# *Appraisal-based indices*

**Crosby, N. and Devaney, S. (2019), "Appraisal-based indices", pp.172-191 in MacGregor, B. D., Schulz, R. and Green, R. K. (Eds.), Routledge Companion to Real Estate Investment, Routledge, Abingdon.**

# Chapter 9 - Appraisal-based indices

**Neil Crosby**
*University of Reading, England, UK*
**Steven Devaney**
*University of Reading, England, UK*

## Abstract

The characteristics of real estate markets make it difficult to construct price-based indices of investment performance. Appraisal-based indices have emerged as a substitute and are now produced for real estate investment markets across the world. This chapter reviews the types of appraisal-based indices and the main performance measures that are produced from them. It also reviews evidence on the differences between appraisals and prices, and explores why appraisal indices are perceived to lag and smooth underlying market movements.

## Introduction

The measuring of asset prices through time is well-established in most asset markets. For example, the Dow Jones Industrial Average for the US equity market was established as early as 1896, the FT-30 index for UK equities was started in 1935 and the Nikkei index was first published in Japan in 1950. These indices aggregate the price movements of individual equities as captured by a wealth of transaction evidence for identical shares being traded at any particular point in time. Such price movements are weighted either equally or with reference to the market capitalisation of the constituent firms to produce a market index. Individual equities may also be categorised into industrial sectors, including real estate companies, or in terms of other characteristics to enable sector indices to be produced. Similar price and performance indices are also published for bonds.

There are several major differences between direct real estate investment and exchange traded investments, such as equities and bonds, that make transaction price indices much more difficult to construct. First, there is a limited volume of transactions in real estate markets and they occur at irregular intervals. Second, there is no transparent central market place where details about real estate transactions can be observed, while public depositories of property

ownership and transaction details are not easy to access in many countries. Third, the heterogeneity of each individual property creates difficulties. No single property is identical to any other, with a unique location and unique physical and legal characteristics. Thesecharacteristics create considerable variation in prices and the challenges of controlling for them in the construction of transaction-based indices are set out in the following chapter.

On account of these difficulties, reliable indices of the performance of direct real estate investments were formulated later than in the case of equities and bonds. Their introduction was preceded by significant change and growth in real estate investment markets during the twentieth century in the major developed economies. In the post WW2 period in the UK, ownership of commercial real estate began to move from the hands of owner-occupiers and local entrepreneurs to real estate companies operating at a national level.[1] This trend was followed in the 1960s and 1970s by a rise in the ownership of real estate by financial institutions, such as insurance companies and pension funds (see Scott, 1996). In contrast, UK residential property markets became more dominated by owner-occupation whereas, in other mature economies, such as the USA, investment in residential real estate was, and still is, significantly more important.

With increased ownership by financial institutions, commercial real estate became part of a multi-asset portfolio. As such, the requirement for measuring its performance and comparing it against other assets led to the introduction of real estate investment indices. According to Fisher (2005), the major objectives for introducing such indices are to monitor the risk and return of real estate investments and to understand how their performance compares with that of other asset classes such as equities and bonds. They also facilitate benchmarking of individual assets, funds, locations and types of property against one another and such comparisons are now fundamental in asset allocation and the selection of investments. Given the interest from, and requirements of, large-scale institutional investors, it was perhaps inevitable that real estate indices concentrated on the more significant ownerships with the largest and most modern portfolios comprising what came to be termed institutional grade assets. This categorisation tended to include the larger lot sizes in the more significant locations within large cities, built to high specifications and let to major occupiers on standard institutional lease contracts.

In the UK, attempts to construct real estate price and performance indices started in the 1960s and 1970s. In the absence of centralised records, the development of indices was initiated by a number of private organisations. These organisations were often managing agents that held a significant amount of data on individual properties and markets gathered during their agency and management activities. Some indices were based on actual properties or funds and some on appraisals of hypothetical properties in actual locations. Morrell (1991) lists early initiatives for the UK real estate market and Crosby (1988) gives further details on the composition and construction of early UK market measures. Arguably, a few early initiatives were driven by some organisations deciding that the production of 'market intelligence' supported business development and new client capture. Yet the gains to be made in market transparency and efficiency were not lost on the real estate industry which, in the most mature markets, was becoming more integrated with the financial sector and more international in outlook.

Right from the beginning, the real estate investment industry resorted to appraisals as a substitute for transaction prices in order to overcome the problems with constructing transaction-based indices that were mentioned above. Appraisals were already a regular feature of real estate investment markets for all kinds of purposes including one-off appraisal for acquisition, sale and bank lending decisions and periodic appraisal for investor reporting and financial statements (as discussed in chapter 10). In many cases, the latter could be utilised for performance measurement purposes and in the construction of indices. This approach was formalised in the 1980s in the two highly mature real estate investment markets of the US and the UK. In the US, the National Council of Real Estate Investment Fiduciaries (NCREIF) was established in 1982 and collected data on individual properties to facilitate construction of an appraisal-based real estate return index (see Diehl, 1993). This index was initially produced by the Frank Russell Company on behalf of NCREIF and was known as the FRC index and the RN index before becoming the NCREIF Property Index (NPI). Meanwhile, the Investment Property Databank (IPD) (now part of the MSCI group) started collecting data on properties from UK institutional investors in the early 1980s, and published its first index of investment returns for the UK real estate market in 1985.

As the pioneers of constructing indices that have both significant market coverage and depth in terms of individual property details, MSCI (through their predecessors, IPD) and NCREIF are the two best known providers of real estate investment indices. NCREIF have remained focused on the US real estate market, but IPD expanded its services internationally and is now

part of MSCI. Both organisations share the same basis for their principal indices – appraisals rather than transactions. In both cases, the indices are based on actual property (rather than hypothetical or fund level) information, which is then aggregated to form real estate market measures. It is only in recent years that increasing availability of transaction data coupled with research into index construction using hedonic and repeat sales regression methods has led to the construction of several transaction-based indices for commercial real estate in both the UK and US. Although IPD was taken over by MSCI, many of the indices still carry the IPD name rather than MSCI. However, all IPD indices are now produced by MSCI.

The next section reviews the different types of appraisal-based indices and the key performance measures that are produced from them. Subsequent sections identify the international coverage of such indices and highlight the issues surrounding the use of appraisals to measure real estate performance.

## Types of appraisal indices and key performance measures

### *Different types*

Appraisal based indices fall into three major categories:

- Whole Fund Indices – constructed from fund performance data and using aggregated, portfolio-level cash flows and values rather than data on individual properties held by those funds. In the UK, a number of early real estate indices adopted this approach.[2]
- Individual Properties – indicators constructed from cash flows and values of individual property investments that are aggregated into various sector, location and/or regional series and, ultimately, into a national 'all property' series. This is the approach adopted by MSCI and NCREIF.
- Individual Locations – indicators constructed from the appraisal of hypothetical properties in selected locations rather than actual properties. Many market barometers released by real estate service providers are produced on this basis. The widest coverage comes from international consulting firms such as CBRE, Jones Lang LaSalle and Cushman & Wakefield, but indicators for national or local markets are also often produced by more local organisations in each country.

This chapter focuses on indices formed from individual property rather than fund data as the former now dominate real estate investment markets. However, market barometers for individual locations, as distinct from assets, are an important source of information for market participants. For example, where the objective is to compare the movement in values in one location against another, these can be more useful indicators than the performance of actual buildings. The barometers are produced by real estate service firms based on knowledge gained from their agency and other activities. Changes in value are identified based on appraisals of either a hypothetical new property or the best property in that location. They are simple to construct and tend to focus on two measures: rental value and yield/capitalisation rate. They require some assumptions to be made concerning the location (often prime, but not always) and the building in that location (in regard to specification and lease terms) but, as occupier requirements change over time, the specific location and the assumed building specification may also change.

