

Chapter Nine

Real Estate Price Indices

Introduction

9.1. For macroprudential analysis, it is highly desirable to have indices of real estate prices both because of the large exposures (both direct and indirect) of deposit-takers to real estate and the potential volatility of price movements.

9.2. There are various sources of deposit-takers' exposure to real estate prices. Deposit-takers' may:

- own real estate;
- lend to customers to purchase, construct, or develop real estate;
- take collateral in the form of real estate from customers to whom they have lent;
- lend to other deposit-takers with real estate exposures, or to fund real estate-related lending;
- be exposed to real estate-related lending of subsidiaries or branches in other economies;
- be exposed to the wider macroeconomic impact on households and corporations arising from changes in the servicing costs of real estate-related borrowing and/or price movements, because of the importance of real estate and real estate borrowing in total assets and liabilities;
- and, be exposed to specific locations (such as tourist facilities or center city offices) that may not reflect demand/supply and price conditions in the wider real estate market.

The direct exposure to risks arising from real-estate related lending to customers can be monitored through the FSIs related to real-estate loans that are described in Chapter 6.

9.3. The reasons why real estate prices are potentially volatile are various. Real estate markets are illiquid with sales negotiated with high transactions costs, and supply is inelastic in the short term as development is often subject to many restrictions, whether legal or actual such as a shortage of buildable urban land. 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 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 activity, credit, and prices to become reinforcing.

Measuring real estate prices

9.4. There is limited international experience in constructing representative real estate price indices, reflecting the difficulty of the task. The difficulties arise because real estate markets are heterogeneous, both within and across countries, and illiquid. There may be no unambiguous market price. Moreover, diversity and lack of standardization results in the need to gather a wide range of data to compile indices that are characteristic of the various market segments—contributing to high data collection costs and a need for technical sophistication. Also, representative real estate prices in residential and commercial markets can be hard to measure accurately with small samples, as there may be disparate prices for apparently similar properties and prices may be volatile. Experience has shown that there are particular difficulties in measuring commercial real estate prices across the economy.

9.5. Given these difficulties, the relative lack of international experience in constructing real estate price indices, and the cost involved in creating real estate price indices, the *Guide* describes a range of techniques whose application can be based on local needs, conditions, and resources rather than recommending a single set of indices or compilation methods. Indeed, given that the content of indices and the technical capacity to construct indices is likely to vary considerably among countries, it would be inappropriate to make such recommendations at this time. Nonetheless, the *Guide* does

recommend the need for separate indices for residential and commercial real estate, because of the highly different conditions prevailing in the two markets.

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

- There is likely to be a wide range of differences between each property. 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 quantity weights to use in indices.
- For sub-indices in particular, there may be too few observations available within a given period relative to the total stock to draw valid statistical conclusions.
- New investment and construction may involve large exposures for financial institutions, but may be highly focused and untypical of the broad markets. Moreover, new ventures may not be well covered in on-going statistical systems.

9.7. 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 sub-indices for at least some market segments, over and above what would be required for an accurate aggregate index. For instance, there may be demand for sub-indices that cover large urban centers, like cities. Sub-indices for key types of real estate combined with information on key real estate exposures can help in the analysis of how price changes might contribute to specific 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. But, as noted above, compiling the necessary information may be challenging both from data collection and technical viewpoints.

Structural indicators of real estate markets

9.8. In order for an economy 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 affecting price to be collected. At its core, this would involve the preparation of inventories of the stock of residential and commercial properties to provide a baseline for compilation of price indices. Perhaps as important, these data could also contribute to the construction of basic statistics on social and economic conditions.

9.9. The inventory could be developed through the use of periodic surveys or censuses of real estate updated by information from transactions records or ongoing surveys.¹⁸³ Transaction records are obtainable from the authority—usually a local or national registry—that is responsible for recording the transfers of property ownership in their locality. Such authorities are likely to keep records of the properties in their locality and who owns them. When ownership changes hands, these authorities update their records. Related to this can be so-called assessment data that are used for the determination of any property taxes on the real estate. 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 upon the characteristics of each property, with the relevant characteristics determined by local circumstances.¹⁸⁴ 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—would assist in the creation of a price index if 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.

