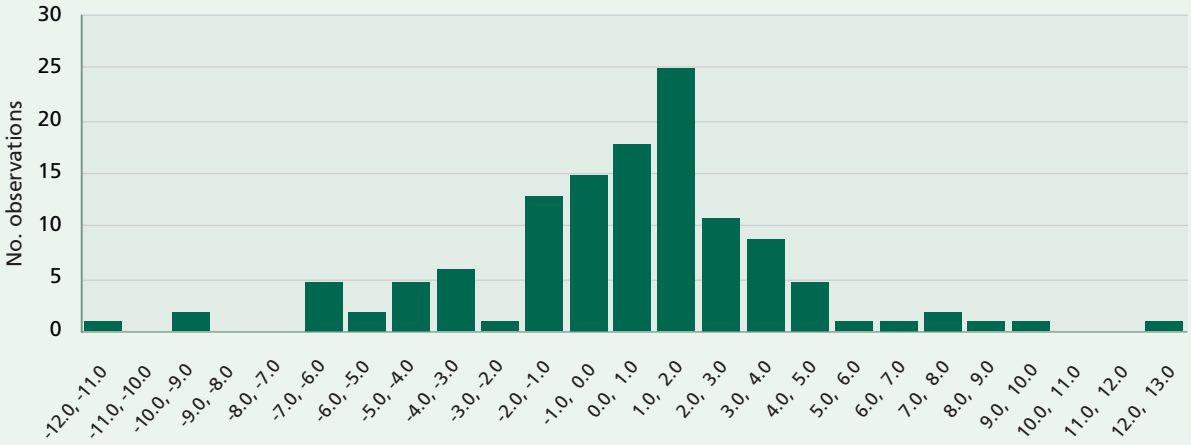
Figure 17: MSCI All Property Capital Growth Quarterly Change, Q1 1987-Q1 2018



The CBRE RYM capital value growth distribution is less symmetrical than either of the other two with a negative skewness of 0.25 and a Kurtosis of 1.94. All three distributions have similar auto correlation.

Figure 18: CBRE RYM All Property Capital Growth Quarterly Change, Q1 1987-Q1 2018



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The differences between the distributions of the rental value and capital value distributions indicate that the capital value distributions are consistently negatively skewed whereas the rental value distributions are basically not skewed. Given that the capital value growth is partly a function of the rental value change, the difference should be manifested in the other major component of capital value change; yield. The correlations between the indices again show no lagging in real terms between any of the indices (Table 8)

Table 8: Correlation between Real Capital Growth Indices

	All Property	Office	Retail	Industrial
CBRE-JLL	0.811	0.770	0.696	0.740
CBRE-MSCI	0.876	0.856	0.798	0.799
JLL-MSCI	0.968	0.955	0.956	0.894
CBRE Lead 1 Quarter				
JLL	0.718	0.685	0.641	0.687
MSCI	0.754	0.764	0.671	0.735
CBRE Lead 2 Quarters				
JLL	0.555	0.527	0.478	0.505
MSCI	0.565	0.601	0.483	0.588

Figure 19 and 20 illustrate the yield shift distributions of the two performance measures where the cap rates are observable; MSCI and CBRE RYM. They both illustrate positive skew (MSCI 1.13; CBRE 0.17) and both have a sharply peaked distribution relative to a normal distribution (Kurtosis - MSCI, 7.7; CBRE 6.8). The positive yield skew introduces the negative skew into the capital growth indices (a negative yield shift/reduction in yield induces a positive capital growth movement). The positive tail is longer than the negative one.

Figure 19: MSCI All Property Yield Shift per Quarter, Q1 1987-Q1 2018

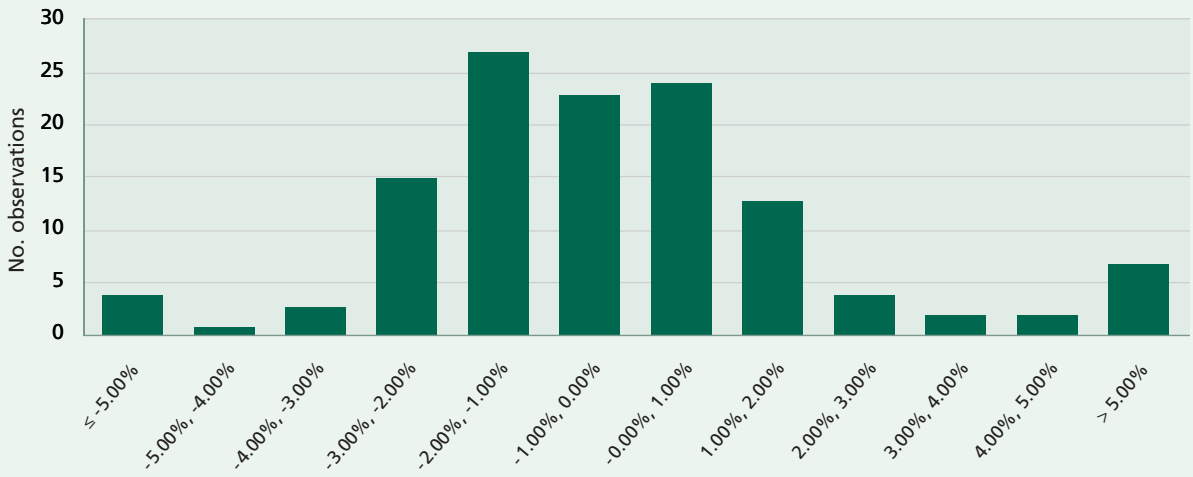

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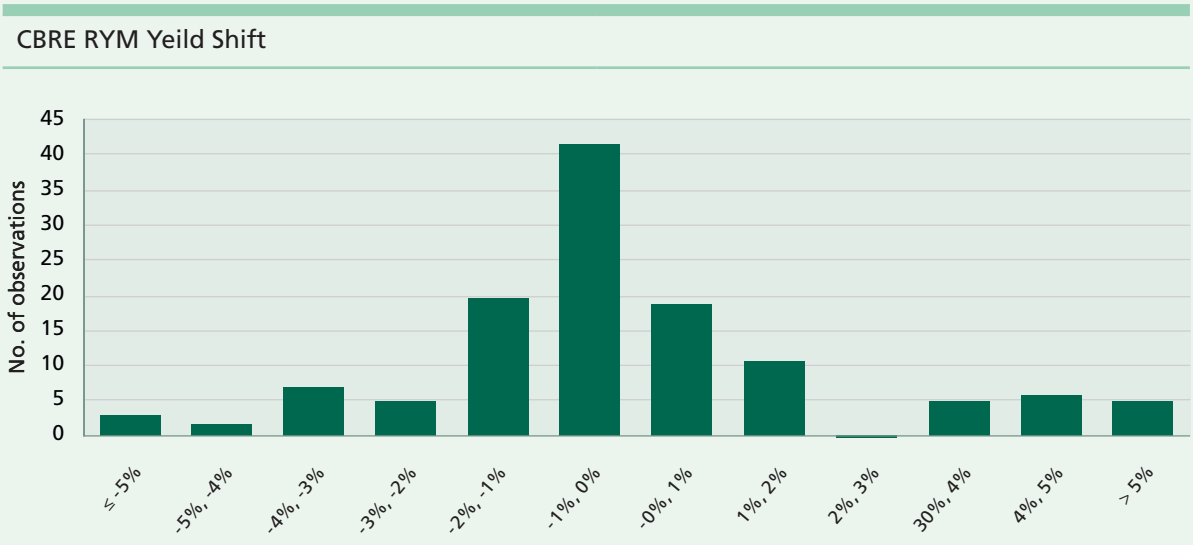
Figure 20: CBRE RYM All Property Yield Shift Per Quarter Q1 1987 to Q1 2018



The changes in yield of the CBRE hypothetical series are less frequent than occur in the index made up from real property valuations; this is unsurprising as the real property index would be static only if none of the individual properties in individual locations were to experience any change. The same could be said for each location within CBRE but CBRE has no individual property asset drivers on yield adjustment.

7. Conclusions

The JLL index is the longest running index but the make-up of the index is less complete than for MSCI and CBRE RYM. Both CBRE and JLL now track the make-up of the MSCI for weightings in reaching all property outcomes from the individual sectors. JLL and MSCI are both based on actual properties and CBRE is based on hypothetical prime properties and therefore does not include depreciation.