*Measures*

The three main performance measures are income return, capital return and total return. These can be measured in two basic ways: as money-weighted rates of return or time-weighted rates of return. Money-weighted rates of return are basically the internal rate of return of the cash flows and take account of the amount of money that is invested in each period. When calculated across several periods, the times at which money was invested or withdrawn will affect the outcome. In contrast, a time-weighted rate of return is based on a succession of return rates measured for individual periods that are then compounded to establish performance over multiple periods. By doing this, the impact of any injections or withdrawals of capital between periods is neutralised. This is useful when trying to understand the performance of a market versus that of an individual investor.[3]

However, in real estate performance measurement, the shortest periods over which return rates are measured are often a month or a quarter. Therefore, assumptions must be made about the timing of receipts or payments such as rent or capital expenditure that occur within each period. For example, the standard measurement period for returns in the MSCI series is one month and the formulas used make assumptions as to when cash flows occur within each month and so are approximations of the internal rate of return over those intervals (see Bacon, 2008). When

annual or quarterly return rates are reported, though, they can be regarded as time-weighted returns, as each contributory monthly return rate is given equal importance in determining the outcome.

NCREIF adopts a similar approach whereby the measurement period is quarterly and the formulas make assumptions about the timing of cash flows within those quarters. The quarterly return rates are then chain-linked to form indices that span longer periods.

The formulas used by MSCI to calculate income, capital and total return for real estate investments are presented below as they produce performance indices in the most countries and these indices are compliant with Global Investment Performance Standards (GIPS) (see MSCI, 2017a). MSCI provides contributors with definitions for the inputs so that investors are aware of what constitutes, say, net income or capital expenditure when they supply the data. Standardised approaches and definitions are necessary so that index results can be compared across markets. Starting with income return, this is calculated by MSCI as net income divided by capital employed over the period.[4] The formula is as follows:

$$IR_t = \left( \frac{NI_t}{CV_{t-1} + CX_t} \right) \times 100 \qquad (9.1)$$

Where $IR_t$ is the income return in period t, $NI_t$ is the rent receivable net of ground rent and other irrecoverable expenditure during period t, $CV_{t-1}$ is the capital value at the end of the prior period, and $CX_t$ is the capital expenditure in period t.

Capital return is calculated as the change in capital value, less any capital expenditure incurred, expressed as a percentage of capital employed over the period. The formula is:

$$CR_t = \left( \frac{CV_t - CV_{t-1} - CX_t + RC_t}{CV_{t-1} + CX_t} \right) \times 100 \qquad (9.2)$$

Where $CR_t$ is the capital return in period t and $RC_t$ equals any capital receipts in period t, while other terms are as previously defined.

Finally, total return is calculated as the change in capital value, less any capital expenditure incurred, plus net income and any capital receipts, expressed as a percentage of the capital employed over the period. The formula is:

$$TR_t = \left( \frac{CV_t - CV_{t-1} - CX_t + RC_t + NI_t}{CV_{t-1} + CX_t} \right) \times 100 \qquad (9.3)$$

Where $TR_t$ is the total return in period t and other terms are as previously defined. Hence, in each month, total return is simply the addition of income return and capital return. Indices that span longer intervals can be computed by chain-linking the monthly return rates; multiplying an arbitrary base value at $t_0$ by $(1 + r_1)$, that is, one plus the first period return rate, to produce an index value for $t_1$, and so on.

Although the calculation frequency is monthly, this does not mean that appraisals are available for each month or that index numbers and return rates are published at this frequency. In practice, the frequency of appraisals differs between investors and across markets. For example, open-ended funds may commission monthly appraisals to assist with unit pricing, but other types of investors may only obtain annual appraisals of their real estate assets. This means that in order to implement a standard calculation interval, MSCI and other index providers have adopted interpolation techniques to generate intermediate appraisal inputs. The techniques include linear interpolation between two genuine appraisals, shaped interpolation with reference to other performance data or holding over the previous appraisal value until a new appraisal is supplied, the latter approach having been used by NCREIF.

When measuring portfolio or market performance, the principle of value-weighting is applied such that the components of each formula become summations of income, values, expenditure and so on across the set of properties being examined. The outcome is that changes in income or value affecting the most valuable assets have the most influence on reported return rates. This is logical for reporting portfolio performance and it has become established practice for reporting market-level performance as well.

The sample of assets used to measure market or segment return rates is held constant in each month. Thus, return rates will relate to an aging set of buildings. Between months, the sample

is refreshed so that subsequent periods include newly purchased assets and exclude assets that have been sold. So the pool of properties on which the index is based should not age or decline in quality in the long run if sold assets are replaced by newer and better quality ones. The measures for each interval will relate to a depreciating portfolio, but the effects of depreciation will differ from those that a static portfolio would experience. Whether this means a higher or lower depreciation rate for the changing sample against a static one depends on the profile of depreciation. Recent research suggests that new properties have higher depreciation rates than older ones (Bokhari and Geltner, 2016; Crosby *et al.*, 2016). In that case, a refreshed sample could experience more depreciation than a static sample. This might seem counter-intuitive, but an old asset getting one period older may lose less value in relative terms than a new asset getting one period older.

There are two issues relating to income and capital return. First, the linking of income return rates into an index seems to be a widespread practice for real estate, but not for tracking the performance of other assets. Both MSCI and NCREIF publish income return indices and this practice is now recognised in Global Investment Performance Standards (CFA Institute, 2010). An income return index can be used to work out the relative contribution of income to total return over longer horizons. However, such indices might be construed as measures of income *change* by uninformed users, so MSCI and NCREIF also report indices of income change that do measure how much income rises or falls relative to the previous period.

The second issue is how capital expenditure is treated. There has been some debate as to whether it should be treated as a deduction from income rather than from value when measuring real estate investment performance (Young *et al.*, 1995; Young, 2005). Both MSCI and NCREIF deduct capital expenditure from capital value change in the numerator of the capital return formula.[5] This helps to isolate the element of capital return that is attributable to market movements rather than capital injections. Yet, arguably, it 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. The approach taken has no effect on total return, but it has a major impact on both capital and income return rates, so this issue concerns the reporting of how investment returns are delivered.

In addition to the measures presented above, some other measures are produced to quantify and explain real estate investment performance. These include rental value indices and measures

of yield/capitalisation rate for the assets being monitored. Rental value indices, where published, use appraisal-based assessments of the Market Rent for each property rather than the actual income received by investors from period to period.[6] Meanwhile, some form of yield or capitalisation rate series is reported for all markets. Initial yield is the simplest measure and this is current income as a proportion of current capital value, analogous to the dividend yield reported in equity markets. However, given differing market conventions, it has proved difficult to obtain even a consistent initial yield measure across all national markets. Differences can arise from how income is defined and from how transaction costs are dealt with in different markets. Both rental value indices and yields can be affected by the rent determination process and whether a headline rent with rent-free periods or an effective rent is used as the input to its calculation.

Both MSCI and NCREIF adopt some further conventions when producing segment or market indices. First, the indices only utilise 'standing investments', that is, properties that have not been traded and which are not undergoing development or major refurbishment over the measurement interval. In contrast, all properties are included when benchmarking fund performance so that the impact of trading or management decisions on returns can be monitored. Second, the indices do not reflect the effects of any leverage. Finally, fund-level management fees are not incorporated into the return calculations. However, some indices do incorporate the impact of leverage and fund management fees, such as the AREF/IPD UK Quarterly Property Fund Index. This is relevant to investors that use funds to access the real estate market rather than investing directly.

Further technical details relating to the different indices and measures are set out in the published technical guides released by each index provider (see MSCI, 2017a; NCREIF, 2016).

