9. Real Estate Price Indices

Introduction

9.1 For macroprudential analysis, it is highly desirable to have indices of real estate prices[1] both because deposit takers may have large exposures (both direct and indirect) to real estate and because they may be affected by the potential volatility of price movements. Moreover, real estate assets are a major element of the wealth of the private sector. The direct exposure to risks arising from real-estate-related lending of deposit takers can be monitored through the FSIs related to real estate loans that are described in Chapter 6.

9.2 Deposit takers' exposure to real estate prices can arise because they may

- Own real estate;
- Lend to customers to purchase, construct, or develop real estate;
- Take collateral in the form of real estate;
- Lend to other deposit takers who have real estate exposures or who fund real-estate-related lending;
- Be subject to the risk that real estate loans will be prepaid, which can contribute to balance sheet volatility and asset-liability mismatches;
- Own securities on which the payment of principal and interest is backed by real estate loans;
- Be exposed to the real-estate-related lending exposures of subsidiaries or branches in other economies;
- Be exposed to households and corporations that can be affected by changes in the servicing costs of real-estate-related borrowing and/or price movements in real estate; or
- Be exposed to specific locations (such as tourist facilities or center city offices) that may be subject to more volatile price conditions than in the wider real estate market.

9.3 The reasons why real estate prices are potentially volatile are varied. Real estate markets are illiquid, with sales negotiated with high transactions costs. Supply is inelastic in the short term owing to the time needed to plan projects and complete construction. Development is often subject to many legal or other restrictions, such as a shortage of urban land that can be developed. Under these conditions, the impact of changes in demand on prices is exacerbated. While international capital flows into or out of real estate can rapidly and unpredictably affect market sales and prices, price volatility is also endogenously induced through the provision of domestic credit. During an upswing in real estate prices, real estate may be used as collateral for extensions of credit for further purchases. But once conditions begin to reverse, such exposure can cause the downturns in economic activity, credit, and real estate prices to become mutually reinforcing.

Measuring Real Estate Prices

9.4 Constructing representative real estate price indices is challenging. Difficulties can arise because real estate markets are heterogeneous, both within and across countries, and illiquid. There may be no unambiguous market price. Moreover, such diversity and lack of standardization result in the need to gather a wide range of data to compile indices that are characteristic of the various market segments; this contributes to high data collection costs and may require greater technical sophistication. Representative real estate prices in residential and commercial markets can be hard to measure accurately given the small samples that are often available, as there may be disparate prices for apparently similar properties

[1]In October 2003, a joint IMF/BIS conference was held to explore the relationships between real estate and financial stability, the information needed on real estate, technical aspects of compilation of real estate indicators, and possible avenues for future work. The proceedings of the conference is in BIS and IMF (2005). This chapter reflects some of the discussions at that conference.

and prices may be volatile. Experience has shown that there are particular difficulties in measuring commercial real estate prices across the economy.

9.5 The measurement problem is compounded by the significant differences in price information on real estate transactions, differences that depend on the stage in the transactions process at which the data are collected. It is possible to construct a timeline—which can cover a half-year or more—of the stages in the real estate transactions process:

- Advertisement of the property and its asked price,
- Verbal agreement to purchase at a negotiated price,
- Approval of mortgage financing,
- Agreement on contract,
- Completion of transaction,
- Registration of transaction or deed, and
- Valuation assessment.[2]

9.6 To understand the properties of the price series compiled, it is important to know the stage in the timeline of transactions at which the information is collected. At each stage, different types of coverage, prices, and data sources may be involved. For example, advertised prices available from brokerage firms often exceed the negotiated sales price, which in turn may be different from the amount of the mortgage, as the latter might include fees and exclude cash contributions. Data on advertised prices provide first indications about price trends but are often incomplete and do not reflect actual prices and transactions. Conversely, information provided at the registration of a transaction can be the most complete, as it can also include privately arranged sales, but it may seriously lag behind transactions and turning points in prices. Similarly, mortgage-based information is sometimes highly detailed regarding the characteristics of the property, but it can be proprietary, limited in coverage, or compiled differently by different lenders. The nature of the information derived at different stages of the transaction can also vary depending on the country. Clearly, these differences can affect the analytic uses of the price series compiled.

