House Price Indexes: Why Measurement Matters

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1 Introduction

Macroeconomists and central banks need measures of residential property price inflation. They need to identify bubbles, the factors that drive them, instruments that contain them, and to analyze their relation to recessions. Timely, comparable, proper measurement is a prerequisite for all of this, driven by concomitant data.

There have been major advances in this area foremost of which are: (i) recently developed international standards on methodology, the Eurostat *et al*. (2103) *Handbook on Residential Property Price Indices;* (ii) an impressive array of data hubs dedicated to the dissemination of house price indices and related series including the IMF's Global Housing Watch and the Bank for International Settlements' (BIS) Residential Property Price Statistics; and (iii) encouragement in compiling and disseminating such measures: real estate price indexes are included as Recommendation 19 of the G-20 Data Gaps Initiative (DGI), and residential property price indexes prescribed within the list of IMF Financial Soundness Indicators (FSIs), in turn included in the IMF's Special Data Dissemination Standard (SDDS) Plus. In this presentation we identify the challenges countries face in the hard problem of measuring residential property (hereafter "house") price indexes (HPIs).[2]

In section 1 we consider some measurement issues making use of country illustrations. Section 2 examines, using a more formal approach to the empirical question as to whether measurement and coverage differences matter and the importance of measurement in modeling house price inflation. Section 3 turns to the similar, though very much harder, measurement area of commercial property price indexes (CPPIs).

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[1] The views expressed herein are those of the author and should not necessarily be attributed to the IMF, its Executive Board, or its management.
[2] We draw on Silver (2011, 2012, and 2013) and Silver and Graf (2014).

2 The Hard Problem of Properly Measuring HPIs

2.1 The Problem

HPIs are particularly prone to methodological differences, which can undermine both within-country and cross-country analysis. Critical to price index measurement is the need to compare transaction prices of representative goods and services, in successive periods, with like. However, there are no transaction prices every month/quarter on the same property. *HPIs have to be compiled from infrequent transactions on heterogeneous properties.* A higher proportion of more expensive houses sold in one quarter should not manifest itself as a measured price increase, and vice versa. There is a need in measurement to control for changes in the quality of houses sold, a non-trivial task.

The main methods of quality adjustment are hedonic regressions, repeat sales data only, and mix-adjustment by weighting detailed homogeneous strata, and the sales price appraisal ratio (SPAR), Eurostat et al. (2013). The method selected depends on the database available. The database needs to include details of salient price-determining characteristics for hedonic regressions, a relatively large sample of transactions for repeat sales, and good quality appraisal information for SPAR.

Second, the *data sources are generally secondary sources that are not tailor-made by the national statistical offices (NSIs),* but collected by third parties, including the land registry/notaries, lenders, realtors (estate agents), and builders. The adequacy of these sources to a large extent depends on a country's institutional and financial arrangements for purchasing a house and vary between countries in terms of timeliness, coverage (type, vintage, and geographical), price (asking, completion, transaction), method of quality-mix adjustment (repeat sales, hedonic regression, SPAR, square meter) and reliability. In the short-medium run users are dependent on series that have grown up to publicize institutions, such as lenders and realtors, as well as to inform. Metadata may be far from satisfactory.

We stress that our concern here is with measuring HPIs for FSIs and macroeconomic analysis. However, for the purpose of national accounts and analyses based thereon, such as productivity, there is a need to both separate the price changes of land from structures and undertake a quality change on structures. This is far more complex since separate data on land and structures is not available when a transaction of a property takes place. Diewert and Shimizu (2013) tackle this difficult problem.

2.2 Country Illustrations

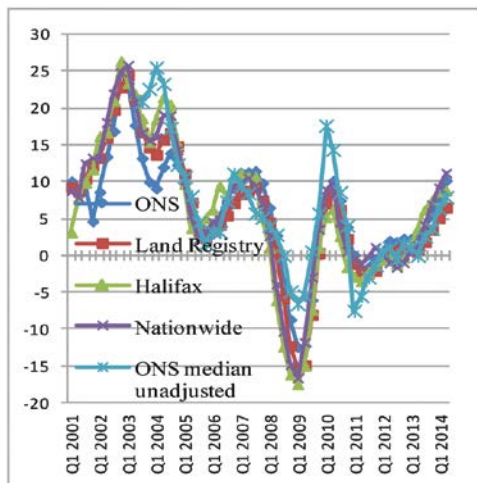*Chart 1: A Feast of UK HPIs*
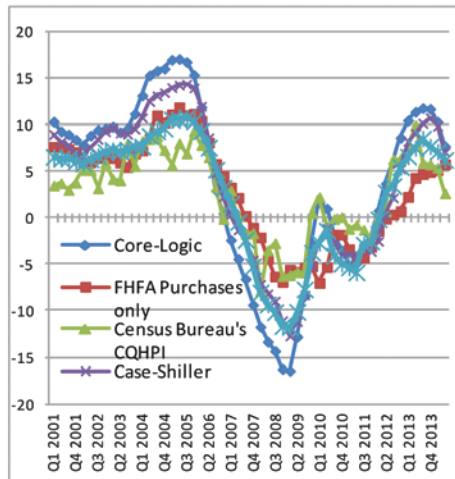*Annual quarterly % rate*

Chart 2: US Repeat Sales HPIs
Annual quarterly % rate

Source: Author's compilation.

