House Price Indexes and the Global Financial Crisis
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The European statistical agency, Eurostat, is about to publish a Residential Property Price Index (RPPI) Handbook. This book describes some of the problems associated with constructing price indexes for residential house prices and gives advice on methods that could be used in order to construct house price indexes.

Why is this topic of house price indexes important? The Global Financial Crisis has several causes but a main cause was a housing bubble in the U.S. which led banks to make mortgage loans that were based on the assumption that house prices were not rising unusually quickly. If accurate regional house price indexes for the U.S. would have been widely available to the public, it is unlikely that so many bad housing loans would have been made; i.e., the housing bubble would have been immediately visible and both lenders and borrowers could have foreseen that U.S. house price inflation rates over the period 2000-2007 were not sustainable.

Part of the problem is that national statistical agencies have not constructed official house price indexes. The RPPI Handbook is an attempt by the international statistical community to encourage countries to construct house price indexes according to the suggested "best practices" that are laid out in the Handbook.

Why have national statistical agencies not constructed best practice regional house price indexes.? There are two reasons:

- It is very difficult to construct accurate house price indexes (we will explain why this is the case below) and so statistical agencies have been reluctant to allocate their scarce resources to the construction of indexes where there has not been international agreement on how exactly to construct such an index;
- House prices by themselves do not occupy an important position in the major statistics that countries construct; i.e., house price indexes do not appear directly in either the Consumer Price Index or in the main components of GDP.

However, it could be argued that house price indexes should appear in the CPI as part of the implicit price of a home owner using his or her house. Current CPI practise either ignores owner occupied housing or prices it according to what the rental value of the house is. The first alternative is not very satisfactory and while the second alternative is satisfactory for less expensive houses, it understates the true opportunity cost of owning a very expensive house and using its services. The true opportunity cost of using the services of an owned house is the *maximum* of what the owner could rent the house for and the financial user cost of the capital that is tied up in the house (along with associated

depreciation and tax expenditures). For less expensive houses, the rent is approximately equal to the user cost in most countries but for expensive houses, the rent is only about one half of the corresponding user cost. Thus in order to calculate the true opportunity cost of using the services of an owned house, it will be necessary to construct accurate house price indexes so that accurate user costs can be constructed and a better treatment of owner occupied housing in the CPI and in the national accounts can be achieved.

House price indexes also play an important role in the balance sheet accounts of a country. Moreover, when nominal balance sheet items are deflated, it is necessary to have accurate indexes for the structure part of a house and for the land component. Thus for balance sheet purposes, it is important to be able to decompose an overall house price index into consistent land and structure subcomponents. As will be discussed below, it is not easy to construct these subindexes.

It should be noted that for most countries, private sector companies provide some form of house price index. The problem with these privately provided indexes is that they use different methodologies of varying quality and they are typically not comparable within and across countries. This heterogeneity explains why Eurostat funded the production of a Handbook that outlines various measurement methodologies and provides some guidance to countries who will probably produce official house price indexes in the near future.

Why is it so difficult to construct house price indexes? To answer this question, it is first necessary to explain how price indexes are formed for "normal" commodities like say a can of soup. The basic "matched model" methodology collects prices on the same item (sold in the same location) at two different points in time and then forms a relative price with the current price in the numerator and the previously collected price in the denominator. These price relatives are then aggregated over say several varieties of soup and this possibly weighted average of the soup price ratios is then a soup price index. The problem with constructing a price index for house sales in a given area is that the houses that transact in two different periods are generally *different* and thus the usual "matched model" methodology that is a basic building block in the construction of a price index cannot be applied.

