Real Estate Prices: methodological frameworks – the international handbooks on Residential Property Price Indices and Commercial Property Price Indices

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Abstract

The need for reliable indices on property prices was recognized at a conference organised by the International Monetary Fund (IMF) and the Bank for International Settlements (BIS) in Washington DC, in October 2003. Subsequently both residential property prices and commercial property prices have been included in the IMF's list of Financial Soundness Indicators (FSIs) and the accompanying compilation guide[i]. The need for reliable indices has been demonstrated by the sub-prime mortgage crisis and the steep decline in property prices from 2006 and the subsequent world recession. A new international Handbook on Residential Property Price Indices [ii] has been published under the auspices of the Inter-Secretariat Working Group on Price Statistics and with Funding from the Statistical Office of the European Community (SOEC). It explains the different user needs, gives details of data sources and compilation methods and makes recommendations. SOEC has also commissioned an international handbook on commercial property price indices. In this paper I present the RPPI handbook and introduce the project relating to the companion handbook on commercial property price indices.

Keywords: price indices; concepts; methodologies; international handbooks.

1. Introduction

The sub-prime mortgage crisis and subsequent world recession, was preceded by years of low interest rates and easy credit conditions which fueled a housing market boom and encouraged an unsustainable level of debt-financed consumption.

The IMF has had a long-term commitment to strengthening financial system stability, including efforts to promote the compilation and use of Financial Soundness Indicators (FSIs) for macro-prudential surveillance and crisis prevention.

FSIs are a set of economic statistics used by national authorities and in the Financial Sector Assessment Program (FSAP)[iii] and in ongoing Fund surveillance to assess the financial strength and vulnerabilities of a country's financial sector. They increase transparency in the international financial system and strengthen market discipline[iv].

Residential real estate prices and commercial real estate prices are two of four indicators relating to real estate markets. When first included in 2003 the IMF noted.

1. "Currently, there is limited international experience in constructing representative real estate price indices, as real estate markets are heterogeneous, both within and across countries, and illiquid.
2. "There is currently limited international experience in constructing representative real estate price indices for the commercial sector".

In recognition of the need for practical guidance to compilers of real estate price indices, SOEC, under the auspices of the Inter-Secretariat Working Group on Price Statistics (IWGPS)[v], has funded the compilation of two handbooks: the recently published RPPI Handbook on Residential Property Price Indices (RPPIs) and the

recently commissioned Handbook on Commercial Property Price Indices (CPPIs).

Interest and demand in these two indicators has been heightened by the financial crisis. Both are relatively under-developed and where indices are published there is little harmonization of compilation methods. This paper summarises the contents of the RPPI Handbook and the work being undertaken for the CPPI Handbook.

2. Handbook on Residential Property Price Indices

The challenges associated with compiling a residential property price index are.

1. The problem of a multi-purpose index - there are *several distinct purposes* for which a RPPI is required and different purposes require different indices. This is primarily a conceptual issue.
2. The problem of heterogeneity. The compilation of price indices typically relies on the *matching* the prices for identical items over time. However, each property has a unique location and usually a unique set of structural characteristics. The matched model methodology is difficult to apply.
3. Transactions are sporadic.
4. For some purposes, notably the construction of national balance sheets and the estimation of user costs of owner-occupied housing, a decomposition of a property price into the land and structures components is required.

This handbook gives comprehensive advice on the compilation of RPPIs. It provides an overview of the conceptual and theoretical issues, explains the different user needs and gives advice on how to deal with the practical problems that confront statistical offices in the construction of such indices. Topics covered include: a description of the different practices currently in use and advice on alternative methodologies.

Conceptual issues

No single indicator can satisfy every purpose. For instance, the price dynamics of the housing market for monitoring house inflation, as experienced by purchasers, may be estimated by constructing a price index of housing unit sales from information on current transaction prices. But to estimate an economy's (real) stock of wealth, information on transacted dwellings must be complemented by data on the stock of non-transacted dwellings in order to construct a price index for the housing stock.

The above illustrates the principle that the target index will depend on its purpose. The *System of National Accounts (SNA)* should be used as the conceptual framework.

The Handbook reaches the following conclusions.

Weighting

A price index which is required to measure the *wealth* associated with the ownership of residential property should be *stock-weighted*. A *stock-weighted* index is also appropriate for a financial stability indicator used to identify property price bubbles.

A price index which is required for measuring the *real output* of the residential real estate industry should be *sales-weighted*. This is consistent in treatment to the acquisition or purchase of goods and services in a consumer price index (CPI).

Index scope

A price index which is required to measure the *wealth* associated with the ownership of residential property should cover both existing properties and properties which have been recently built. This also applies to an index used as a financial stability indicator.

A price index which is required for measuring real investment in the residential real estate industry should cover sales of new property. The construction part of new

housing produced is part of *gross investment*. The cost of the land, apart from the value of any improvements made to this element, should be excluded for this purpose. But a price index for the sales of both new and existing houses is required to construct real output measures for the activities of real estate agents in selling houses. The scope of the index for this application should cover both the structure and land values.