Capital expenditure is taken account of in the MSCI index but the version without capital expenditure has been used in this project for two reasons. First, it mimics JLL data and, second, the objective is to investigate market performance rather than the impact of managing individual properties.

The main inputs used in this project are the rental growth indices and the capitalisation rate data in order to model sustainable rents and yields. The different datasets may produce different results and therefore it is important to identify the differences in the datasets to interpret any analysis that is affected by these differences.

The main period of analysis, where all of the datasets were operating quarterly and can be compared, is from the beginning of 1987 until the end of Q1 2018. The rental growth rates of the CBRE index are higher across this period. This is expected given the lack of depreciation and other factors concerning rent determination. The level of cap rates in CBRE is also lower than MSCI due to the assumptions of new or best buildings in the best locations of any location included in the CBRE value points across the UK. MSCI and JLL are a sample of real buildings.

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Correlations between the indices show that the JLL and MSCI do not lag or lead each other as far as rents are concerned. The CBRE nominal rental index leads the MSCI index by at least one quarter and up to two in the case of industrial rents when viewed in nominal terms but this lag disappears when inflation is stripped out of the analysis. The CBRE yield indicator does not lead changes in the MSCI yield indicator, they move contemporaneously. However, the yield correlations between MSCI and CBRE are lower than the corresponding rental value correlations.

The divergences between JLL and MSCI and CBRE and MSCI tend to occur in the build-up and aftermath of the two major downturns in the commercial real estate market in 1990 and 2007. Given the instability at those times, the larger quarterly adjustments and the major turning points, this is not surprising. Observation of any significantly wide variation in a particular quarter tends to result in a conclusion that the variation follows a less marked divergence in the other direction over a longer period, leading to an element of catch-up. However, these quarterly divergences do not seem to have had any significant effect on the long-term results.

The main conclusion is that the two performance measures based on actual properties and similar constructions are a very good surrogate for each other over the analysis period. The real rental value comparison between 1987 and 2018 does suggest that the JLL All Property Rental Value Index is marginally closer to being normally distributed with less auto-correlation than MSCI and therefore, coupled with its earlier start point, is the best indicator for long-term real estate rent analysis. The lack of yield data is a constraint on the use of JLL for capital values but the combined effect of yield shift and rental value growth is available through the capital returns. At the very least, JLL provides a longer running substitute where MSCI data cannot be used and specific cap rates are not required.

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Annex 1: Make-Up of the JLL and MSCI Indices

Table 9: JLL Property Index – Number of Properties, 1978-2018

Year	Office	Shop	Industrial	Agriculture	All Property
1978	29	34	27	8	98
1979	30	40	30	8	108
1980	35	52	35	8	130
1981	38	56	40	8	142
1982	37	51	43	8	139
1983	40	58	38	9	145
1984	41	63	37	9	150
1985	37	53	36	8	134
1986	47	56	38	8	149
1987	48	57	37	8	150
1988	58	63	35	6	162
1989	67	81	40	6	194
1990	63	86	39	6	194
1991	64	85	40	6	195
1992	63	94	39	5	201
1993	63	129	36		228
1994	52	120	31		203
1995	52	110	29		191
1996	61	113	32		206
1997	58	106	32		196
1998	55	83	30		168
1999	55	94	30		179
2000	53	90	31		174
2001	211	402	187		800
2002	221	316	184		721
2003	171	328	157		656
2004	145	296	141		582
2005	118	251	144		513
2006	128	215	150		493
2007	148	228	171		547
2008	260	292	223		775
2009	251	286	206		743
2010	251	286	206		743
2011	256	322	249		827
2012	230	310	179		719
2013	288	431	500		1219
2014	232	362	254		848
2015	241	389	289		919
2016	241	379	242		862
2017	186	300	235		721
2018	148	243	198		589
2019					

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Table 10: JLL Property Index – Segment Breakdown by Capital Value, 1968-2018

Year	Office	Shop	Industrial	Agriculture
1968	72%	9%	19%	
1969	66%	15%	19%	
1970	58%	11%	31%	
1971	67%	10%	19%	4%
1972	59%	13%	20%	8%
1973	54%	14%	21%	11%
1974	51%	18%	20%	11%
1975	60%	13%	21%	6%
1976	63%	13%	19%	5%
1977	59%	17%	17%	7%
1978	53%	20%	19%	8%
1979	48%	23%	20%	9%
1980	48%	26%	20%	6%
1981	46%	29%	19%	6%
1982	47%	30%	18%	6%
1983	50%	28%	16%	6%
1984	49%	31%	15%	5%
1985	47%	36%	14%	4%
1986	51%	33%	14%	3%
1987	47%	33%	19%	1%
1988	46%	36%	17%	1%
1989	48%	32%	19%	1%
1990	56%	26%	17%	1%
1991	53%	27%	19%	1%
1992	51%	29%	19%	1%
1993	46%	37%	17%	
1994	40%	45%	15%	
1995	42%	43%	15%	
1996	38%	47%	15%	
1997	36%	46%	18%	
1998	40%	43%	17%	
1999	34%	52%	14%	
2000	33%	51%	16%	
2001	38%	45%	17%	
2002	41%	43%	16%	
2003	35%	47%	18%	
2004	33%	49%	18%	
2005	28%	51%	21%	
2006	35%	43%	23%	
2007	38%	39%	23%	
2008	39%	41%	20%	
2009	37%	39%	25%	

COMPARISON OF PROPERTY MARKET INDICES

Table 10: JLL Property Index – Segment Breakdown by Capital Value, 1968–2018 (cont'd)

Year	Office	Shop	Industrial	Agriculture
2010	37%	39%	25%	
2011	29%	44%	27%	
2012	30%	50%	20%	
2013	30%	48%	22%	4%
2014	31%	46%	23%	8%
2015	32%	44%	24%	11%
2016	33%	41%	26%	11%
2017	30%	42%	28%	6%
2018	32%	42%	26%	5%
2019			17%	7%

COMPARISON OF PROPERTY MARKET INDICES

Table 11: Composition of MSCI Property Index

	By Capital Value			Number of Properties			
Year	Office	Retail	Industrial	All Property	Office	Retail	Industrial
1987 Q1	41%	46%	12%	1,408	395	701	282
1987 Q2	42%	46%	11%	1,366	380	699	257
1987 Q3	44%	44%	11%	1,307	389	652	235
1987 Q4	43%	44%	11%	1,398	411	696	259
1988 Q1	44%	43%	11%	1,388	415	683	258
1988 Q2	45%	43%	11%	1,435	418	726	258
1988 Q3	44%	44%	12%	1,456	429	740	255
1988 Q4	44%	42%	14%	1,527	441	774	285
1989 Q1	45%	40%	15%	1,654	483	838	306
1989 Q2	44%	39%	17%	1,664	492	826	320
1989 Q3	43%	38%	18%	1,682	494	831	330
1989 Q4	43%	38%	19%	1,678	499	821	332
1990 Q1	45%	36%	19%	1,656	504	798	328
1990 Q2	43%	37%	20%	1,619	483	784	328
1990 Q3	43%	36%	20%	1,595	480	767	325
1990 Q4	43%	36%	20%	1,573	475	760	317
1991 Q1	44%	36%	20%	1,566	474	757	312
1991 Q2	41%	37%	22%	1,559	464	750	321
1991 Q3	40%	38%	22%	1,564	459	759	321
1991 Q4	39%	39%	22%	1,568	460	768	316
1992 Q1	37%	41%	22%	1,566	455	781	307
1992 Q2	36%	42%	22%	1,585	456	799	307
1992 Q3	35%	43%	22%	1,579	453	807	305
1992 Q4	33%	44%	22%	1,578	437	824	304
1993 Q1	33%	45%	22%	1,583	439	830	303
1993 Q2	32%	47%	21%	1,564	425	841	288
1993 Q3	32%	47%	21%	1,580	429	850	291
1993 Q4	31%	49%	19%	1,667	437	924	295
1994 Q1	32%	49%	19%	1,991	541	1,096	342
1994 Q2	32%	50%	19%	2,088	555	1,164	356
1994 Q3	32%	49%	19%	2,155	582	1,186	374
1994 Q4	32%	49%	18%	2,180	587	1,210	369
1995 Q1	32%	49%	19%	2,197	588	1,211	384
1995 Q2	33%	48%	19%	2,206	593	1,210	389
1995 Q3	33%	48%	19%	2,172	581	1,192	386
1995 Q4	34%	47%	19%	2,167	586	1,187	381
1996 Q1	33%	47%	19%	2,450	657	1,334	431
1996 Q2	33%	47%	19%	2,463	651	1,351	434
1996 Q3	32%	47%	19%	2,528	651	1,358	449
1996 Q4	31%	48%	19%	2,553	645	1,380	456
1997 Q1	30%	49%	20%	2,663	655	1,451	485
1997 Q2	30%	49%	20%	2,723	659	1,484	510