**Global coverage**

Real estate market indices and performance measurement now extend across many parts of the globe. The main provider of real estate investment indices is MSCI, which operated in 32 countries across five continents in 2016. In 25 of those countries, the data collected are deemed to be sufficiently developed to contribute to the construction of a global real estate index. These countries are listed in Table 9.1. MSCI also monitors real estate investment markets in several Asian countries, including China, for which indices were not published at the time of writing

(see Table 9.2). MSCI only releases one index for countries in Africa and none for countries in South America, reflecting historical patterns of economic development, investment activity and real estate market maturity. Not all of the national indices listed in Table 9.1 were initiated by either MSCI or their predecessors, IPD. For example, the Australia index was initially developed by the Property Council of Australia, while the index for Finland continues to be produced by KTI, but within the MSCI technical guidelines.

*Insert Table 9.1 and Table 9.2*

As can be seen from Tables 9.1 and 9.2, coverage of each national market varies widely. This coverage is assessed in relation to the estimated total value of real estate held in professionally managed investment portfolios (see Teuben *et al*., 2017) and not against the value of the total property stock, estimates of which are often unavailable. In Australia, New Zealand and South Africa, MSCI estimates its coverage at over 50% of the professional investment market, but in Germany and the US, it estimates coverage to be below 20%, while in Japan it is just over 20%. Nonetheless, the MSCI US index comprised over 5,700 properties worth over $350 billion as at end 2016. However, the NCREIF Property Index had a greater coverage of the US market, measuring over 7,500 assets worth more than $550 billion at the end of 2017.

Coverage of each market varies because private indices rely on investors choosing to contribute data and participate in the index and any associated benchmarking service. This is more likely to occur in larger, more mature markets where large-scale professional investors are present. Within each national market, the coverage of individual property types and locations will also vary. With institutional investors typically being the main contributors, the makeup of any index will reflect their investment preferences, which are likely to be higher value assets in prime locations within major cities – often office buildings and large retail malls.[7] Secondary locations and assets, or more unusual properties and property types are less likely to be included. Yet the MSCI indices are not simply prime property indices since the contributing investors typically have some older properties and some inferior locations in their portfolios. In some instances, these may have been the prime assets of an earlier period that have not yet been sold and have suffered depreciation over time.

The MSCI indices have varying histories, ranging from a start date of December 1980 for the main UK Annual Index to a start date in the mid-2000s for several markets, including Belgium,

Poland and South Korea. In most cases, the index histories are unfrozen, which means that the addition of new investors to the MSCI services can cause revisions to results for earlier years. However, in some markets, such as France and the UK, the indices have been frozen to preserve historically published figures, even if new contributors can supply additional older data. There are also varying frequencies, with some markets, such as the UK and Ireland, able to support quarterly as well as annual indices (and even a monthly index in the UK case).

MSCI has combined data from different countries to produce a global index for annual real estate investment returns since 2006. This is despite a number of technical challenges including varying start dates for different national indices, varying coverage within each market and the different currencies that are involved. A discussion of these challenges is provided by Cullen (2010). At the end of 2016, the Global index was based on 61,800 properties worth over $1,470 billion from the 25 countries listed in Table 9.1, and provided a time series stretching back to end-2000 (MSCI, 2017b). Meanwhile, for the seven Asian countries not included in the Global Index, MSCI monitor properties worth $127 billion as at the end of 2016. Together with South Korea and Japan, this gives a Pan-Asia measurement portfolio of c. $300 billion of real estate at end 2016.

Latin America has no MSCI indices. JLL (2016, p42) notes that "very low transparency" in regard to performance measurement and data on market fundamentals is "continuing to pose the greatest challenges for most countries throughout Latin America and the Caribbean". Brazil is an exception, with the IGMI-C index having been created by FGV and launched in 2011.[8] This index measures income, capital and total returns using the same basic approach as the MSCI indices discussed above. At its launch, the IGMI-C is reported to have consisted of 190 individual properties of which 50% were offices. In the third quarter of 2017, it was based on 529 properties with a quarterly index history dating back to Q1 2000. The quarterly publications do not reveal how the composition has developed; the sample of buildings initially increased, but, since 2014, has declined from 580 to 529.

Finally, in addition to Japan being included in the MSCI Global Index, the Association for Real Estate Securitization (ARES) in Japan publishes the Japan Property Index (AJPI) using income-producing office, retail and residential assets situated in several core markets: Tokyo, Nagoya, Osaka and Fukuoka.[9] The main index began in 2002, based on data for 24 properties owned by one fund, but had grown to 3,880 properties within 94 funds by the middle of 2017.

The indices are based on methods used by NCREIF and they provide income, capital and total returns at monthly, quarterly and annual frequency, while data such as occupancy rates, rents and capitalisation rates are also reported for the locations listed above.

**Issues with appraisal-based indices**

There are a number of issues with appraisal-based indices of real estate performance, many of which relate to the use of appraisals as a substitute for transaction prices. The reasons why appraisal-based indices dominate real estate performance measurement were discussed at the start of this chapter and their creation enabled more thorough investment analysis of real estate markets to take place. However, such analysis must be undertaken with full awareness of the limitations of these series and their inputs.

The appraisal process was discussed in a previous chapter. The basis of appraisal for performance measurement purposes is Market Value. Market Value is defined as an exchange price concept and is an attempt to identify the price of the asset at the date of appraisal in the absence of an actual sale. Although there is little dispute concerning the definition, there can be subtle differences in its interpretation by appraisers across countries. These differences stem from the variations in market circumstances and professional practices in different parts of the world. Some real estate markets are highly liquid and transparent, but others are illiquid and opaque, and this contributes to the ease or otherwise of estimating values in those places. Nonetheless, appraisal theory, practice and legal precedent suggest a preferred method of market valuation: comparison with transaction prices for other, similar properties where a transaction of the actual property has not occurred (see Chapter 10).

Appraisers search for evidence of transaction prices and that evidence may be sparse and imperfect. This means that appraisers must exercise judgement about the relationship of those price signals to the property in question. In doing so, appraisers may make errors in their estimate of Market Value. Given the quality of the available evidence and the difficulty of the task, such errors are unsurprising and do not necessarily imply a lack of competence. However, academic research has highlighted the potential for bias in the estimation of values with the result that appraisals might systematically lag and/or understate market price movements. Explanations for such bias are reviewed below and fall into rational, behavioural and institutional explanations, the latter encompassing the legal and client context in which

appraisals are provided. Such issues are not confined to performance measurement appraisals, but the sub sections below review the production, accuracy and veracity of appraisals in this particular setting.

*Appraisal accuracy, variation and bias*

The uncertainty surrounding appraisals is now firmly recognised in appraisal standards.[10] There has never been an expectation of complete accuracy but there is an expectation that appraisers will produce a solution and that it will be within certain parameters. These parameters have been discussed by courts in appraisal negligence cases (see Crosby, 2000) and have been tested in studies where sale prices of assets have been compared to prior appraisals (accuracy) or where estimates of value by one appraiser have been compared to appraisals of the same property by another appraiser (variation). Most empirical studies have examined the commercial real estate markets of the UK, US and Australia. Crosby (2000) reviews studies for these markets undertaken in the 1990s. Since then, fewer studies have explored these markets, but work on appraisal accuracy has been done for other parts of Europe (see, for example, Hordijk, 2005) and for Africa (Adegoke, 2016).

The most recent US study by Cannon and Cole (2011) analysed over 7,000 apartment, retail, office and industrial real estate investments that were sold from portfolios in the US NCREIF database over the period 1984 to 2010. They measure both the percentage difference and absolute percentage difference between prices and preceding appraisals, controlling for market movements and capital expenditure between the sale and prior appraisal date. The average absolute percentage difference across the period was 12.5%, while the average percentage difference, where positive and negative differences can cancel each other out, indicated that prices were 3.9% higher than appraisals. However, the latter figure, in particular, hides the impact of market state and the authors reported that differences were more positive when markets were appreciating, while in 2008 to 2009 (a declining market), the differences were negative, with appraisals above sale prices. Thus, they concluded that appraised values were biased estimates of sale prices and the direction of that bias changes in up and down markets.