Chart 1 shows a feast of HPIs available for the UK including the UK Office for National Statistics (ONS) (UK coverage, hedonic mix-adjusted, completion price); Nationwide and Halifax (both UK, hedonic, own mortgage approvals, mortgage offer price; Halifax weights); the England and Wales (E & W) Land Registry (E & W coverage, repeat sales, all transaction prices); and the ONS Median price index unadjusted for quality mix – given for comparison. Also available are the LSL Acadata E &W HPI (E&W, mix-adjusted with forecasts, all transaction prices) and a realtor, Rightmove (UK, asking prices, hedonic), among others. Measured inflation in 2008Q4 coming into the trough was – 8.7 (ONS) – 12.3 (Land registry) – 16.2 (Halifax) – 14.8 (Nationwide): and – 4.9 (ONS Median unadjusted (for quality mix change); methodology and data source matter.

In contrast for Brazil there is a famine of HPIs: Banco Central do Brasil "Measures the long term trend. It uses individual loan collateral appraisal data to construct series of median house values. These median house appraisals series are filtered using a HP filter. The FipeZap Index of over 100,000 (January 2012) monthly advertised prices of apartments; is a weighted (2000 Census shares in total income) average of median asking prices of 64 cells (16 regions and 4 bedroom sizes). Neither of these measure up to the concepts and standards of the RPPI Handbook.

Chart 2 shows the main HPIs available in the US; they include the: CoreLogic, Federal Housing Finance Agency (FHFA) purchases-only, Case-Shiller, and the FHFA expanded-data HPI, chart 2. These all use repeat sales for quality-mix adjustment. The FHFA expanded-data HPI includes, in addition to purchases-only transactions price information from Fannie Mae and Freddie Mac mortgages, transactions records for houses with mortgages endorsed by the Federal Housing Administration (FHA) and county recorder data. This change in source data coverage accounted for the 4.6 percentage point difference in 2008 Q4 between the annual quarterly HPI respective falls of 16.26 and 11.66 percent for the FHFA "All Purchases" and "Expanded-Data" FHFA HPIs. Coverage limited to particular types of mortgages matters.

Leventis (2008) decomposed into methodological and coverage differences the average difference between the FHFA (then Office of Federal Housing Enterprise Oversight (OFHEO)) and S&P/Case-Shiller HPIs for the four-quarter price changes over 2006Q3-2007Q3. Of the overall 4.27 percent average difference, FHFA's use of a more muted down-weighting of larger differences in the lags between repeat sales, than use in Case-Shiller, accounted for an incremental 1.17 percent of the difference. The manner in which a method is applied matters.

2.2.1 Making Your Own Luck

There is no need to simply accept data sources with associated problems; you can make your own luck. France benefited from the combination of a research-based central statistical agency and a monopolistic network of notaries, 4,600 in 2009. Up to the end of the 1990s, only the "Notaires-INSEE" 1983 apartments' index for the city of Paris was based on such data, though it was not quality-mix adjusted. There has since been a steady program of improvement as a result of close collaboration between the Notary associations and INSEE. Currently, for Paris and separately for the Provinces, there are hedonic quality-mix adjusted HPIs for apartments and houses by about 300 zones comparing transaction prices of fixed bundles of observed characteristics. The hedonic coefficients are now updated every 2 years – previously 5 years – band weights chain-linked (Gouriéroux and Laferrère, 2009).

2.3 More Formally: Does Measurement Matter?

HPI measurement differences may arise from: (i) the method of enabling constant quality measures for this average (repeat sales pricing, hedonic approach, mix-adjustment through stratification, sale price appraisal ratio (SPAR); (ii) type of prices (asking, transaction, appraisal); (iii) use of stocks or flows (transactions) for weights; (iv) use of values or quantities for weights; (v) use of fixed or chained weights; aggregation procedure; (vi) geographical coverage (capital city, urban etc.),

(vii) coverage by type of housing (single family house, apartment etc.) and (viii) vintage, new or existing property.

2.3.1 An Empirical Exercise

Silver (2012) collected 157 HPIs from 2005: Q1 to 2010: Q1 from 24 countries with, for each HPI, explanatory measurement and coverage variables (based on (i) to (vii) above; details are given in Annex 1 of Silver (2012). The panel data had fixed time and fixed country effects; the estimated coefficients on the explanatory measurement variables were relaxed to be time- and subsequently country-varying.