COMPARISON OF PROPERTY MARKET INDICES

Table 11: Composition of MSCI Property Index (cont'd)

	By Capital Value				Number of Properties		
Year	Office	Retail	Industrial	All Property	Office	Retail	Industrial
1997 Q3	30%	49%	20%	2,666	643	1,438	517
1997 Q4	30%	50%	19%	2,689	649	1,469	502
1998 Q1	29%	51%	19%	3,192	740	1,785	580
1998 Q2	30%	51%	19%	3,197	743	1,782	584
1998 Q3	29%	50%	19%	3,239	753	1,804	591
1998 Q4	29%	51%	19%	3,122	723	1,724	585
1999 Q1	29%	51%	19%	3,103	735	1,689	579
1999 Q2	29%	50%	19%	3,082	747	1,643	590
1999 Q3	30%	48%	19%	3,083	747	1,624	603
1999 Q4	31%	48%	19%	3,043	742	1,597	597
2000 Q1	32%	47%	19%	3,116	771	1,615	623
2000 Q2	33%	46%	20%	3,105	783	1,577	636
2000 Q3	33%	44%	20%	3,150	797	1,577	668
2000 Q4	34%	43%	21%	3,092	799	1,520	662
2001 Q1	38%	45%	14%	10,657	2,883	5,031	2,160
2001 Q2	39%	44%	14%	10,548	2,843	4,954	2,170
2001 Q3	39%	44%	15%	10,447	2,747	4,802	2,339
2001 Q4	38%	44%	15%	10,240	2,700	4,627	2,341
2002 Q1	37%	45%	15%	10,408	2,733	4,639	2,428
2002 Q2	37%	46%	15%	10,319	2,718	4,539	2,460
2002 Q3	36%	46%	15%	10,273	2,683	4,467	2,524
2002 Q4	34%	47%	16%	10,198	2,647	4,387	2,559
2003 Q1	34%	48%	15%	10,204	2,684	4,353	2,558
2003 Q2	33%	49%	16%	9,977	2,628	4,232	2,508
2003 Q3	32%	50%	15%	9,889	2,565	4,196	2,531
2003 Q4	31%	51%	16%	9,766	2,490	4,161	2,535
2004 Q1	30%	51%	16%	9,745	2,475	4,132	2,561
2004 Q2	29%	52%	16%	9,773	2,457	4,155	2,584
2004 Q3	29%	52%	16%	10,067	2,515	4,233	2,733
2004 Q4	28%	53%	16%	10,374	2,530	4,334	2,760
2005 Q1	28%	52%	16%	10,475	2,544	4,366	2,797
2005 Q2	29%	52%	16%	10,490	2,575	4,332	2,806
2005 Q3	29%	51%	16%	10,643	2,625	4,345	2,871
2005 Q4	29%	51%	16%	10,844	2,685	4,376	2,979
2006 Q1	30%	50%	17%	10,961	2,720	4,392	3,038
2006 Q2	31%	49%	17%	11,048	2,777	4,375	3,064
2006 Q3	32%	48%	17%	11,172	2,845	4,366	3,118
2006 Q4	33%	47%	17%	11,191	2,869	4,303	3,167
2007 Q1	34%	46%	16%	11,418	2,974	4,354	3,197
2007 Q2	35%	45%	16%	11,395	3,004	4,301	3,185
2007 Q3	35%	45%	16%	11,289	2,974	4,234	3,152
2007 Q4	35%	44%	16%	11,142	2,929	4,158	3,155
2008 Q1	34%	45%	16%	10,744	2,797	3,997	3,065
2008 Q2	34%	45%	16%	10,502	2,721	3,887	3,005

COMPARISON OF PROPERTY MARKET INDICES

Table 11: Composition of MSCI Property Index (cont'd)

	By Capital Value			Number of Properties			
Year	Office	Retail	Industrial	All Property	Office	Retail	Industrial
2008 Q3	33%	45%	16%	10,240	2,644	3,799	2,921
2008 Q4	33%	45%	16%	9,992	2,594	3,683	2,845
2009 Q1	33%	45%	17%	9,825	2,545	3,626	2,790
2009 Q2	32%	46%	17%	9,603	2,472	3,547	2,732
2009 Q3	31%	47%	17%	9,414	2,380	3,499	2,718
2009 Q4	29%	48%	17%	9,459	2,373	3,570	2,703
2010 Q1	30%	49%	16%	9,821	2,574	3,682	2,692
2010 Q2	30%	48%	16%	9,895	2,576	3,715	2,721
2010 Q3	30%	49%	16%	10,036	2,597	3,752	2,749
2010 Q4	30%	49%	16%	10,094	2,593	3,803	2,746
2011 Q1	30%	49%	15%	10,095	2,574	3,804	2,729
2011 Q2	30%	49%	15%	10,159	2,557	3,841	2,748
2011 Q3	30%	49%	15%	10,271	2,560	3,877	2,775
2011 Q4	30%	48%	15%	10,409	2,535	3,879	2,751
2012 Q1	30%	49%	15%	10,326	2,483	3,896	2,707
2012 Q2	29%	48%	16%	9,919	2,376	3,650	2,690
2012 Q3	29%	48%	16%	9,891	2,348	3,663	2,673
2012 Q4	28%	47%	16%	9,906	2,341	3,672	2,668
2013 Q1	29%	47%	16%	9,755	2,281	3,619	2,618
2013 Q2	28%	47%	17%	9,705	2,228	3,601	2,631
2013 Q3	29%	46%	17%	9,616	2,187	3,584	2,624
2013 Q4	29%	46%	17%	9,660	2,175	3,607	2,637
2014 Q1	29%	45%	17%	9,776	2,154	3,645	2,673
2014 Q2	30%	45%	17%	10,074	2,176	3,652	2,693
2014 Q3	30%	44%	17%	10,138	2,191	3,679	2,671
2014 Q4	30%	43%	18%	10,214	2,186	3,676	2,718
2015 Q1	31%	43%	18%	10,162	2,151	3,667	2,743
2015 Q2	30%	42%	18%	10,027	2,108	3,666	2,664
2015 Q3	31%	41%	18%	10,100	2,095	3,594	2,675
2015 Q4	31%	41%	19%	10,027	2,062	3,543	2,665
2016 Q1	31%	41%	19%	9,911	2,027	3,514	2,599
2016 Q2	30%	41%	19%	9,778	1,968	3,465	2,581
2016 Q3	30%	40%	19%	9,390	1,912	3,372	2,356
2016 Q4	30%	40%	20%	9,085	1,830	3,270	2,287
2017 Q1	29%	40%	20%	8,978	1,774	3,239	2,252
2017 Q2	29%	40%	20%	8,964	1,761	3,204	2,257
2017 Q3	28%	39%	21%	8,943	1,716	3,196	2,263
2017 Q4	28%	39%	22%	8,827	1,671	3,102	2,264
2018 Q1	27%	38%	22%	9,054	1,683	3,133	2,341
2018 Q2	27%	37%	23%	9,047	1,656	3,108	2,362
2018 Q3	27%	36%	24%	9,099	1,642	3,064	2,419
2018 Q4	27%	35%	24%	9,034	1,625	3,017	2,419

COMPARISON OF PROPERTY MARKET INDICES

Annex 2: Total Returns, Rental Growth and Capital Growth Per Quarter of the Main Sectors within JLL and MSCI Indices