IPD, in conjunction first with Drivers Jonas (now part of Deloitte) and then the RICS, carried out a series of similar studies for the UK, starting in the 1990s. This exercise was subsequently extended to France, Germany and the Netherlands and, recently, extended again by MSCI to

12 countries where it has a long index history (Reid, 2017). These countries are Australia, Canada, France, Germany, Italy, Japan, Netherlands, South Africa, Sweden, Switzerland, UK and the US. Tables 9.3 and 9.4 set out the average absolute percentage difference and the average percentage difference between prices and prior appraisals for those countries over the seventeen years from 2000 to 2016. As in the case of Cannon and Cole (2011), market movements between the sale date and appraisal date are controlled for, but the averages are weighted so that differences for more valuable assets have more influence on the results. Another difference is that in Cannon and Cole (2011) the denominator in the calculation of percentage difference is the preceding appraisal whereas in the IPD and MSCI studies, it is the price.[11]

*Insert Table 9.3 and Table 9.4*

The shape exhibited by the average percentage difference over time in most countries is similar to that suggested in Cannon & Cole (2011). Nine out of eleven countries exhibit increasing absolute variation in the period 2004 to 2007, but, during the global downturn in 2008, only the US, UK and Sweden have a negative average difference (with appraisals higher than prices). Investors in the other nine countries still sold assets at more than appraised values, on average. However, by 2009, Germany, Japan, the Netherlands, Canada and Australia all exhibited negative differences as well.

There are issues with these studies as a test of appraisal accuracy. One issue is that observed prices may be noisy signals of any true market price given the private and decentralised markets in which real estate transactions take place. Another issue is that the sample of assets that is transacted may not be a representative sample. Finally, there is little work on the role of appraisals in selecting assets for sale and whether appraisals and sale prices are truly independent of one another. It may be that an appraisal figure is instrumental in the decision to market and sell a particular asset and crucial to the price that can be accepted for that asset. For example, in normal circumstances, German open-ended funds are prohibited from selling assets at amounts more than a few percentage points below the prior appraisal.[12] However, investment committees may consider the relationship of price to prior appraisal as a factor even where no formal rules exist.

Despite this, these results have potentially important implications for appraisal-based indices. Errors will affect the reliability of appraisal-based indices as measures of market conditions and investment performance. Yet the impact of individual errors should be diversified at index level provided that the index is based on a large sample of assets and that any inaccuracy in appraisals is random rather than systematic. In this respect, it is of some concern that the average percentage difference is non-zero and that the size and direction of this difference varies with market state. Possible explanations for these observed biases are explored next.

*Anchoring, smoothing and lagging*

A large literature over the last three decades has emerged on the reliability of appraisal-based indices. While some of this literature refers to the appraisal accuracy debate, other research is founded on the statistical attributes of appraisal-based indices and their perceived smoothness relative to other indicators or practical experience of market conditions. It has been argued that movements in appraisal-based indices both understate and lag movements in prices.[13] If true, this creates problems when such indices are used to measure the volatility of real estate investment returns and the covariance of such returns with those of other asset classes. It also makes multi-asset portfolio managers more conservative towards real estate as an asset class owing to the uncertainty around the veracity of the performance measures (Fisher and Geltner, 2000).

Geltner (1993), among others, identifies two sets of factors that may explain the smoothness and lagging associated with appraisal-based indices. One set of factors surrounds the production of individual appraisals and how appraisers behave. The other set concerns how appraisals are then aggregated to form an index. Taking the production of individual appraisals first, it is argued that appraisers anchor on past appraisals or past price evidence rather than just using contemporaneous information to estimate values. In a context of uncertainty, where there is only a limited pool of recent price information, Quan and Quigley (1991) argue that such behaviour is rational as the appraiser seeks to minimise the amount of error in relation to each individual appraisal. They represent this behaviour using the following mathematical expression:

$$V_t = \alpha V^*_t + (1 - \alpha) V_{t-1} \qquad (9.4)$$

Where V equals the appraised value as at time t or t-1, V* equals the contemporary indicator of market value and α is a parameter that captures the degree of weight that the appraiser puts on contemporary information.

Although this may be rational behaviour in the production of an individual appraisal, it does cause problems when appraisals are used to form aggregate performance measures. A random error that is significant in the context of a single asset is not important at index level provided there is a large sample of other buildings across which the effects of individual errors can be reduced. In contrast, a small systematic bias may be less significant for an individual appraisal, but impossible to eradicate from an index because that same error occurs in other appraisals as well. Yet, while this is a widely accepted argument, some studies dispute whether this behaviour at a disaggregate level necessarily produces smoothing at an aggregate level.[14]

The Quan and Quigley model has been used and extended in subsequent research that has sought to reverse the effects of appraiser behaviour on aggregate level indices, a process that has been called unsmoothing or desmoothing. A key issue is how to parametrise α accurately. Geltner *et al.* (2003) review early studies in this area, many of which assumed a value for α that would facilitate removal of all autocorrelation from the adjusted series. This is consistent with ideas on how prices behave in markets with full informational efficiency. Later studies relax this assumption. They also note that results from research in the US and UK show the standard deviation of return rates from an adjusted series to be anything from 1.5 to 5 times higher than that exhibited by return rates from the original index. Such findings are contingent on time period and methods used, as well as the frequency of the appraisal-based index: those using monthly or quarterly appraisals appear to exhibit more smoothing than those based on annual appraisals.

One issue is that the degree of smoothing may depend on market conditions and the amount of transaction evidence available to appraisers.[15] Geltner *et al.* (2003) suggest that anchoring on past appraisals is greater in less liquid markets (where liquidity is defined as the amount of transaction activity), but the accuracy studies show that the gap between prices and appraisals increases in booms where transaction activity is often greatest. This suggests that the speed and scale of price changes might have an influence as well. In a boom, new information might not be incorporated into appraisals quickly enough for them to keep pace with rapidly rising prices. This would mean that, when prices start to fall, appraisals 'catch up' with price levels,

with over-valuation only occurring if a downturn is particularly steep and prolonged. In a downturn, any propensity to anchor on prior appraisals might then increase owing to the lack of transactions taking place. This is consistent with the patterns shown in Tables 9.3 and 9.4.

However, there is surprisingly little empirical work on the existence and nature of smoothing that refers directly to individual appraisal data. One exception is provided by Clayton *et al.* (2001) who studied 202 individual appraisals for a sample of 33 real estate investments and tested how much weight was placed on previous appraisals versus price evidence for comparable assets. Another exception is Bond *et al.* (2012) who examined a larger sample of 2394 individual asset returns from the IPD UK Monthly Index. The findings of Bond *et al.* (2012), in particular, suggest that the smoothing in individual appraisals is not as great as has been implied from analysis of index-level data which they suggest could reflect that previous papers had too simple a model of the return generating process for real estate assets.

Another explanation for this may lie in how appraisals are aggregated to create indices. For instance, US research identified a 'stale appraisal' problem in relation to the NCREIF NPI.[16] Here, a quarterly index was developed based on a sample of properties where some were valued less frequently than quarterly. To retain these assets in the sample, values for the intervening quarters were populated with the figure from the last appraisal. This practice reduces the information content of the series, as movements in value are dampened by the group of assets whose values do not move. In the case of MSCI indices, this is why the reporting frequencies vary across countries, as these are tied to the frequency with which appraisals are conducted. Yet, even if all properties were revalued each period, some temporal aggregation can arise because it is not logistically practical to conduct all appraisals on a single date such as a calendar year-end; instead, they will be conducted over the days and weeks leading up to that date.[17]

Aside from rational concerns to minimise inaccuracy, appraisers may be influenced by behavioural and institutional factors. Diaz and Wolverton (1998) conduct experimental research in which results suggested a tendency by appraisers to anchor on their own previous assessments of value. Clayton *et al.* (2001) found that anchoring was greater when a property was appraised previously by the same appraiser and suggest that rotation of appraisers might be necessary to reduce this. More generally, appraisers may be influenced by criticisms, usually voiced in the aftermath of a property crash, of over-valuation. For example, in the UK,

appraisers have been sued or threatened with court proceedings by banks for appraisals produced in previous boom markets. As under-valuation has rarely been contested, this is a further reason why appraisers might be expected to err towards under- rather than over-valuation (Crosby, 2000).