The regressions had substantial explanatory power, $\bar{R}^2$, at about 0.45 in mid-2009, a result especially notable given only fixed effects, and measurement variables were included. Measurement mattered and, in particular, $\bar{R}^2$ increased over the period of recession, when it really matters. On excluding the country- and time-fixed effects, the effect of the measurement variables alone, while diminished, accounted during the recession for about a quarter of the variation in house price inflation rate.

2.3.2 Does It Matter for Modelling?

Silver (2012) took (an earlier version of) the model in Igan and Loungani (2012) (hereafter IL) to illustrate the impact of measurement differences on such analytical models. Country house price inflation for Silver was estimated using (441 (21 countries by 21 quarterly changes) coefficients on country-time interaction dummy variables, from a pooled regression that included measurement variables, and time-varying country effects. Silver employed the same estimator (OLS with robust standard errors), variable list, and dynamics used by IL, but their model was estimated with measurement-adjusted and unadjusted HPIs on the left hand side.

Measurement – adjusted (Madj) estimates were found to improve on the unadjusted ones. Both stock price changes and long-term interest rates had no (statistically significant at a 5% level) affect on HPI changes both for the IL estimates and unadjusted estimates, but did so with the appropriate sign for the measurement-adjusted estimates.

Silver allowed parameters on measurement variables to vary across the 17 countries, for both measurement-adjusted and unadjusted HPIs. The individual results, for example for stock price changes and long-term interest rates, were for the large part – over 70% of the 272 estimates – statistically significant at a 5% level. The disparity between the estimated parameters arising from using measurement-adjusted and unadjusted HPIs, as well as the magnitude of their effects, was found to be quite marked in some countries, including Japan, Netherlands, Switzerland, the United Kingdom and the United States.

3 Commercial Property Price Indexes (CPPIs)

3.1 Alternative Data Sources: Problems

The compilation of commercial property price indexes (CPPIs) is the elephant in the room. Commercial property can be highly heterogeneous and transactions infrequent, more so than for residential, thus complicating comparisons of average transaction prices for a fixed-quality bundle of properties over time. Kanutin (2013) and Silver (2013) highlight some of these limitations, especially for appraisal data. The focus of our work is on better ways of handling transaction data. Two illustrations of technical research work to improve measurement are given below.

3.2 Sparse Data and Index Aggregation in a Regression Framework

CPPI country measurement practice, for the large part, benefits from a regression-based framework, as is the case with HPIs. The transaction-based CPPIs used in this US study were provided to the authors by Real Capital Analytics (RCA CPPI). The empirical work uses two panel data sets: RCA CPPIs from 2000: Q1 to 2012: Q4 for "apartments" broken down by 34 metros/markets areas, and similarly for "other properties."

3.2.1 How to Derive More Efficient Estimates Given Sparse Data

Silver and Graf (2013) (hereafter SG) considered the problem of sparse data and an increase in the efficiency of the estimator. SG used data on "counts"– number of transactions – in each quarter for each area/type of property, provided by RCA, and WLS to improve the efficiency of the estimates, in line with the literature on "errors in measurement" in the dependant variable – Hausman (2001). Such measurement errors result in OLS parameter estimates that are unbiased, but inefficient, with reduced precision and associated lower t-statistics. We found significant differences between OLS and WLS estimates during the recession.

3.2.2 How to Aggregate in Regression Framework: Modeling Spatial Dependency

Index price changes in CPPIs are often measured as parameter estimates on a time dummy in a regression. This formulation for measuring aggregate price change can be subject to omitted variable bias if there are price spillovers across geographical areas. SG included a spatial autoregressive (SAR) term in the regression thus removing potential bias by incorporating spillover effects – a SAR model, Anselin

(2008). SG found the inclusion of a spatial term to significantly affect measured inflation. The OLS estimates were biased upwards against the SAR total (fixed) for apartments (core commercial) by, on average 1.78 (1.68) percentage, and in 2009: Q1 by 2.47 (2.48) percentage points. Moreover, they introduced weights into the hedonic aggregation by means of a novel approach.

4 Summary

For the hard problem for countries of properly measuring residential property price indexes countries generally have available to them secondary data sources, including land registries/notaries, lenders, realtors, buyers, and builders, each of which may have, albethey different, problems of coverage, pricing concept, timeliness, reliability and sufficiency for enabling quality-mix adjustment; harmonization is not a given. Looking at country illustrations we found that measurement matters, even for a given method, however we also showed an example of a country making its own luck and improving its HPIs by adopting a long-run strategies: the way forward.

A formal analysis showed that measurement mattered, and that it really matters when it matters, as we moved into, during and recovering from recession. It also mattered in modeling, but less so than may be envisaged.

The really hard area of price index measurement was for commercial property where transaction data can be very sparse and properties very heterogeneous. Valuation data and methodology for sparse transaction-based CPPIs both need further research and development. CPPI measurement using transaction data is quite technical; two problems looked at were of sparse data and aggregation within a regression framework.

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