9.7 Moreover, there is limited international experience in constructing representative real estate price indices. Although compilation of information on real estate prices is a part of the measurement of the national accounts, and such prices are included in many countries' consumer price indices, little attention has been paid to the construction or dissemination of real estate price indices in many countries. Compilation efforts have been constrained by the high cost and technical difficulty involved, the limited demand for such data in the past, and the proprietary control of much of the key detailed data useful for compiling indices. Indeed, in many countries, the compilation and dissemination of real estate indices are undertaken by private corporations or associations involved in the various real estate transactions mentioned above that have good access to data and commercial reasons to compile the indices.

9.8 Given the relative lack of international experience in constructing real estate price indices, the cost of creating real estate price indices, and the diversity of users with needs for different types of real estate information, the *Guide* does not recommend a single set of indices or compilation methods but describes a range of techniques whose application can be based on local needs, conditions, and availability of resources. Nonetheless, the *Guide* does recommend that separate indices be compiled for residential and commercial real estate, because of the very different conditions prevailing in the two markets. To capture changes in real estate price trends, the *Guide* advocates quarterly compilation of data. Metadata describing in detail the content and coverage of, and the conceptual approach underlying, any price index disseminated is essential.

9.9 When developing real estate price indices, the compiler should be aware of the following:

- There is likely to be a wide range of differences among properties. Typically, real estate prices differ widely based on locality, type of real estate, and specific features of each property. It is often difficult to identify a standard real estate unit.
- The mix of transactions by type may vary period by period, complicating the construction of weights to use in indices.
- As noted in paragraphs 9.5 and 9.6, information can differ significantly depending on the stage in the transactions process at which data are collected.
- For subindices in particular, there may be too few observations available within a given period to draw valid statistical conclusions.
- Different approaches may be needed to measure transactions and stocks in real estate. Transactions data, which cover those properties for which transactions are reported in a given period, could be volatile because of the changes in the mix of trans-

[2]This can occur on an ongoing basis.

actions[3] but might provide early signals of price changes. In contrast, stock data can be more representative but cover the large majority of properties for which there are no transactions within the period.
- Real estate exposures of financial institutions may be highly focused and atypical of the broad markets. Moreover, exposures to new real estate ventures may not be well covered by existing statistical data collection systems.

9.10 To the extent that there are a variety of distinct real estate market segments, there may be a demand from users (such as the institutions financing the properties and the regulators of such institutions) for subindices for at least some market segments, in addition to an accurate aggregate index covering the economy. For instance, there may be a demand for subindices that cover large urban centers. Subindices for key types of real estate, combined with information on the most important types of real estate exposures, can help in the analysis of how price changes might affect financial stability conditions within a country. Such analysis can often be useful, provided care is taken to ensure that the price indices used are relevant for the exposures identified. However, as noted above, compiling the necessary information in ways that highlight the specific exposures under investigation may be challenging.

9.11 Finally, real estate price information can be drawn from data used to compile the national accounts, such as balance sheet data on the stock of housing and other real estate, price movements, new construction expenditures, maintenance expenses, and depletion and loss of stock. National statistical offices, which compile sectoral data, could be an important source of information about the condition of the real estate sector and price movements affecting real estate and construction.

Structural Indicators of Real Estate Markets

9.12 To construct real estate price indices that provide a consistent measure of price developments over time, the *Guide* considers it necessary for basic structural information to be collected about the stock of real estate and the factors that affect real estate prices. This involves the preparation of inventories of the stock of residential and commercial properties to provide a baseline for the compilation of price indices. These data could also contribute to the construction of basic statistics on social and economic conditions.