9.10. Specifying characteristics (categories) of real estate in any inventory is important. Such categories should be sufficiently disaggregated to be able to identify the

¹⁸³ One possibility is 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.

¹⁸⁴ These and other data sources are discussed in *Journal of Housing Research*, “Data Sources for Measuring House Price Changes” (1995), Henry Pollakowski.

key features of the real estate, 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 determined by national authorities, based on the local conditions and needs. Set out ahead are some of the key categories typically required for the construction of real estate price indices, along with some other important structural information on the real estate market of general economic and socio-demographic importance:

- **Number of units, by major type of unit, by location:** In this category, for residential real estate, a unit might be a single-owner dwelling; the type might be a detached, semi-detached, town house, or apartment; and location would be the address.
- **Purpose:** This category attributes a real estate unit by its use, such as a dwelling, shop/retail outlet, a factory, or government offices.
- **Age of unit** in years since construction.
- **Size in square meters or square feet of the structure and lot.**
- **Number of rooms:** This category could itemize the number of bedrooms, and bathrooms.
- **Utilities and amenities:** This category would include whether the property has a water supply connection, sewerage connection, and electricity.
- **Physical condition,** such as interior and exterior maintenance and/or evidence of damage
- **Last sales date and value; current market value,** and **tax valuation** for real estate units.
- **Vacant units:** Real estate units not in use.

- **Tenure:** This category would include the status of the occupant—owner-occupied (freehold or leasehold), private rental, or public sector rental.
- **Rental information** in terms of the amounts paid to rent the real estate unit.
- **Number of occupants** in residential real estate units.
- **Building permits**, completions, or other measures of current activity

9.11. The above information can be used to develop price indices described in the next section. Further, an average sales price statistic in each reporting period can be calculated by taking the information on the sale prices agreed divided by the number of unit transacted during the period. This “unit value index” is not a price index and 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. But unit value indices are probably the most widely available price measures for real estate and sometimes provide useful information about large changes in prices, especially if highly disaggregated, more homogeneous, sub-indices are compiled. However, they are generally considered less reliable than the price indices described in the next section.

9.12. Also, with the above information, data can be compiled on the turnover, key structural features of, and general conditions in, the real estate market, that helps supplement real estate price information when undertaking financial sector stability analysis.¹⁸⁵ For example, the following basic information could be compiled—split between residential and commercial property, by city or other geographic location:

- Total stock in number of units, and the change in stock.
- Occupancy rate, and vacancy rate.
- Total number of transactions, annually or quarterly.

¹⁸⁵ The inventory of real estate market conditions described here does not provide a complete picture of the financial sector stability implications of real estate. A more complete analysis would include compilation of key financial data that cover financial institutions’ exposures and the financial conditions of occupants and purchasers.

- Average rents per residential unit, or unit of business space (such as square meter).

Constructing real estate price indices

9.13. 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 calculate a composite or standard unit of real estate.¹⁸⁶ In a price index, the effects of changes in the composition of transactions or changes in quality can be removed. Price indices are pure numbers describing a change from a benchmark unit of value (usually 100) in a base period, and as such, they can be compared among economies with different types of real estate.

Laspeyres real estate indices

9.14. A Laspeyres price index for real estate calculates the weighted average change in prices over a period for a fixed basket of real estate in some base period. In effect it compares the total cost of purchasing quantities of real estate in the base period with the total cost of purchasing the same quantities 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.

Table 9.1: Quantities and Prices of Real Estate

Type of Property k_i	Base period quantity q_0	Base period price p_0	Current period price p_t
A ($i=1$)	160	50	60
B ($i=2$)	30	70	90
C ($i=3$)	10	100	110

¹⁸⁶ 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 ahead.

9.15. 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: $(160)(60) + (30)(90) + (10)(110) = 13,400$

(iii) The Laspeyres index for the current period is therefore: $100(13,400/11,000) = 121.8$

9.16. Generalizing, the Laspeyres index can be specified as:

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

Where,

K is the number of property types,

q_{oi} is the quantity of property type i in the base period

p_{oi} is the price of property type i in the base period, and

p_{ti} is the price of property type i in the current period.