A price index restricted to new properties is also appropriate when a residential property price index is an input into a CPI for the measurement of owner-occupier housing costs on a net-acquisition cost basis, where the CPI covers the cost of acquiring properties which are new to the housing market. This approach treats the purchase of a dwelling exactly like the purchases of any other consumption good.

Constant Quality

A residential property price index compares the values of the sales or of the stock of residential property between two time periods after allowing for changes in the attributes of the properties. It is necessary to decompose price changes into those associated with changes in attributes and the residual which relates to the underlying "pure price" change. A constant quality price index is appropriate for both a stock and sales-weighted price index and for all purposes.

Compiling a constant-quality residential price index can be difficult, largely due to the nature of the housing market and the lack of relevant information.

1. Residential properties are heterogeneous. No two properties are identical. This would not be problematic on its own as long as detailed descriptions of each property sold were recorded.
2. Property sales are infrequent - in many countries, less than ten per cent of the housing stock changes hands every year – and prices are often negotiated. The compiler will not be able to obtain a selling price for a particular house in successive index periods.
3. The price of a property is not fixed and can change throughout the transaction process until finalized on transfer of ownership. The registration of the transfer of ownership may take many months to complete and the transaction price recorded may be depressed to avoid taxes. A property's market value – and the detailed market valuation of its characteristics (see bullet point (1)) may only be known after a significant time-lag and even then could be suspect.

There are a number of practical methodologies which can be used to construct a "constant quality" index, which overcome the above problems by varying degrees. Four methods have been studied in depth in the handbook: stratification or "mix-adjustment"; hedonic regression methods; repeat sales; and appraisal-based methods (the SPAR method). Each method attempts to adjust for the change in the "quality mix" of the houses whose prices are combined to construct the index.

1. Stratification or mix-adjustment

This is the most straightforward way to control for changes in the composition of properties sold. The handbook recommends this method where the volume of sales is large enough to support a detailed classification of properties but takes the view that it is second best to hedonic regression if there are sufficient data available to use the latter. Stratification can generate sub-indices for different housing market segments. The effectiveness of stratification depends upon the stratification variables, because it will not account for changes in the mix of properties sold within each stratum.

The more detailed the stratification, the more the index controls for changes in the characteristics of the properties covered but increasing the number of strata reduces the average number of price observations per stratum and can lead to empty cells and a lack of matching observations across two time periods.

The main advantages of stratification/mix-adjustment are.

- It adjusts for compositional change amongst the dwellings (although its effectiveness depends on the choice of stratification variables).

- It is reproducible.
- It is not subject to revision.
- Indices can be constructed for different types and locations of housing.

The main disadvantages of stratification/mix-adjustment are.

- It requires information on relevant housing characteristics to construct appropriate strata. This includes age of structure to allow for depreciation & the "condition" of the property to allow for major repairs and renovations.
- If the stratification is coarse, compositional changes will affect the indices but if the stratification is fine, the cells can be subject to considerable sampling variability due to small sample sizes or some cells may be empty.
- The value of land cannot be separated out.

Thus, the handbook concludes that stratification/mix-adjustment is an appropriate method where.

- There is a suitable level of detail for the cells and it can be applied in practice.
- The age of the structure is one of the stratification variables.
- A decomposition of the index into structure and land components is not required.

2. Hedonic regression

The handbook takes the view that, if sufficient data is available, hedonic regression is the best technique for constructing a constant quality residential property price index, especially when combined with stratification

Hedonic regression is a statistical technique that measures the relationship between the observable characteristics of a good or service and its price or value. In the context of residential property price indices, the "best" form of the hedonic function may be linear rather than log-linear to reflect the fact that the value of a property is generally equal to the sum of the price of the structure and the price of the land.

Hedonic imputation is recommended. A separate hedonic regression is performed in each time period and the "missing" current period prices for the properties sold in the base period are imputed using the predicted prices from the hedonic equation. A symmetric approach is possible by imputing the "missing" base period prices for the properties sold in the current period and taking the geometric mean of both indices.

Hedonic regression can suffer from omitted variable bias and multi-collinearity can be a problem, particularly when a decomposition into structure and land is required.

The main advantages of hedonics are.

- It can adjust for both sample mix changes and quality changes over time of the individual houses.
- It maximizes the use of data.
- Price indices can be constructed for different types of dwellings and locations through stratification and the application of hedonics to each individual stratum.
- In principle, it can decompose the index into land and structure components.

The main disadvantages of hedonic regression are.

- It is data intensive.
- It may be difficult to control sufficiently for location if property prices and price trends differ across detailed regions.
- The outcome can be sensitive to the variables used in the regression and to the functional form for the model.
- It is less transparent than stratification.