All Property

Figure 21: JLL and MSCI Quarterly All Property Total Returns, 1987-2018

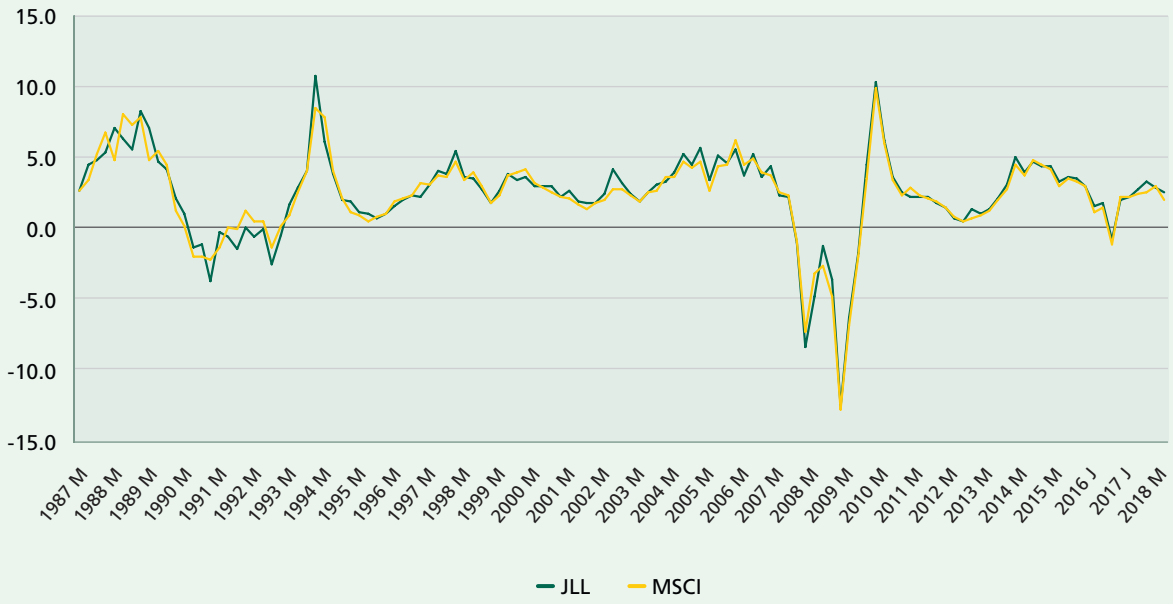
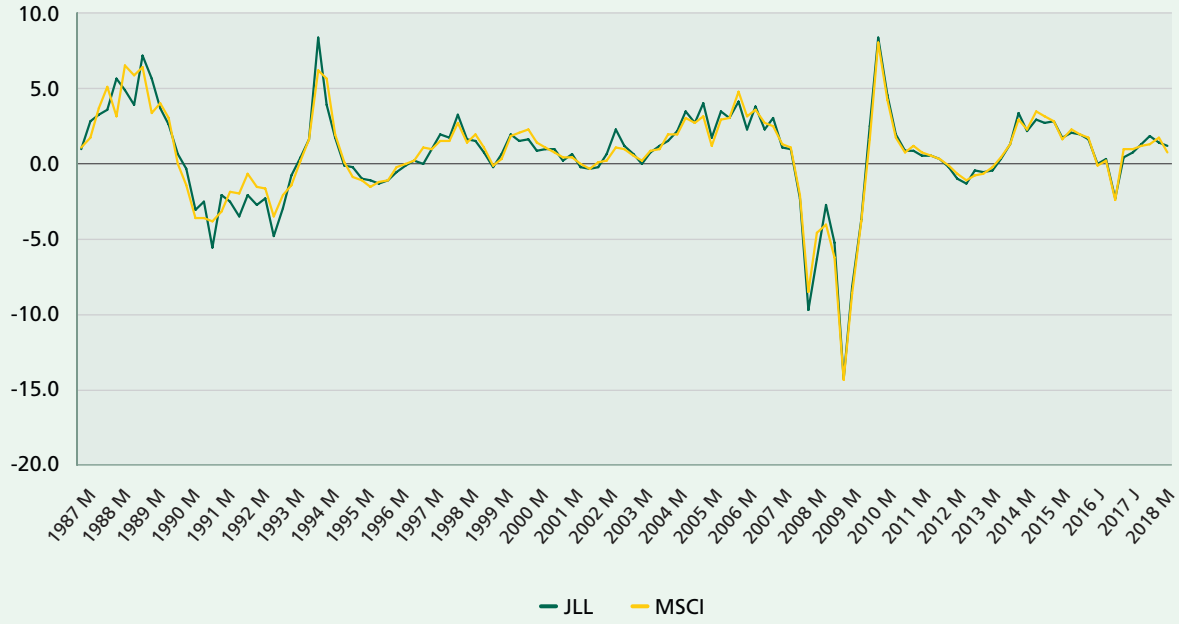