9.17. 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 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 types (such as two-bedroom apartment, center city street-level retail space between 80-100 square meters) meaningful for the particular economy. 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.

9.18. A Laspeyres index is well suited for broad measures of price changes, such as national indices of house prices or national accounts estimates of imputed rent for

owner-occupied residences.¹⁸⁷ It can also be used for targeted measures such as housing in the capital city. Potential problems in Laspeyres indices arise because it does not reflect the current mix of transactions, may not capture information on sectors where a standard unit of real estate cannot be defined, and may miss rapidly developing sectors.

Hedonic or quality-adjusted regression price indices

9.19. The use of hedonic regressions is a more advanced approach to calculating real estate price indices. Any compiler intending to undertake such an approach must be aware that it is expensive in terms of data demands—requiring detailed transactions data—and professional support.

9.20. Hedonic regressions derive the price series for a standard real estate unit by regressing and removing the price influence of multiple specific quality factors that affect actual sales prices. The factors typically include age of the unit, size, number of rooms, physical location, and facilities such as running water or toilets. The relevant factors can differ by country.

9.21. In view of the complexity of real estate properties and their defining characteristics, and particularly, the effect of the age of structures on prices, hedonic regressions—updated at reasonably frequent intervals—are conceptually the best method to estimate the evolution of real estate prices. Hedonic models, first defined in the work of Griliches in the 1960’s,¹⁸⁸ are well-known and generally accepted as best practice measures for constructing real estate price indices. An important advantage of hedonic regressions is that regressions 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 property characteristics.

¹⁸⁷ See *1993 SNA*, paragraphs 6.29 and 6.89.

¹⁸⁸ For instance, Griliches (1964) “Notes on the Measurement of Price and Quality Changes” in *Models of Income Determination*, Studies in Income and Wealth, NBER Report, Princeton University Press.

9.22. Three variations of hedonic methods are described in Table 9.2.

Table 9.2: Regression Methods to Measure Real Estate Price Indices		
Method	Description	Features
Simple hedonic price model	Estimate of the price of a standard real estate unit through regression on all transactions, taking into account variables affecting price.	Covers all transactions.
Weighted repeat sales model	Examines price change on all units within a sample that transact more than once during the period.	Method provides for great homogeneity between the price index base and current period, and also tends to capture most active segment of market. Method is only feasible if a significant number of paired observations are available. A problem is that some types of property may have multiple sales more often than other types of property.
Hybrid of simple hedonic and repeat sales model	Uses two jointly estimated equations covering all multiple transaction pairs, and all other units that transacted only once.	Makes maximum use of available information.

Descriptions drawn from Case and Szymanoski, *Precision in House Price Indices: Findings of a Comparative Study of House Price Index Methods*. Journal of Housing Research (Volume 6, No. 3. pp. 483-496).

Commercial real estate indices

9.23. 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.

9.24. A complicating factor is the greater diversity of types of commercial real estate, which may be highly specialized because of the specific business of the occupant. Such specialization means that the price of the property may be closely linked to the business success of the underlying business, or to the need for potential purchasers to make substantial investments into a property to customize it to their needs. Also, the

number of transactions may be much smaller than residential transactions, which means that the mix of transactions and the value of transactions within each reporting period may be quite volatile. Another problem is that statistical reporting systems may not effectively pick up the relatively small number of commercial transactions—often because they may involve privately negotiated sales—and the changing patterns of new construction.

9.25. Easing the process is the commercialized nature of the product, which permits many properties to be characterized as a commodity consisting of square footage or square meters of commercial space for which rental values can be estimated. The stock, new construction, rental rates, and vacancy and occupancy rates can all be measured in terms of space. 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 comparisons of rental costs.

9.26. Experience suggests that commercial real estate indices tend to be based on localities, such as big cities, and perhaps because of the smaller sample, more volatile than residential real estate indices.