3. Repeat sales

The repeat sales method observes the price development of a specific sample of houses over a period of time by reference to the selling price each time each house is sold. The price change of a selection of houses during overlapping time periods is observed to estimate, using a simple dummy variable regression model, the general trend in residential property prices. Measuring the average price changes in repeat sales on the same properties ensures a "like for like" comparison although it ignores depreciation and renovations on the structure between the periods of sale.

The handbook takes the view that the repeat sales method is not as good as hedonics but can be applied where sample selection bias is not a problem and no distinction between the structure and land is required. It can be a useful method where housing characteristics are limited but the number of repeat transactions is large.

The main advantages of the repeat sales method are.

- It requires no characteristics information so can be used on administrative data.
- It follows a matched-model methodology with no imputations.
- Standard repeat sales regressions are easily run and the indices easy to construct.
- By construction, location is automatically controlled for.
- The results are reproducible.

The main disadvantages of the repeat sales method are.

- It uses information only on those properties that have sold more than once during the sample period so discards information on other sales and can suffer from sample selection bias.
- Newly built dwelling units are excluded.
- It ignores (net) depreciation.
- It cannot generate separate price indices for structures and for land.
- There may not be enough repeat sales to compute monthly (sub-) indices.
- It could be subject to revision when transaction information becomes available for houses not previously in the index.

4. Appraisal-based methods (most particularly the SPAR method)

Appraisal-based methods use "assessed" values, such as valuations for taxation purposes or valuations from specially commissioned surveys using estate agents, to overcome the two main problems associated with the repeat sales methodology – the relatively small number of price observations which are generated and the susceptibility to sample selection bias. Where the valuations refer to a standard reference period, the matched model methodology can be applied. Like the repeat sales methodology, appraisal-based methods generally cannot deal adequately with quality changes to individual houses.

Assessed values can be used in addition to sale prices in a repeat sales framework. For each property sold in some comparison period there is a sale price & a base period "price" – the assessed value. Price relatives with a common base period – the valuation period – can then be constructed

The Sale Price Appraisal Ratio (or SPAR) method uses appraisals with a common reference period as base period prices in a standard matched-model framework.

The main advantages of the SPAR method are.

It follows standard matched model methodology and is straightforward to compute.

- It less susceptible than repeat sales to problems arising from a relatively small number of price observations and from sample selection bias.
- It is reproducible and doesn't suffer from revisions.

The main disadvantages of the SPAR method are.

- It cannot deal adequately with quality changes (depreciation and renovations).

- Value assessments at the address level must be available for all properties.
- It is dependent on the quality of the assessments.
- It cannot provide a de-composition into the land and structures components.

The Handbook concludes that the SPAR methodology is better than repeat sales if the assessed values are reliable, particularly if used in conjunction with stratification.

3. Commercial Property Price Indices

The drafting of a Handbook on Commercial Property Price Indices (CPPIs) can be seen as a natural development from the RPPI Handbook. The importance of this initiative is exemplified by the fact the G20 2011 data gaps initiative included CPPIs in a list of statistics which needed improvement. As with the RPPI Handbook, the CPPI Handbook will cover conceptual frameworks, the purposes and uses of CPPIs, current compilation practices and the relative merits of different methodologies.

Compared with information on residential property prices, information on commercial property prices is much reduced, e.g. there are fewer transactions, and there is even greater heterogeneity. Other problems also arise. For instance research indicates that appraisal-based information has systematic problems far greater than in the residential property market that are far more difficult to detect due to commercial property having the high level of heterogeneity compared to housing. It has been suggested that this kind of problem was a major factor in the delay in disposing of bad loans by financial institutions following the recent property bubble collapse[vi]. The options for index construction and the relative merits of different methodological approaches differ for a CPPI compared with an RPPI. For example, one option available for CPPIs is the construction of stock-market-based indices[vii]. These track the pricing and investment performance of commercial properties.

A final version of the handbook will be ready for publication in early 2015 and it is planned to have a related conference to present its contents, including the recommendations. A draft will also be accessible electronically for user review.

5. Conclusions

The RPPI Handbook and the recently commissioned CPPI Handbook are important steps in facilitating the construction of reliable indices for monitoring trends in residential and commercial property prices. The conceptual basis of these indices depends on their purpose and their construction will depend on the available data.

6. References

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[i] Financial Soundness Indicators, http://fsi.imf.org/

[ii] Handbook on Residential Property Price Indices,

http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home

[iii] The Financial Sector Assessment Program (FSAP)

http://www.imf.org/external/NP/fsap/fsap.aspx

[iv] IMF Executive Board Discusses Financial Soundness Indicators

http://www.imf.org/external/np/sec/pn/2003/pn0371.htm

[v] Institutional members are the ILO, ECE, IMF, World Bank, OECD, Eurostat and UNSD.

[vi] Shimizu;Diewert; Nishimura;Watanabe (Conference on Commercial Property Price Indicators, 2012)

[vii] Geltner (Conference on Commercial Property Price Indicators, 2012)