Figure 22: JLL and MSCI Quarterly All Property Rental Growth, 1987-2018

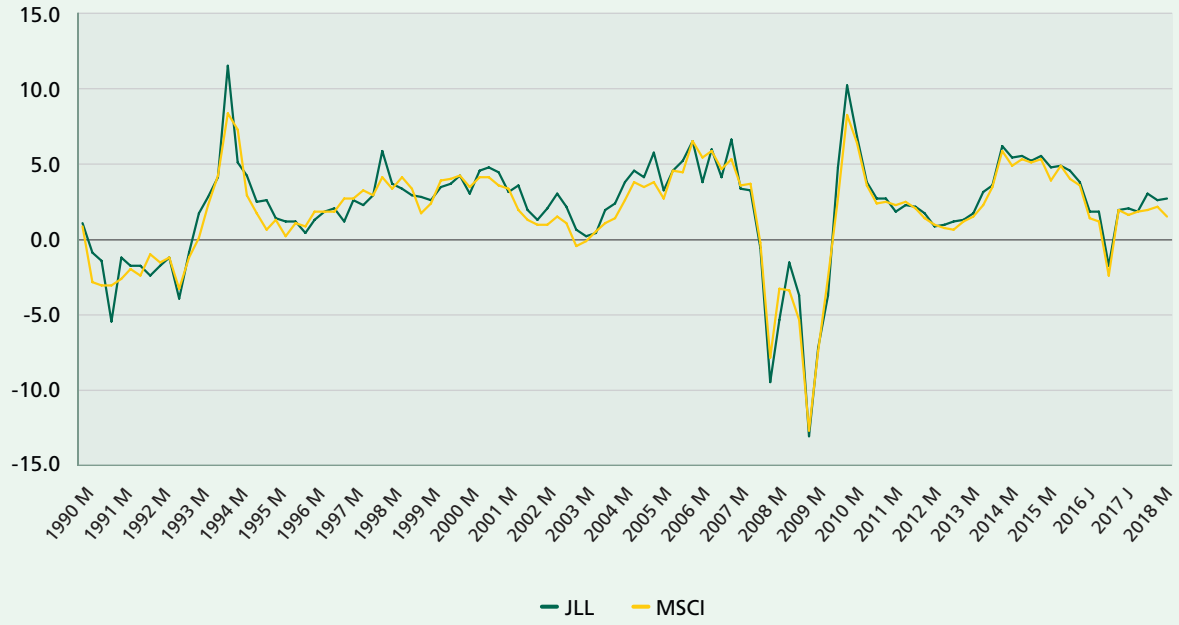
COMPARISON OF PROPERTY MARKET INDICES

Figure 23: JLL and MSCI Quarterly All Property Capital Return, 1987-2018



Offices

Figure 24: JLL and MSCI Quarterly Office Total Returns, 1990-2018



COMPARISON OF PROPERTY MARKET INDICES

Figure 25: JLL and MSCI Quarterly Office Rental Growth 1987 to 2018

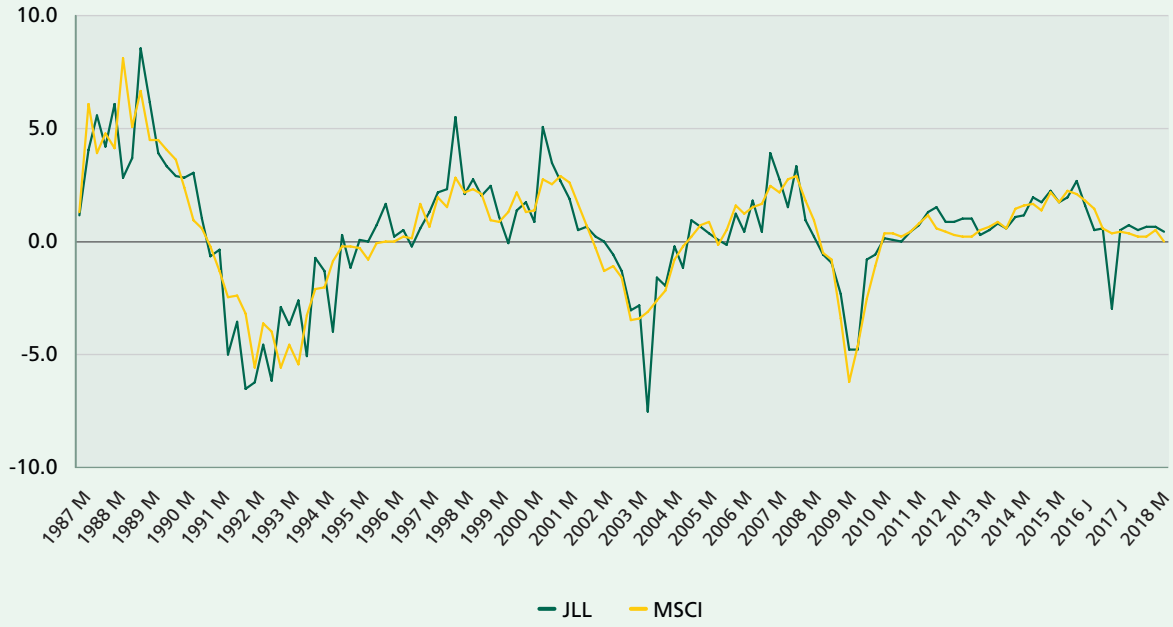
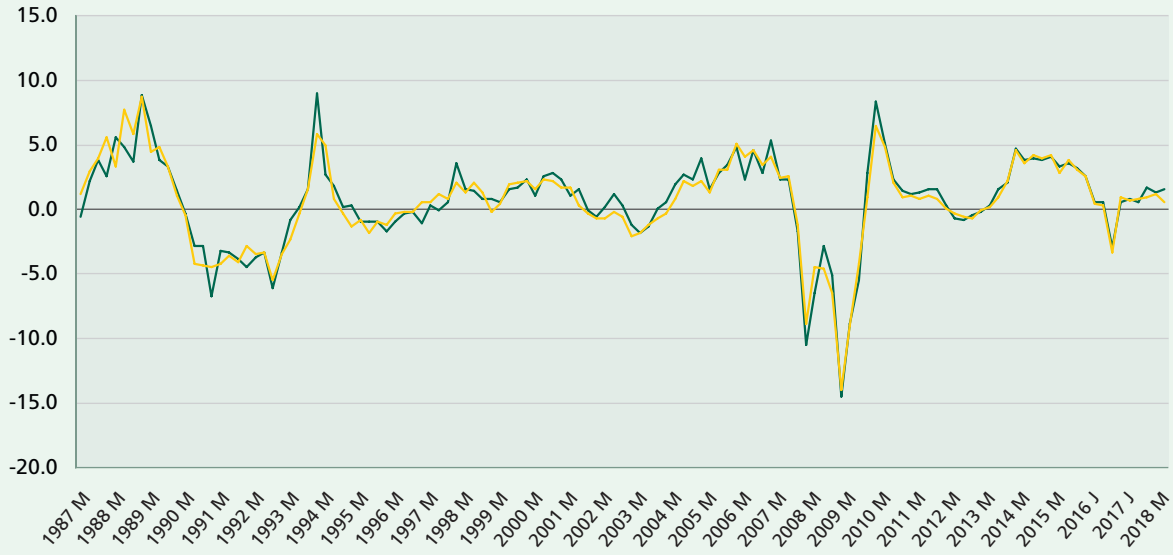


Figure 26: JLL and MSCI Quarterly Office Capital Return 1987 to 2018



COMPARISON OF PROPERTY MARKET INDICES

Retail

Figure 27: JLL and MSCI Quarterly Retail Total Returns, 1990-2018

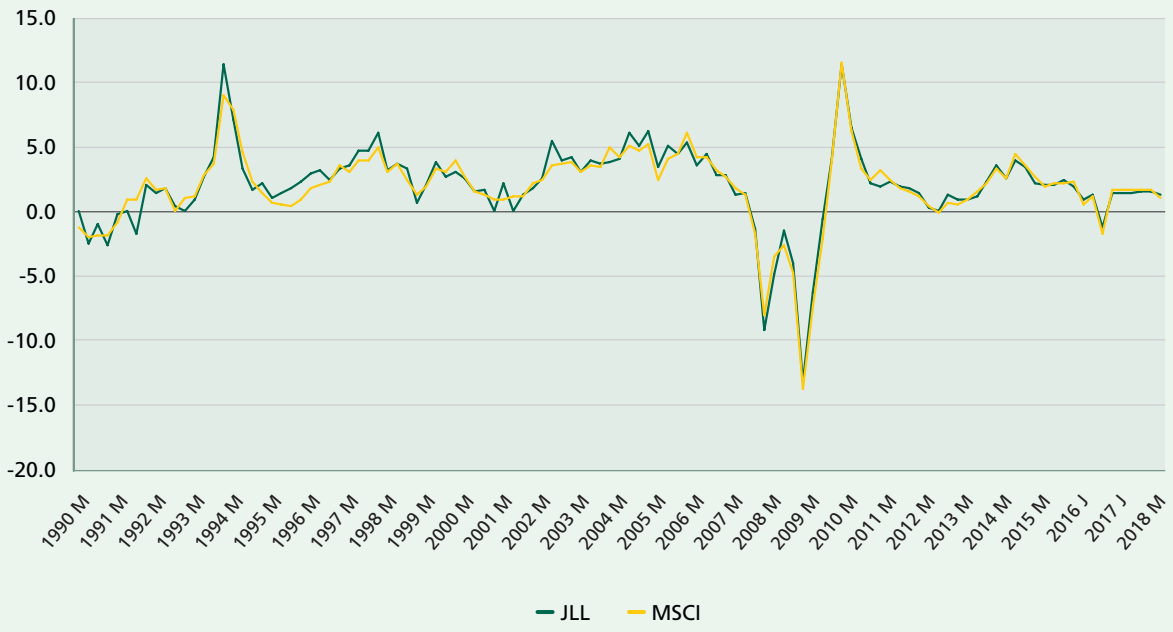
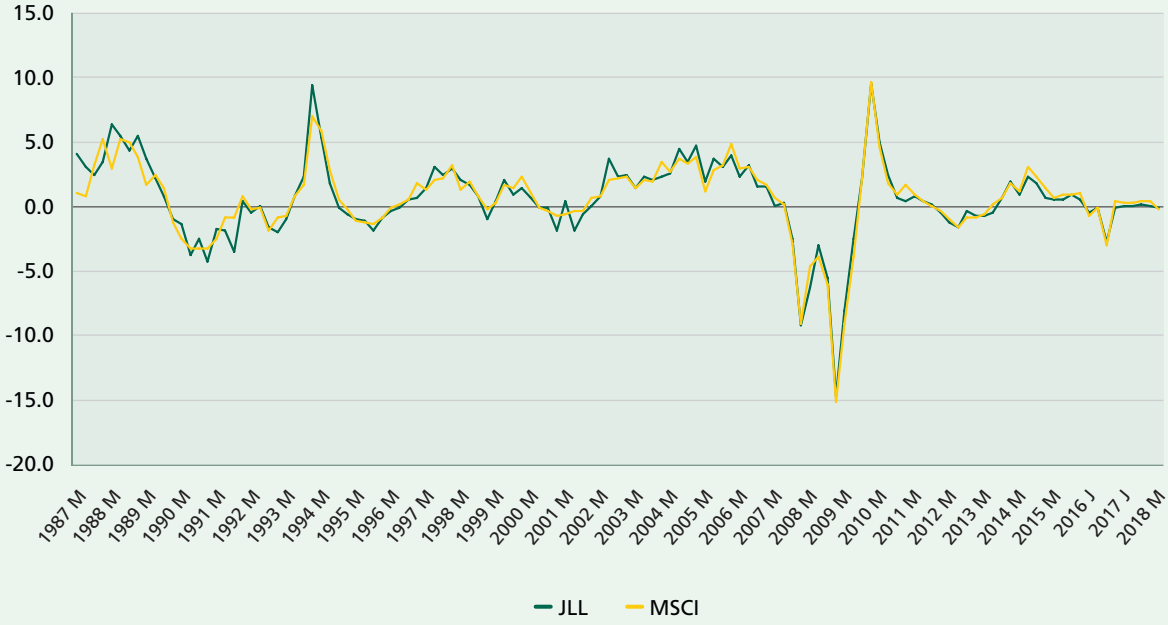