*Client Influence on appraisals*

Appraisal accuracy can be also compromised by undue client or other stakeholder influence on the outcome. Principal/agent issues arise when the objectives of the principal and their agent are not aligned or when there are incentives for both principal and agent to act unprofessionally. Baum *et al.* (2000) identified opportunities for UK investors to compromise the objectivity of appraisals, such as in draft valuation meetings. For the client, motives to do this include a performance bonus culture, which prevails in the asset management business, links between portfolio values and banking covenants, or the impact of performance on company share prices or unit prices of open-ended funds. Appraisals can also be used by managers to support particular asset management decisions, such as disposals from the portfolio. For the appraiser, repeat business could be jeopardised by a reluctance to move appraisals in line with client motivations.

The client influence literature includes studies that relate directly to performance measurement and indices (for example, Levy and Schuck, 2005; Crosby *et al.*, 2018). Many appraisal-based indices are constructed from assets in very different types of ownership; for example, pension funds, insurance companies, REITs, open-ended funds and closed-end funds. These different owner groups can have different motivations. For example, in many countries, Property Company and REIT appraisals are also used for financial statements and can have a direct impact on the share price. Thus, the firm may have an interest in keeping appraisals as high as possible to underpin the share price. However, other types of owner may want appraisals to fall. For example, open-ended funds may want appraisals to fall by as much as possible in a downturn to prevent a run on funds where unit-holders think that the appraisals overstate true values. Fund managers may also have reasons to influence appraisals. For example, a new fund manager may want a low starting value and then subsequently influence appraisals upwards to maximise performance (Baum *at al.*, 2000).

Crosby *et al.* (2018) examined individual property returns from the IPD UK Quarterly Index to see how values changed during the global financial crisis and to identify whether type of owner had an impact on that performance. After controlling for property type and other attributes, they found differences between the returns of properties held by open-ended and unit-linked funds and the returns of other types of owner such as REITs. However, such effects were temporary and did not persist throughout the downturn. Hence, although clients may influence appraisals in a particular direction in the short-term, there are limits to the process because the appraisal from one period becomes the starting point for calculating returns in the next period. Continued pressure in a given direction would eventually make performance and values unrealistic, even allowing for the inherent uncertainty around appraisals.

*Basis of valuation interpretation*

Over the past 50 years, there has been substantial movement towards consistent valuations across the world and definitions have been standardised through the work of the International Valuation Standards Council. However, how valuers interpret these standards and definitions is more difficult to standardise. For example, Market Value is an exchange price concept, but appraisers in some parts of the world may seek to identify the 'best' price that could be achieved while others may attempt to identify an average price or, alternatively, a 'sustainable' price. Information on such interpretations is sparse and mainly confined to anecdotes from international investors. However, comparisons between appraisal-based and transaction price indices, where the latter are available, illustrate very different relationships in different countries and this, coupled with other evidence (for example, Crosby *et al.*, 2011), sustains such doubts. This reduces confidence when comparing returns for different national markets owing to uncertainty about the consistency of appraisals and whether they track market trends in similar ways.

To illustrate this further, transaction-linked indices produced by MSCI for a range of European markets can be compared with the corresponding appraisal-based indices for those countries.[18] Figure 9.1 compares the standard deviation in quarterly capital return rates produced by each type of index for several countries over the period 2002-2012. This comparison raises some interesting questions. Clearly, some real estate markets over this period were more volatile than others, such as Ireland. Of more concern here are discrepancies between the two types of index. At one extreme, the UK has similar figures for volatility regardless of index type, but,

at the other extreme, Germany and Switzerland each has a transaction index volatility only just below the UK, but an appraisal index volatility below 0.5%. It is differences like this that have raised questions as to how an ostensibly similar basis of appraisal is interpreted in different countries and whether appraisal based indices can identify differences in the performance characteristics of different international markets.

*Insert Figure 9.1*

These differences in interpretation are becoming increasingly problematic as the ownership of real estate in major cities such as London, Frankfurt, Sydney and New York is changing and moving from national to international investors. To maintain coverage, properties in foreign ownership should be included in the index sample for these locations. At present, many national and sub-national indices are based on assets owned by domestic investors only. Index providers such as MSCI could include assets owned by foreign investors in their indices if interpretations of value were harmonised. At present, any amalgamation of international and domestically owned assets could distort the indices.

**Summary and conclusions**

This chapter has introduced and examined appraisal-based indices of real estate performance. In most cases, the performance of assets in other investment markets can be measured by reference to transactions of those assets.[19] In the case of real estate, the absence of a centralised market and a heterogeneous set of assets, coupled with a relatively low level of transaction activity, make the use of transaction-based indices difficult. This explains why appraisal-based indices still dominate real estate investment performance measurement, despite the conceptual superiority of transaction based measures. Appraisal-based indices enable larger samples to be used, leading to possibilities of greater disaggregation than currently possible from transaction indices. Therefore, it is likely that they will continue to be the main basis for measuring real estate investment performance for the foreseeable future, despite their limitations.

The first appraisal-based indices emerged in the mature commercial real estate investment markets of the US and the UK. Such indices have now spread around the increasingly global real estate investment market. The development of indices has helped national real estate markets to become more transparent which, in turn, encourages the growth of foreign and

domestic investment. This chapter has identified the different types of indices and the different measures produced by the index providers, which include income, capital and total returns, as well as various other measures useful in analysing real estate markets. Other types of appraisal index include those which measure movements in a location and are not based on actual properties.

Issues arise in the construction of appraisal based indices. Some of these relate to coverage of the market, which varies widely between and within countries, but they also relate to problems that arise because the indices are based on appraisals, rather than actual transactions. Performance measurement appraisals are universally based on market value, which is an exchange price concept. The theory and practice of appraisal reinforces the use of transactions on similar real estate assets as the main evidence base for undertaking appraisals. However, transactions take time to complete and there is a substantial literature on appraisers' reliance on past information, which includes past valuations, versus contemporaneous market signals. This is thought to lead to some element of smoothing of real estate appraisals as compared to prices, with appraisals understating the peaks and troughs of market cycles. This has implications for comparing the performance and risk of real estate against other asset classes.

The usefulness of the performance measures generated from the appraisal-based indices has been improved by research into the limitations of these indices. Most of this research relates to the use of appraisals and their impact on the measures. Research into transaction-based indices has been important for identifying differences between their outcomes and those of appraisal-based indices at the more aggregated level. An aspect that has been identified for further research is the interpretation of the basis of appraisal used for appraisal-based indices in different countries. Although they all use the basis of Market Value, existing research coupled with anecdotal comment suggests that appraisers in different countries interpret it differently. This makes international comparisons based on appraisal-based indices and subsequent cross-border investment decisions more difficult. There is, therefore, a need to continue research into the impacts of appraisal methods and the appraisal process on the outputs from appraisal-based indices, with particular emphasis on less well-researched markets outside of the US and UK where the use of performance measurement indices is less established.

**References**


Adegoke, O. J. (2016) Effects of valuation variance and inaccuracy on Nigerian commercial property market, *Journal of Property Investment and Finance*, 34(3), 276-292.