9.13 The inventory could be developed through the use of periodic surveys or censuses of real estate and be updated by information from transactions records or ongoing surveys, or through the use of tax, permit, deed, or other records.[4] For example, transactions records might be obtained from the authority—usually a local or national registry—that is responsible for recording the transfers of property ownership in its locality. When ownership changes hands, these authorities update their records. Related to this can be assessment data used for the determination of any property taxes. While this information may well be updated only infrequently, such records might be detailed to the extent that the level and rate of taxation might vary depending on the characteristics of each property, with the relevant characteristics determined by local circumstances.[5] The availability of transactions data from transactions records held by the local authorities or from real estate agents—that is, entities that bring together buyers and sellers of real estate—could assist in the creation of a price index if such transactions data are available over time for real estate of a similar or common type. Financial institutions active in lending to the real estate market may also be a source of information because they often need detailed descriptions of properties to assess their value for lending purposes, for use as collateral, and/or for any transfer of the mortgage loan to third parties. Valuation assessments are particularly important in the case of commercial property.

9.14 Specifying characteristics (categories) of real estate in any inventory is important. Such categories

[3]Transactions data may be affected by cyclical movements in prices and volumes, as well as by the types of units for which there are transactions. For instance, during periods of price upswings, sales might be more common for higher-priced properties and vice versa in downswings.

[4]One possibility is to undertake a household survey, although obtaining adequate responses from households can be difficult. Such a survey could be incorporated into a broader survey of household income, expenditure, assets, and liabilities that would also support the compilation of other FSIs, and macroeconomic statistics more generally.

[5]These and other data sources are discussed in Pollakowski (1995).

should be sufficiently disaggregated to be able to identify the key features of the real estate that affect its value, but the degree of detail captured will also vary according to needs and resources. The specific categories that are important to determining prices will vary among economies and so should be identified by national authorities, based on local conditions. Set out below are some of the key characteristics that might be captured in such an inventory:

- **Number of units, by major type of unit.** For residential real estate, a unit might be a single-owner dwelling, and the type might be a detached or semidetached town house or apartment.
- **Location.** The address and perhaps neighborhood, census tract, or administrative district.
- **Purpose.** The use of the real estate unit, such as dwelling, shop or retail outlet, factory, or government offices.
- **Type of construction.** Concrete, wood, thatch, and so on.
- **Age of unit.** The number of years since construction or major renovation.
- **Size.** The number of square meters or square feet of the structure and lot.
- **Number of rooms.** The total number of rooms, with possible itemization of specific types of rooms, such as bedrooms or bathrooms.
- **Utilities and amenities.** Whether the property has a water supply connection, sewerage connection, electricity, or other relevant amenity.
- **Physical condition.** Interior and exterior maintenance, evidence of damage, and similar issues.
- **Last sales date and value, current market value,** and **tax valuation.**
- **Vacant units.** Whether the real estate is in use.
- **Tenure.** The status of the occupant, that is, owner-occupied (freehold or leasehold), private rental, or public sector rental.
- **Rental information.** The amounts paid to rent the real estate, in total or in terms of the cost per unit of space, such as per square meter.
- **Building permits, completions, or other measures of current activity.**

9.15 With the above information, data can be compiled on the turnover in, the key structural features of, and the general conditions in the real estate market, which help supplement real estate price information when undertaking financial sector stability analysis.[6] For example, the following basic data, preferably disaggregated between residential and commercial property by city or other geographic location, could be compiled from the information set out in paragraph 9.14:

- Total stock of units and the change in the stock;
- Occupancy rate and vacancy rate;
- Total number of transactions, annually or quarterly; and
- Average rent per residential unit or per unit of business space (such as square meter).