Figure 28: JLL and MSCI Quarterly Retail Rental Growth, 1987-2018

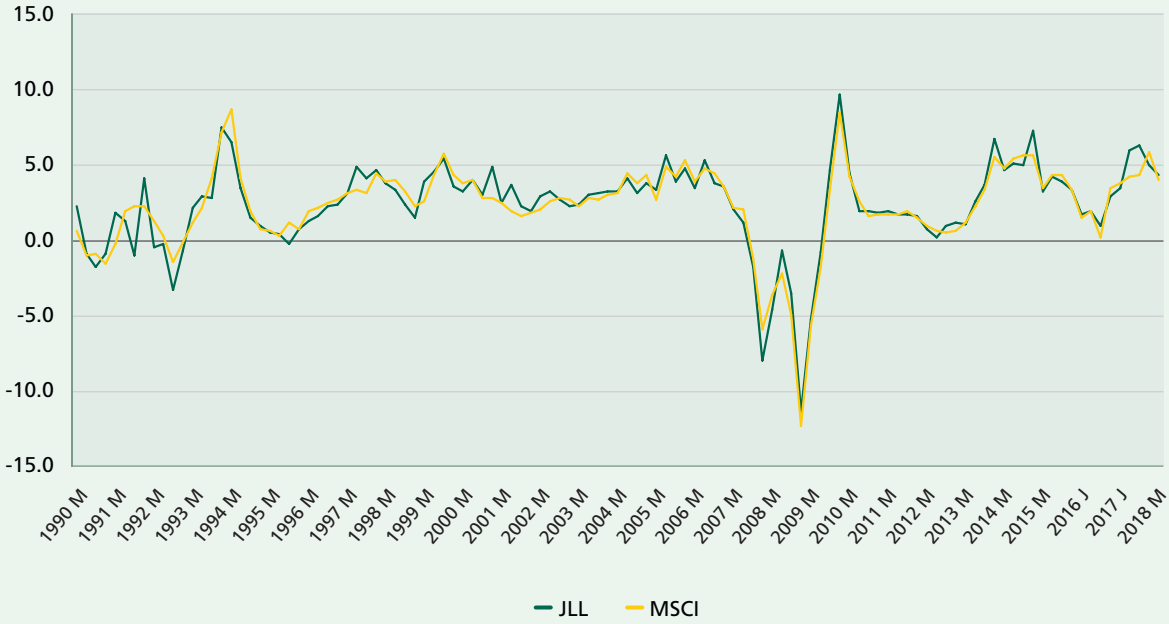
COMPARISON OF PROPERTY MARKET INDICES

Figure 29: JLL and MSCI Quarterly Retail Capital Return, 1987-2018



Industrial

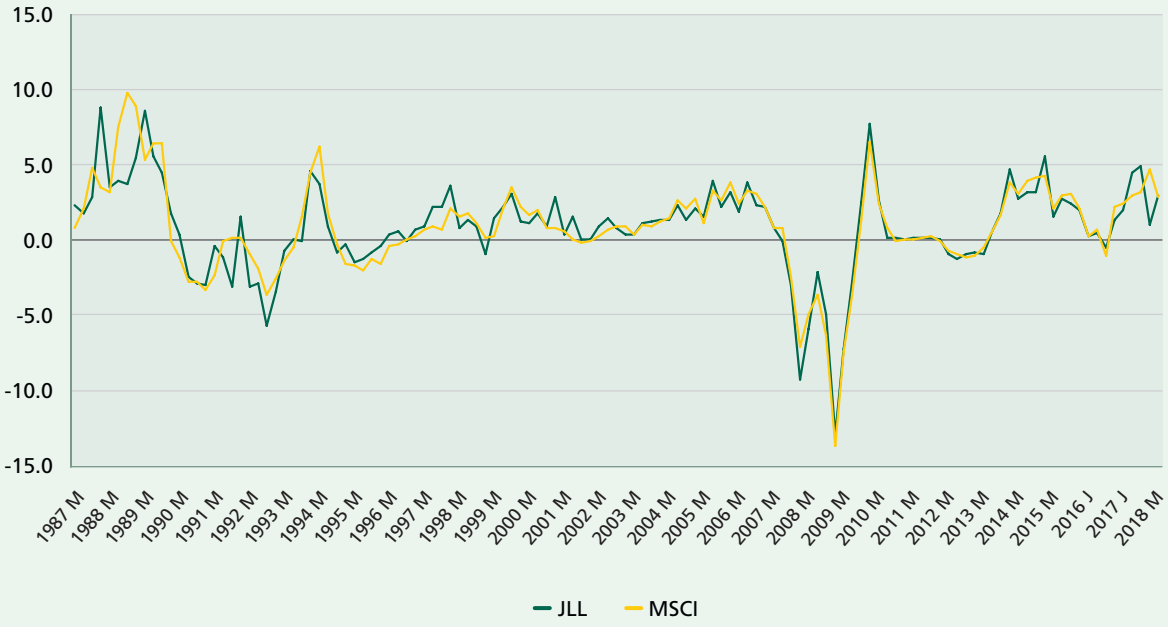
Figure 30: JLL and MSCI Quarterly Office Total Returns, 1990-2018



COMPARISON OF PROPERTY MARKET INDICES

Figure 31: JLL and MSCI Quarterly Industrial Rental Growth, 1987-2018

Figure 32: JLL and MSCI Quarterly Industrial Capital Return, 1987-2018



COMPARISON OF PROPERTY MARKET INDICES

Annex 3: Rental Growth Per Quarter of the Main Sectors within CBRE RYM and MSCI Indices

Figure 33: CBRE RYM/MSCI Quarterly All Property Rental Growth, 1987-2018

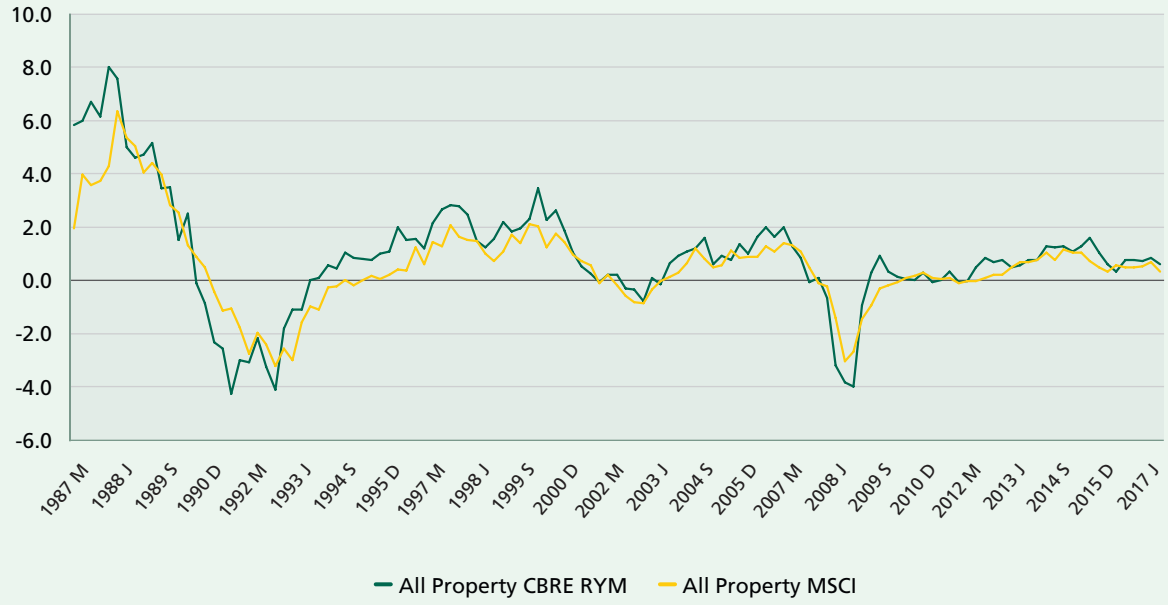
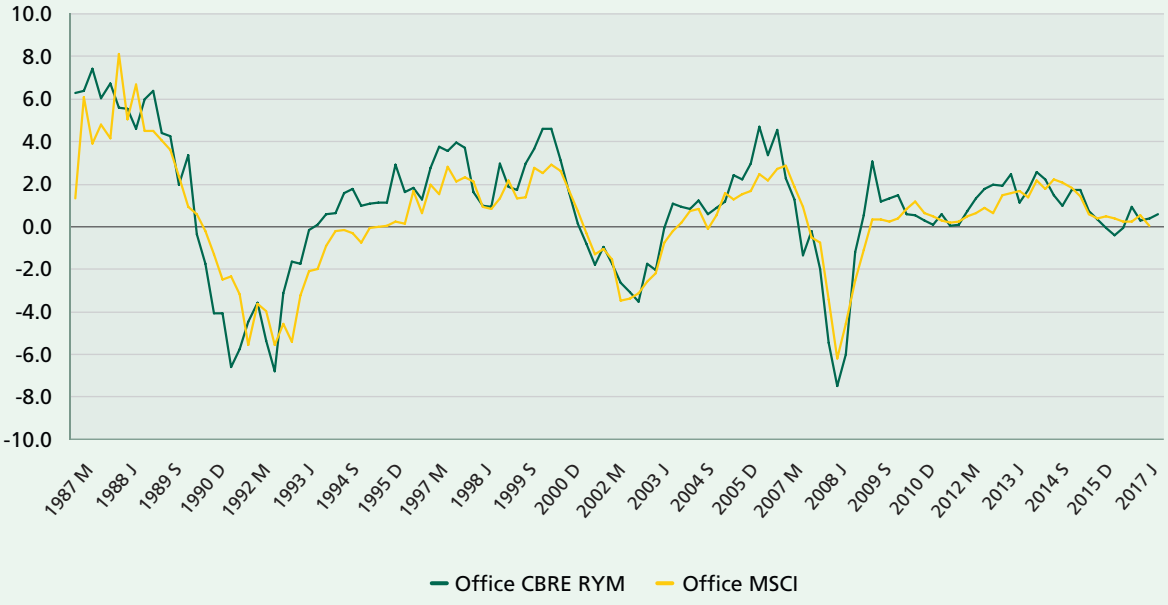