Bacon, C. R. (2008) *Practical portfolio performance measurement and attribution*, 2nd Edition, Chichester, John Wiley & Sons.

Baum, A., Crosby, N., Gallimore, P., Gray, A. and McAllister, P. (2000) *The influence of valuers and valuations on the workings on the commercial property market*, Report for the Education Trusts of IPF, RICS and Jones Lang LaSalle.

Bokhari, S. and Geltner, D. (2016) Characteristics of depreciation in commercial and multifamily property: an investment perspective, *Real Estate Economics*, Forthcoming.

Bond, S. A., Hwang, S. and Marcato, G. (2012) Commercial real estate returns: an anatomy of smoothing in asset and index returns, *Real Estate Economics*, 40(4), 637-661.

Cannon, S. E. and Cole, R. A. (2011) How accurate are commercial real estate appraisals?: evidence from 25 Years of NCREIF sales data, *Journal of Portfolio Management*, 35(5), 68-88.

CBRE (2008) *German Open-ended Funds: Past, Present and Future*, London: CB Richard Ellis.

CFA Institute (2010), *Global Investment Performance Standards*, CFA Institute: www.gipsstandards.org/standards/current/pages/index.aspx

Chaplin, R. (1997) Unsmoothing Valuation-Based Indices Using Multiple Regimes. *Journal of Property Research*, 14(3), 189–210.

Cheng, P., Lin, Z. and Liu, Y. (2011) Heterogeneous information and appraisal smoothing. *Journal of Real Estate Research*, 33(4), 443-469.

Clayton, J., Geltner, D. and Hamilton, S. W. (2001) Smoothing in commercial property valuations: evidence from individual appraisals, *Real Estate Economics*, 29(3), 337-360.

Crosby, N. (1988) An analysis of property market indices with emphasis on shop rent change, *Land Development Studies*, 5(2), 145-177.

Crosby, N. (2000) Valuation accuracy, variation and bias in the context of standards and expectations, *Journal of Property Investment and Finance*, 18 (2), 130-161.

Crosby, N., Devaney, S. and Law, V. (2011) Benchmarking and valuation issues in measuring depreciation for European office markets, *Journal of European Real Estate Research*, 4(1), 7-28.

Crosby, N., Devaney, S. and Nanda, A. (2016) Which factors drive rental depreciation rates for office and industrial properties? *Journal of Real Estate Research*. 38 (3): 359-92.

Crosby, N., Devaney, S., Lizieri, C. and McAllister, P. (2018) Can institutional investors bias real estate portfolio appraisals? Evidence from the market downturn, *Journal of Business Ethics*, 147 (3): 651-667.

Cullen, I. (2010) Constructing a global real estate investment index, pp 100-113 in Newell, G. & Sieracki, K. (Eds.), *Global Trends in Real Estate Finance*. Chichester: Blackwell Publishing.

Devaney, S. (2014) Measuring European property investment performance: comparing different approaches, *Journal of European Real Estate Research*, 7(1), 112-132.

Diaz, J. and Wolverton, M. L. (1998) A longitudinal examination of the appraisal smoothing hypothesis, *Real Estate Economics*, 26(2), 349-358.

Diehl, J. B. (1993) The Russell-NCREIF property indices: institutional real estate performance benchmarks, *Journal of Real Estate Literature*, 1(1), 95-103.

Edelstein, R. H. and Quan, D. (2006) How does appraisal smoothing bias real estate returns measurement?, *Journal of Real Estate Finance and Economics*, 32(1), 41-60.

Fisher, J. D. (2005) US commercial real estate indices: the NCREIF property index, pp 359-367 in *Real estate indicators and financial stability*, Vol. 21, Bank for International Settlements.

Fisher, J. D. and Geltner, D. (2000) De-lagging the NCREIF Index: transaction prices and reverse-engineering, *Real Estate Finance*, 17(1), 7-22.

Fisher, J. D., Geltner, D. M. and Webb, R. B. (1994) Value indices of commercial real estate: a comparison of index construction methods, *Journal of Real Estate Finance and Economics*, 9(2), 137-164.

Freshfields Bruckhaus Deringer (2011) *Possible sales in the German real estate market: survey on open-ended real estate funds*, Hamburg: Freshfields Bruckhaus Deringer LLP.

Geltner, D. (1993) Estimating market values from appraised values without assuming an efficient market, Journal of Real Estate Research, 8(3): 325-345.

Geltner, D. and Goetzmann, W. (2000) Two decades of commercial property returns: a repeated-measures regression-based version of the NCREIF index, Journal of Real Estate Finance and Economics, 21(1), 5-21.

Geltner, D., MacGregor, B. and Schwann, G. (2003) Appraisal smoothing and price discovery in real estate markets, Urban Studies, 40(5-6), 1047-1064.

Geltner, D. M., Miller, N. G., Clayton, J. and Eichholtz, P. (2007) Commercial real estate analysis and investments, 2nd Edition, South-Western Cengage Learning.

Henneberry, J. and Roberts, C. (2008) Calculated inequality? portfolio benchmarking and regional office property investment in the UK, Urban Studies, 45(5-6), 1217-1241.

Hoesli, M. and MacGregor, B. D. (2000) Property investment: principles and practice of portfolio management, Harlow: Longman.

Hordijk, A. (2005) Valuation accuracy in real estate indices: the case of the ROZ/IPD Netherlands Property Index compared to the IPD UK Index and the NCREIF USA Index, IVSC Information Paper, March 2005.

IPD (2013) IPD Quarterly Property Price Indicators: December 2012, London: Investment Property Databank.

IVSC (2013) Valuation uncertainty, Technical Information Paper No 4, London: International Valuation Standards Council.

JLL (2016) Taking Real Estate Transparency to the Next Level, Global Real Estate Transparency Index, 2016. Jones Lang LaSalle.

Lai, T. and Wang, K. (1998) Appraisal smoothing: the other side of the story, Real Estate Economics, 26(3), 511-535.

Levy, D. and Schuck, E. (2005) The influence of clients on valuations: the clients' perspective, Journal of Property Investment and Finance, 23(2), 182-201.

Lizieri, C., Satchell, S. and Wongwachara, W. (2012) Unsmoothing real estate returns: a regime-switching approach, Real Estate Economics, 40(4), 772-804.

MSCI (2017a) MSCI Global Methodology Standards for Real Estate Investment. MSCI. https://www.msci.com/real-estate.

MSCI (2017b) IPD Global Annual Property Index. MSCI. https://www.msci.com/real-estate.

Morrell, G. D. (1991) Property performance analysis and performance indices: a review, Journal of Property Research, 8(1), 29-57.

NCREIF (2016) NCREIF data, index and products guide 2016, National Council of Real Estate Investment Fiduciaries: https://www.ncreif.org/public_files/NCREIF_Data_and_Products_Guide.pdf

Quan, D. C. and Quigley, J. M. (1991) Price formation and the appraisal function in real estate markets, Journal of Real Estate Finance and Economics, 4(2), 127-146.

Reid, B. (2017) Private Real Estate: Valuation And Sale Price Comparison. MSCI. https://www.msci.com/www/research-paper/private-real-estate-valuations/0183964217

RICS (2017) RICS Valuation – Global Standards 2017, London: Royal Institution of Chartered Surveyors.

Scott, P. (1996) The property masters, London: E & FN Spon.

Teuben, B., Shah, S. and Hariharan, G.G. (2017) Real Estate Market Size 2016. London: MSCI. https://www.msci.com/www/research-paper/real-estate-market-size-2016/0183961169

Young, M. S. (2005), Making sense of the NCREIF Property Index: a new formulation revisited, Journal of Real Estate Portfolio Management, 11(3), 211-223.

Young, M. S., Geltner, D. M., McIntosh, W. and Poutasse, D. M. (1995) Defining commercial property income and appreciation returns for comparability to stock market-based measures, Real Estate Finance, 12(2), 19-30.