Constructing Real Estate Price Measures

Average (Unit Value) Prices

9.16 An average sales price statistic in each reporting period can be calculated by dividing the sum of sales prices by the number of units for which there were transactions during the period. Unit value indices are probably the most widely available price measures for real estate, in the form of average sales data or average tax assessment data, and sometimes provide useful information about large changes in prices, especially if disaggregated into more homogeneous subindices.[7]

9.17 Such a unit value index is, however, not a true price index. It can be seriously biased by a few transactions with extreme values, changes in the mix of transactions, or changes in the quality of the units being transacted. For example, unit value indices make no adjustment for quality improvements over time and therefore suffer from an upward bias over time. Although broadly useful as a snapshot of overall real estate prices, unit value indices often are less useful than price indices that adjust for changes in the mix of characteristics of properties.

Median and Mode Prices

9.18 To compensate for the biases affecting average prices, some indices are based on median price (the

[6]The inventory of real estate market conditions described here does not provide a complete picture of the financial sector stability implications of real estate, which would also include compilation of data on financial institutions' exposures and the financial conditions of occupants and purchasers.

[7]For instance, subindices for standard two-bedroom apartments in different cities could be compiled, as such types of apartments are usually common.

middle value from among all values in the panel) or mode (the most commonly experienced price). These measures may be useful for specialized purposes, but both methods suffer from the exclusion of significant information.

Price Indices

9.19 Price indices are composite measures that quantify the value of a set of prices for a variety of items. Price indices can be compiled either by standard formulas or regression techniques that estimate the value of a composite or standard unit of real estate.[8] A price index can remove the effects of changes in the composition of transactions or of changes in quality, to arrive at a more accurate measure of prices for comparable units of real estate. Price indices are pure numbers describing a change from a benchmark unit of value (usually 100) in a base period and, as such, can be compared among economies with different types of real estate.

Laspeyres real estate indices

9.20 A Laspeyres price index for real estate calculates the weighted average change in prices over a period for a fixed basket of real estate drawn from some base period. It compares the total cost of purchasing a specific quantity and mix of real estate in the base period with the total cost of purchasing the same quantity and mix in other periods. An index of these costs is then constructed. The intention is to calculate a price index for the outstanding stock of real estate using information from transactions over a period and/or from appraised values of real estate.

9.21 For example, using the information in Table 9.1:

(i) The total cost of purchasing types A, B, and C properties in the base period was (160)(50) + (30)(70) + (10)(100) = 11,100.

(ii) At prices prevailing in the current period, the total cost of purchasing the base period quantities is (160)(60) + (30)(90) + (10)(110) = 13,400.

Table 9.1. Quantities and Prices of Real Estate

Type of Property K_i	Base Period Quantity q_0	Base Period Price p_o	Current Period Price p_t
A ($i = 1$)	160	50	60
B ($i = 2$)	30	70	90
C ($i = 3$)	10	100	110

(iii) The Laspeyres index for the current period is therefore 100(13,400/11,000) = 121.8. This means that prices in the current period are 21.8 percent higher than in the base period.

9.22 Generalizing, the Laspeyres index can be specified as

$$L = \left(\frac{\sum_{i=1}^{K} q_{oi} p_{ti}}{\sum_{i=1}^{K} q_{oi} p_{oi}} \right) \times 100,$$

where

K = the number of property types;
q_{oi} = the quantity of property type i in the base period;
p_{oi} = the price of property type i in the base period; and
p_{ti} = the price of property type i in the current period.

9.23 The following data are needed for calculating a Laspeyres real estate index: (1) the stock of real estate by type in the base period, and (2) the price by type of real estate in the current period relative to the base period price. Ideally, a census of real estate is taken to establish the stock and price for each type of real estate in the base period. Each real estate type i in the base period should be defined to be some common real estate type meaningful for the particular economy (such as two-bedroom apartment, or center-city street-level retail space between 80 and 100 square meters). The index itself is a pure numeric scalar that can be compared between economies without having to directly compare the types of real estate in each economy.