Figure 34: CBRE RYM/MSCI Quarterly Office Rental Growth, 1987-2018



COMPARISON OF PROPERTY MARKET INDICES

Figure 35: CBRE RYM/MSCI Quarterly Retail Rental Growth, 1987-2018

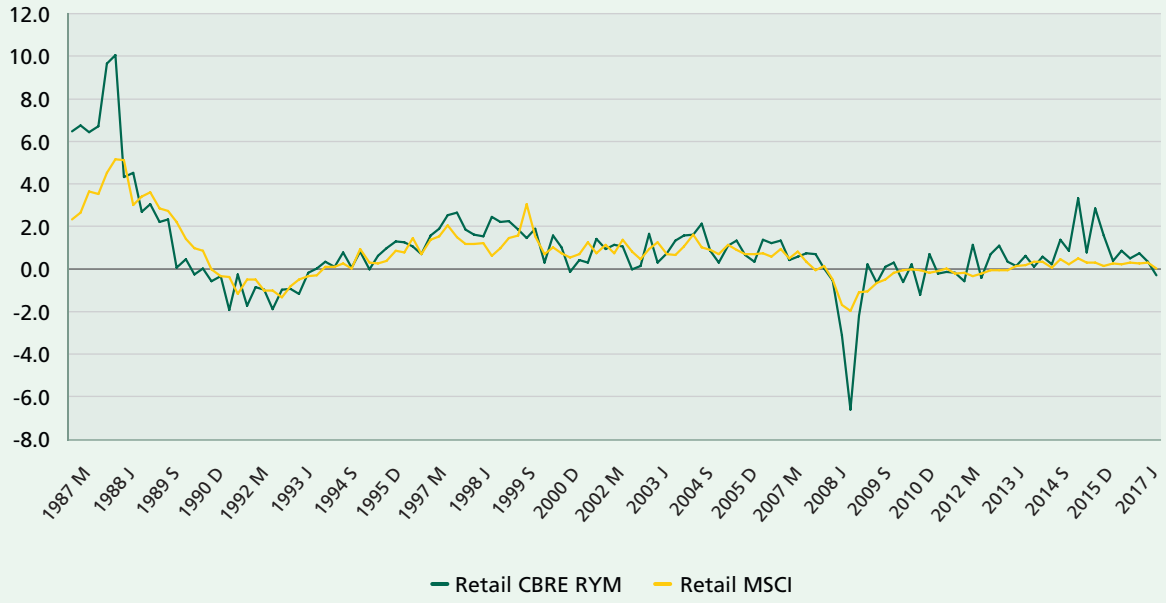
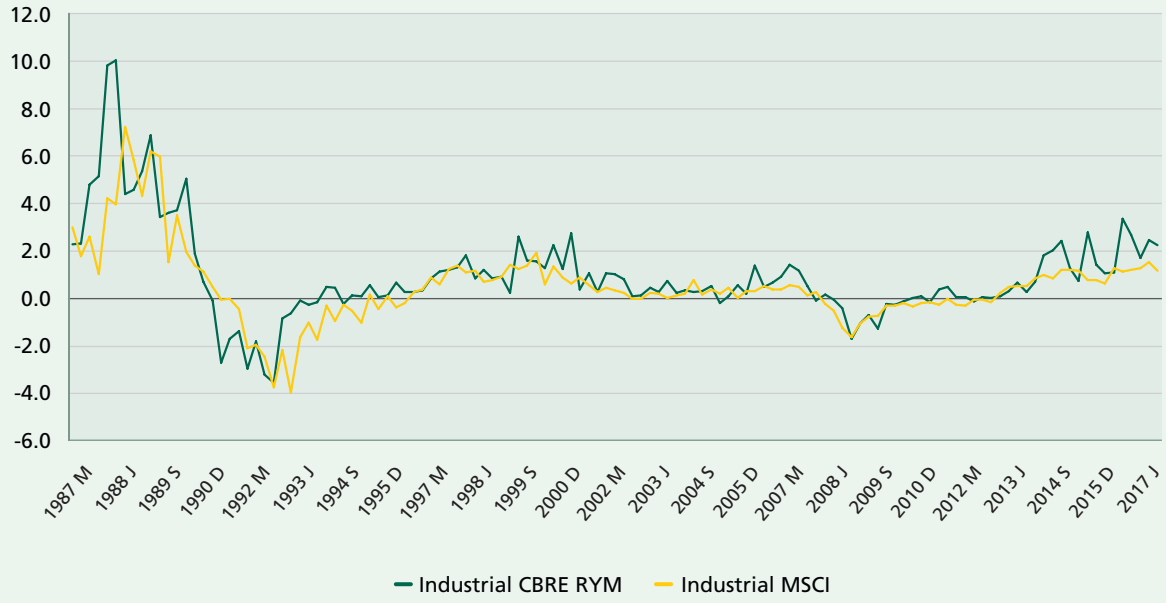


Figure 36: CBRE RYM/MSCI Quarterly Industrial Rental Growth, 1987-2018



COMPARISON OF PROPERTY MARKET INDICES

Annex 4: Capitalisation Rates Per Quarter of the Main Sectors within CBRE RYM and MSCI Indices