**Table 9.1: IPD Global Annual Property Index – constituent countries as at end-2016**

| | No. of funds | No. of assets | Value of assets $bn | Market size $bn | % coverage end-2016 |
|---|---|---|---|---|---|
| Australia | 62 | 1,436 | 124.5 | 225.9 | 55.1 |
| Austria | 15 | 334 | 6.9 | 34.3 | 20.2 |
| Belgium | 23 | 238 | 6.3 | 51.9 | 12.1 |
| Canada | 44 | 2,454 | 105.7 | 287.7 | 36.7 |
| Czech Republic | 14 | 111 | 2.1 | 16.8 | 12.6 |
| Denmark | 16 | 534 | 12.5 | 49.8 | 25.1 |
| Finland (KTI) | 26 | 1,718 | 19.4 | 61.4 | 31.6 |
| France | 109 | 5,944 | 134.8 | 353.1 | 38.2 |
| Germany | 90 | 1,796 | 53.1 | 395.8 | 13.4 |
| Hungary | 9 | 57 | 0.8 | 8.2 | 9.4 |
| Ireland | 13 | 443 | 8.8 | 26.3 | 33.6 |
| Italy | 53 | 1,512 | 19.2 | 105.4 | 18.2 |
| Japan | 69 | 3,515 | 156.5 | 729.2 | 21.5 |
| Netherlands | 72 | 4,027 | 40.3 | 128.8 | 31.3 |
| New Zealand | 17 | 434 | 9.6 | 17.4 | 55.0 |
| Norway | 16 | 429 | 15.1 | 48.6 | 31.0 |
| Poland | 23 | 210 | 5.1 | 37.7 | 13.4 |
| Portugal | 30 | 572 | 7.6 | 23.3 | 32.8 |
| South Africa | 13 | 1,450 | 21.7 | 39.5 | 55.0 |
| South Korea | 90 | 178 | 22.0 | 60.7 | 36.3 |
| Spain | 40 | 509 | 21.6 | 73.0 | 29.6 |
| Sweden | 48 | 3,937 | 77.6 | 165.7 | 46.8 |
| Switzerland | 37 | 4,014 | 92.6 | 213.2 | 43.4 |
| United Kingdom | 272 | 22,530 | 249.8 | 604.6 | 41.3 |
| United States | 98 | 5,721 | 363.0 | 2,729.7 | 13.3 |

Source: compiled by authors from Teuben *et al*. (2017) and from individual index factsheets.

**Table 9.2: MSCI-monitored Asian markets not included in Global Index as at end-2016**

| | Value of assets $bn | Market size $bn | % coverage end-2016 |
|---|---|---|---|
| China | 15.5 | 415.6 | 3.7 |
| Hong Kong | 40.8 | 310.6 | 13.1 |
| Indonesia | 2.3 | 11.5 | 19.7 |
| Malaysia | 7.9 | 22.8 | 34.6 |
| Singapore | 52.6 | 139.8 | 37.6 |
| Taiwan | 2.6 | 36.3 | 7.2 |
| Thailand | 5.7 | 16.7 | 34.1 |

Source: Teuben *et al*. (2017)

**Table 9.3: Weighted average absolute difference between sale prices and preceding appraisals, by country**

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Australia | 3.8 | 3.9 | 4.3 | 4.8 | 4.8 | - | - | 13.7 | 10.1 | 8.2 | 5.6 | 6.8 | 3.5 | 5.8 | 9.3 | 12.7 | 10.1 |
| Canada | 7.4 | 6.4 | 9.7 | 8.1 | 9.3 | 11.6 | 15.7 | 13.5 | 8.8 | 9.8 | 8.2 | 10.4 | 16.7 | 7.2 | 9.5 | 15.6 | 12 |
| Denmark | - | 16.1 | 12.3 | 11.5 | 17.5 | 22.2 | 22.5 | 16.6 | 14.7 | - | - | - | 6 | 20.1 | 17.4 | 10.5 | 17.6 |
| France | 6.6 | 7.8 | 6.6 | 5.4 | 11.5 | 10.2 | 14.5 | 12.9 | 9.9 | 7.8 | 11.1 | 10.5 | 9.6 | 9.2 | 9.3 | 12.6 | 11.1 |
| Germany | 12.2 | 9.2 | 7.2 | 11.6 | 5.1 | 6.1 | 14.7 | 15.1 | 14.8 | 6.1 | 10.6 | 9.5 | 9.2 | 7.6 | 8.9 | 9.9 | 13.2 |
| Italy | - | - | - | - | - | - | 9.3 | - | 17.5 | 12.5 | 11.4 | 7.3 | 10 | 5.7 | 9.3 | 8.6 | 8.6 |
| Japan | - | - | - | - | - | 22.3 | 8.1 | 12.9 | 7.3 | 10.1 | 8.6 | 8.2 | 12 | 11.6 | 10.9 | 14 | 12.8 |
| Netherlands | 10.2 | 8.3 | 9 | 7.9 | 8.3 | 8.6 | 11.6 | 12.5 | 5.6 | 9.3 | 4.8 | 4.8 | 7.5 | 9.5 | 5.8 | 7 | 10.2 |
| South Africa | 11.8 | 9.3 | 9.3 | 9.5 | 7.6 | 11.5 | 9.2 | 21.7 | 9.6 | 9.4 | 6.7 | 10.5 | 10.5 | 9.2 | 9 | 3.7 | 5.2 |
| Sweden | 18.5 | 9.6 | 10.1 | 8 | 10 | 10.4 | 21.6 | 15.8 | 13.7 | 16.7 | 9 | 11.4 | 7.1 | 10.8 | 10.8 | 13 | 12.4 |
| Switzerland | - | - | - | 10.3 | 9.1 | 8.5 | 8.2 | 9.5 | 9.1 | 13.6 | 11.3 | 10.7 | 12.2 | 7.5 | 7.3 | 19.2 | - |
| UK | 7.8 | 7 | 7.6 | 7.5 | 7.9 | 7.8 | 8.9 | 9.9 | 9.4 | 11.2 | 9.7 | 9.6 | 8.7 | 10.3 | 10.9 | 10.1 | 8.7 |
| USA | 5.1 | 8.6 | 7.7 | 6.3 | 9.6 | 11.6 | 10.8 | 10.3 | 8.6 | 14.9 | 10.8 | 9.5 | 8.7 | 11.1 | 8.6 | 8.8 | 6.2 |
| Other | - | 16.1 | 6.8 | 8.9 | 13.3 | 12.6 | 15.5 | 12.6 | 9 | 12.7 | 10.4 | 8.9 | 8.5 | 9.8 | 8.9 | 10.7 | 13.6 |
| Global | 8.6 | 7.2 | 7.6 | 7.3 | 8.4 | 9.2 | 11.5 | 12 | 10.1 | 11.1 | 9.5 | 9.4 | 9 | 9.5 | 9.4 | 10.4 | 9.1 |

Source Reid, B (2017)

Note: Reid (2017) analyzes 13 of the largest national markets included in MSCI's IPD Global Annual Property Index. In addition, results for another 11 countries, with fewer recorded transactions, are grouped together in the 'Other' category. This includes Austria, Belgium, the Czech Republic, Hungary, Ireland, New Zealand, Norway, Poland, Portugal, South Korea and Spain.