9.24 A Laspeyres index is well suited for constructing broad measures of prices, such as national indices

[8] A standard unit of real estate, separately identified for residential and commercial, is a construct that attempts to take account of all the specific factors that might affect the price of real estate. This construct is associated with hedonic methods of calculating real estate price indices, described below.

of house prices or national accounts estimates of imputed rent for owner-occupied residences.[9] It can also be used for targeted measures of prices, such as housing in the capital city. Problems in Laspeyres indices can arise to the extent that they do not reflect the current mix of transactions, may not capture information on sectors where a standard unit of real estate cannot be defined, and do not adequately capture information on rapidly developing sectors.

Hedonic or quality-adjusted regression price indices

9.25 Hedonic regressions derive the price series for a standard real estate unit by using econometric regressions to remove the influence of specific quality factors that affect actual sales prices. The factors typically include the age of the unit, size, number of rooms, physical location, and facilities such as running water or toilets. The relevant factors differ by country. The use of hedonic regressions is a more advanced approach to calculating real estate price indices. However, this approach requires detailed data on the characteristics of each property and may be challenging to apply.

9.26 In view of the complexity of the defining characteristics of real estate properties, and particularly the effect of the age of structures on prices, hedonic regressions—updated at reasonably frequent intervals—are often used to estimate the evolution of real estate prices. Hedonic models were first defined in the work of Griliches in the 1960s.[10,11] An advantage of hedonic regressions is that they can utilize data from virtually all transactions without having to undertake a base period census. Another advantage is that a variance (disturbance term) not explained by the econometric model is generated, which gives an idea of the dispersion of prices and period-to-period variation after controlling for the mix in property characteristics.[12]

[9]See *1993 SNA,* paragraphs 6.29 and 6.89.

[10]See Griliches (1964).

[11]An example is provided in Case and Szymanoski (1995).

[12]Hedonic estimates can be used in Laspeyres indices. For example, the U.S. Bureau of the Census used this approach for single-family houses until 1996, fixing the house characteristics over the period of the index. Subsequently, indices were constructed that allowed for changes over time in house characteristics as preferences changed.

Liquidity-adjusted price indices

9.27 Liquidity-adjusted price indices adjust price measures to separately account for the influence of changes in the volume of transactions on prices. Market liquidity refers to the speed at which real estate transactions take place, which is a reflection of the relative strength of market demand for real estate relative to supply. Prices are often positively correlated with liquidity, rising during periods of fast turnover, and falling during slowdowns. By factoring in information on the volume of transactions during a given period, it is possible to estimate the separate price effect due to changes in the transactions volume and thus derive a measure of the underlying price movements as if there were no changes in the volume of transactions.

Commercial real estate indices

9.28 The principles described above apply to residential and commercial real estate, but there are some special features of commercial real estate that can either complicate or ease the task of compilation of price indices.

9.29 A complicating factor is the great diversity of types of commercial real estate, which may be highly specialized to serve of the specific business of the occupant. Such specialization means that property price may be closely linked to the success of the occupant's business, or to the need for potential purchasers to make substantial investments in a property to customize it to their needs. Moreover, the number of transactions may be much smaller than in the case of residential transactions, which means that both the mix of transactions and the value of transactions may be quite volatile across reporting periods. Another complicating factor is that statistical reporting systems often do not effectively pick up the relatively small number of commercial transactions—as they may involve privately negotiated sales—and the changing patterns of new construction. Moreover, experience suggests that commercial real estate indices tend to be based on localities, such as big cities, where there are specific concentrations of properties available commercially.

9.30 Facilitating the process of compiling price indices for commercial real estate is the fact that

commercial real estate can be characterized as a commodity consisting of square footage or square meters of commercial space for which rental or use values can be estimated. The stock, new construction, rental rates, and vacancy and occupancy rates can all be measured in terms of space. For example, rental rates are often expressed in terms of the annual cost per unit of space, most commonly per square meter. Such measures can also be used for purposes of international comparison of rental costs. Importantly, commercial real estate brokers and lenders often collect current and detailed information on prices, turnover, and demand and supply, all of which can be useful in compiling commercial real estate price indices. Agents and lenders in some countries already compile such indices.