Figure 37: CBRE RYM/MSCI Quarterly All Property Yields, 1987-2018

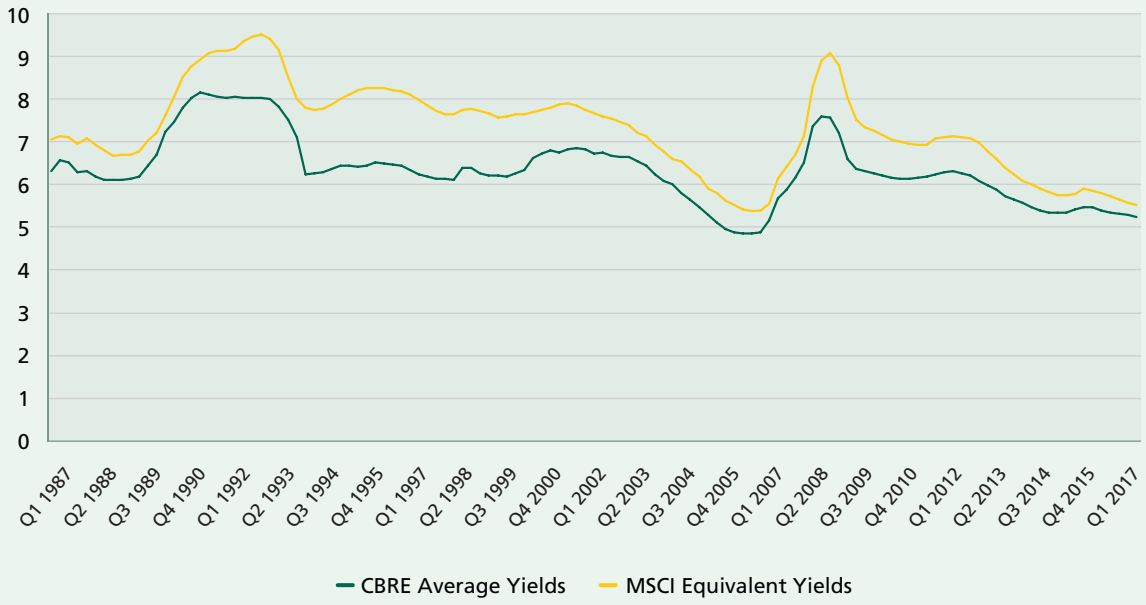
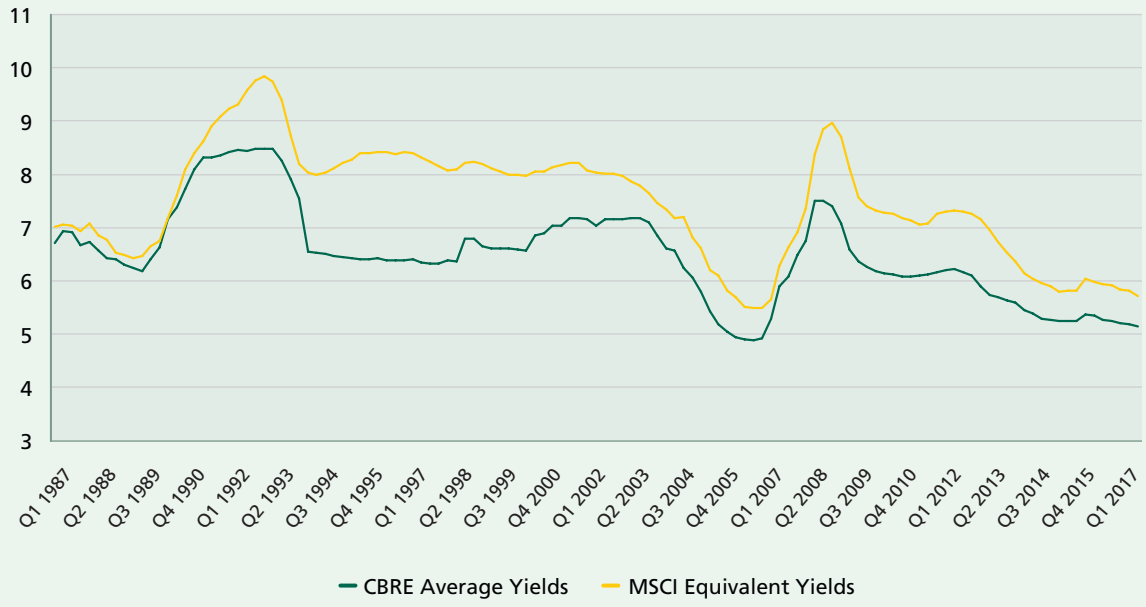


Figure 38: CBRE RYM/MSCI Quarterly Office Yields, 1987-2018



COMPARISON OF PROPERTY MARKET INDICES

Figure 39: CBRE RYM/MSCI Quarterly Retail Yields, 1987-2018

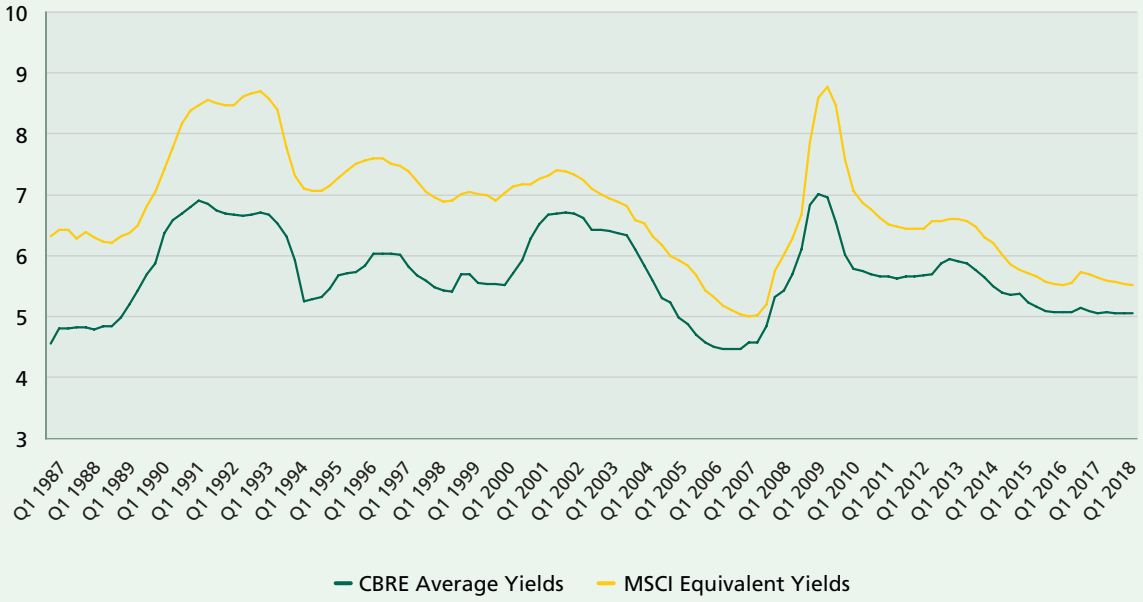
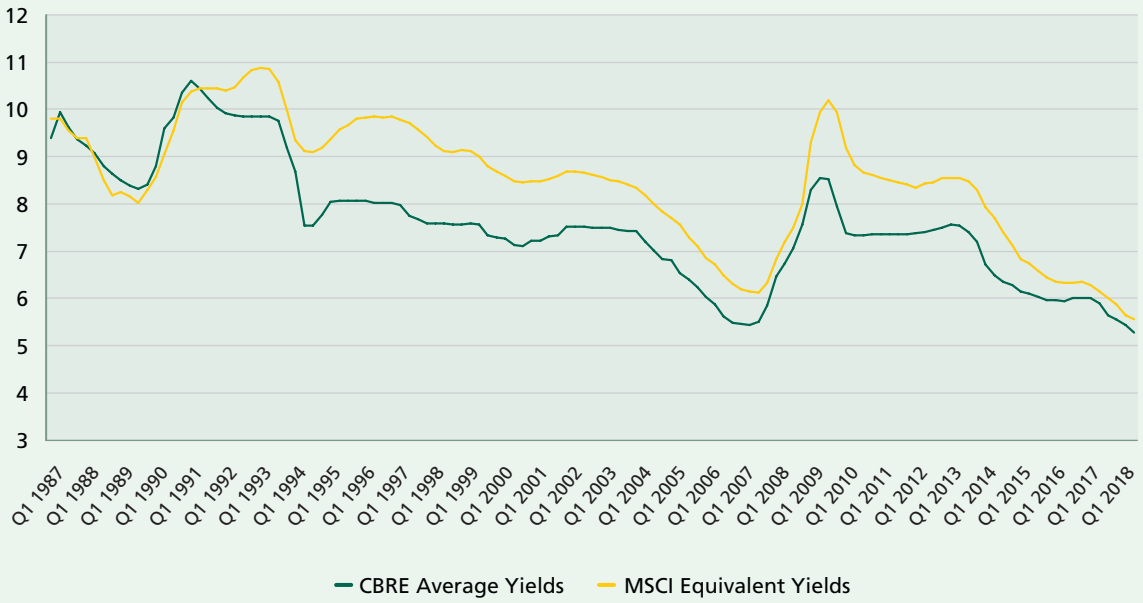


Figure 40: CBRE RYM/MSCI Quarterly Industrial Yields, 1987-2018



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