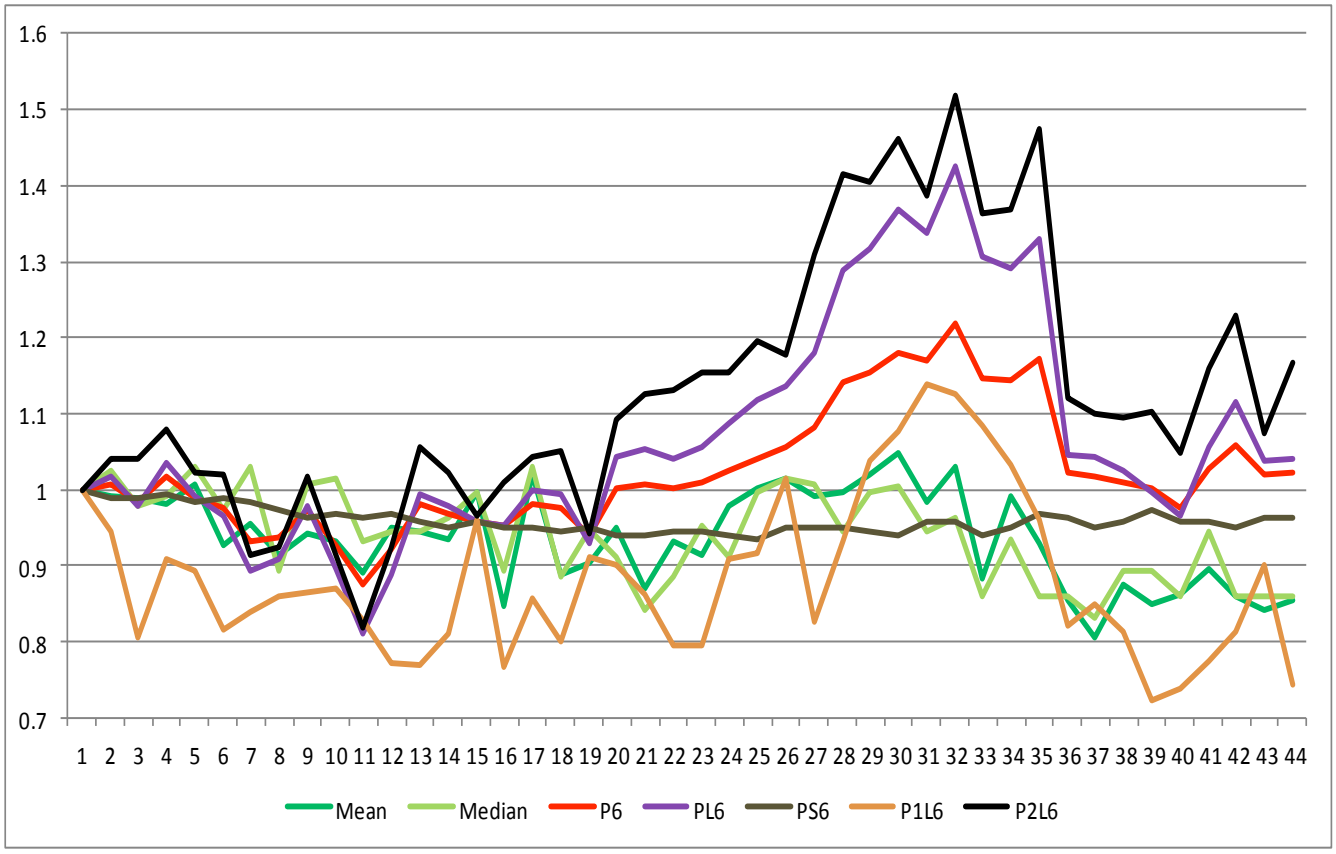
One method for dealing with the lack of matching is the repeat sales method. This method looks only at houses that sold in both of the periods under consideration and so at first glance, it appears that this method solves the lack of matching problem. Unfortunately, the same house at different points in time is not really the same house: in the time between the two sales, the house has depreciated (and hence is less valuable) and it may have undergone some renovations. Thus the repeat sales method generally has a (small) downward bias that will grow as the time between sales grows. Another problem with this method is that it does not use all of the information on house sales that may be available.

How then can accurate house price indexes be constructed? The first step is to determine what are the important price determining characteristics of a house. The main characteristics are:

- The age of the house;
- The size of the land area of the house in square meters;
- The size of the structure in square meters of floor space;
- The type of structure (detached house, apartment, wood construction) and
- The location of the house (which determines its access to amenities)

With the above list of price determining characteristics in mind, the RPPI Handbook recommends two broad methods for matching like with like over time in the housing context: (1) Stratification methods where sales of houses in a given period are grouped into cells where the characteristics of the houses are similar and (2) Hedonic regression methods where the selling price of a house is set equal to a function of the characteristics listed above plus an error term. The RPPI Handbook explains how the above methods work and provides some empirical illustrations of the recommended methods.

We applied one of the RPPI Handbook recommended hedonic regression methods for constructing overall house price indexes that has a decomposition into land and structures components to 5580 detached house sales for 22 wards of Tokyo over the 44 quarters, starting Quarter 1 of 2000 and ending in Quarter 4 of 2010. We decomposed the 22 wards into lower land price wards with a price of land series P1L6 in the chart below and higher land price wards with a price of land series P2L6. The overall land price series in the Chart is PL6 and the overall structures price index for Tokyo is PS6. This index is equal to the MLIT frame house construction cost index for wood frame houses in Tokyo, which we take to be the "true" structure price index for new houses in Tokyo. Our overall house price index P6 is a weighted average of the structures price index PS and the land price indexes for poorer and richer wards in Tokyo, P1L6 and P2L6 respectively. Note that our overall house price index P6 lies above the corresponding Mean and Median house price indexes using the same data set. Thus the Median house price index, which is widely used as a house price index, has a downward bias relative to our hedonic index P6. This downward bias of about 16% over our sample period is due to the fact that the Median index cannot take into account the effects of structure depreciation. Over the two years, 2006-2007, overall land prices increased 27.4%, a mini bubble. Over the same two years, land prices increased about 22.9% for the less expensive wards and 27.2% for the more expensive wards. It can be seen that the fluctuations in land prices are larger in the rich wards and over the entire 11 year period, land prices increased 17% in the richer wards while they decreased 25% in the poorer wards.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Mean
Median
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PL6
PS6
P1L6
P2L6