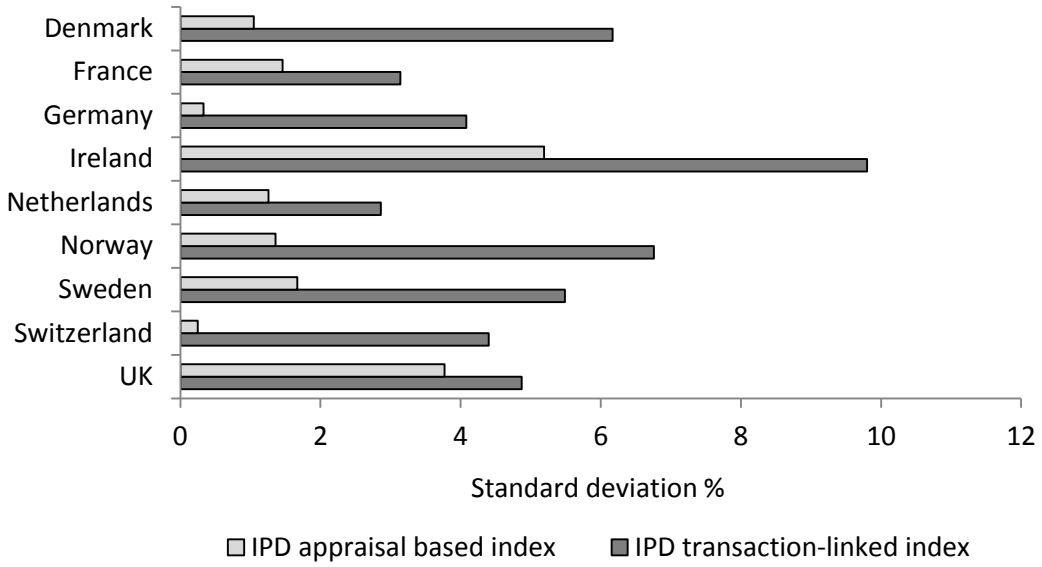
**Table 9.4: Weighted average difference between sale prices and preceding appraisals, by country**

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Australia | 0.4 | -0.2 | 0 | 1.9 | 1.3 | - | - | 11.8 | 3.5 | -4.6 | 1.4 | 3.6 | -0.3 | 3.2 | 7.4 | 11.9 | 5.5 |
| Canada | -1.4 | 0.7 | 2 | 2.5 | 6.5 | 5.5 | 15.4 | 10.5 | 5.8 | -0.2 | 1.6 | 6.3 | 14.4 | 3.4 | -0.4 | 11.8 | 7.9 |
| Denmark | - | 14.4 | 8.7 | 6.6 | 13.6 | 19.7 | 18.5 | 13.5 | 11.5 | - | - | - | 2.3 | -1.7 | 12.1 | 8.4 | 13.1 |
| France | 2.6 | -0.1 | 1.2 | 2.5 | 8.8 | 8.6 | 12.9 | 10.4 | 3.5 | 0.9 | 5.6 | 8.5 | 5.9 | 5.1 | 3.7 | 8.9 | 6.9 |
| Germany | 3.6 | 1.2 | -3.3 | -4.8 | -1 | 0.8 | 0.5 | 12.3 | 9.7 | -2.9 | 4.4 | 7.2 | 3.3 | 3.4 | 4.3 | 6.5 | 4.8 |
| Italy | - | - | - | - | - | - | 6.1 | - | 16.2 | 3.9 | 2.8 | 2.8 | 1.9 | -3 | 0.1 | 2.4 | 0.3 |
| Japan | - | - | - | - | - | 21 | 7.1 | 11.5 | 4.8 | -8.5 | -3.6 | -2.1 | -3.4 | 2.3 | 9.1 | 10.1 | 8.8 |
| Netherlands | 7.6 | 2.2 | 6.2 | 2.5 | 4.7 | 5.2 | 4.6 | 10.6 | 2.9 | -5.2 | 2 | 1.4 | -0.2 | -6 | -1.4 | -1.4 | 3.5 |
| South Africa | 0.1 | -3 | 0.3 | 1.9 | -0.6 | 6.3 | 0.4 | 18.1 | 1.6 | 6.6 | 0.9 | 5.4 | 6.7 | 7.6 | -0.7 | 1.3 | 1 |
| Sweden | -8.7 | 4.8 | 5.9 | 4.5 | 7.3 | 7.5 | 21.3 | 10.8 | -7.7 | 12.9 | 1 | 10.2 | 3.2 | 5.9 | 1.2 | 7.2 | 4 |
| Switzerland | - | - | - | 6.2 | 4.5 | 0.7 | 5.8 | 6.6 | 7.3 | 13.1 | 9.7 | 8.9 | 9.8 | 5.8 | 5.1 | 15.4 | - |
| UK | 3.8 | 3.4 | 5.1 | 5.5 | 6 | 5.8 | 6.6 | 2.9 | -2.9 | 3.8 | 5.2 | 6.2 | 2.7 | 7.3 | 8.6 | 6.1 | 3 |
| USA | -1.5 | 1 | 4.2 | 4.4 | 5.5 | 7.4 | 7.5 | 4.8 | -4.3 | -10.3 | 5.3 | 4.8 | 4.1 | 2.3 | 4.2 | 5.7 | 0.7 |
| Other | - | 4.4 | 4.9 | 6.5 | 10.3 | 9.3 | 11 | 7.9 | 3.6 | -0.8 | 0.9 | 5.7 | 2.3 | -0.1 | -0.6 | 6.5 | 11.6 |
| Global | 0.9 | 2.2 | 3.6 | 3.9 | 5.4 | 6.4 | 7.6 | 7.6 | 0 | -0.1 | 2.6 | 5.5 | 4 | 3.6 | 4.4 | 6.6 | 3.9 |

Source Reid, B (2017)

Note: Reid (2017) analyzes 13 of the largest national markets included in MSCI's IPD Global Annual Property Index. In addition, results for another 11 countries, with fewer recorded transactions, are grouped together in the 'Other' category. This includes Austria, Belgium, the Czech Republic, Hungary, Ireland, New Zealand, Norway, Poland, Portugal, South Korea and Spain.

**Figure 9.1 – Standard Deviations of Quarterly Capital Return Rates from Different Types of Index**




Source: Adapted from MSCI (2013)

## Notes

[1] Commercial for the purposes of this chapter is used as a generic title for all non-residential real estate assets and includes retail, office and industrial properties.
[2] Examples were the Morgan Grenfell Laurie/Corporate Intelligence Group Property Performance Index and The Property Index, neither of which is now published.
[3] Numerical examples showing the difference between money- and time-weighted rates of return can be found in many real estate textbooks. For example, see Geltner *et al.* (2007) or Hoesli and MacGregor (2000).
[4] Note that any capital expenditure during the period is assumed to occur at the start of the period.
[5] In contrast, maintenance expenditure is deducted from rent to produce net operating income.
[6] Market Rent is the rent that could be agreed in a new rental transaction at that point in time and may differ from the actual rent being paid under the terms of an existing lease contract.
[7] For critical comment on the role of benchmarking in reinforcing these preferences, see Henneberry & Roberts (2008).
[8] Details are available at http://portalibre.fgv.br/main.jsp [correct as at December 2017].
[9] See: http://index.ares.or.jp/index-en.php [correct as at December 2017].
[10] See IVSC (2013) and RICS (2017).
[11] In both cases, the numerator is the difference between achieved sale price and preceding valuation.
[12] See Freshfields Bruckhaus Deringer (2011) or CBRE (2008).
[13] See Geltner *et al.* (2003) for a review of the early literature in this area.
[14] See Lai and Wang (1998), Edelstein & Quan (2006) and Cheng *et al*. (2011).
[15] This has been recognised in some papers that attempt to adapt desmoothing techniques as a result. For examples, see Chaplin (1997) and Lizieri *et al.* (2012).
[16] See Geltner (1993), Fisher *et al.* (1994) or Geltner and Goetzmann (2000).
[17] Note that transaction-based indices face similar problems when combining observations of prices across a period to create a single index value for the period in question (Geltner, 1993).
[18] See Devaney (2014) for a more in-depth comparison of these series.
[19] However, some asset classes such as private equity and infrastructure face similar issues in creating indices to those raised here.