Issues related to House Price Statistics – Indian Experience

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Abstract: *Real estate activity is a key engine of economic growth which has assumed considerable significance over the years due to its inter-linkage with macroeconomic stability. In the emerging market economies, housing sector activities have implications for basic needs as well as wealth effect and speculation, which necessitate tracking housing prices for macro policy purposes. In India, house ownership is critical for very large population to meet general aspirations of economic well-being. Absence of transparent market, however, makes it imperative to tap alternative sources of housing price data. Against this background, we discuss alternate data sources for assessing movements of house price in India. We discuss here the exploratory work undertaken in the Reserve Bank to initiate a 'Residential Asset Price Monitoring Survey' based on transaction-level housing loan data from banks and housing finance companies. This intends to provide an effective information system for use in monetary and financial stability policy formulation. The evolution and progress of the survey, the compilation of house price indices and other measures, methodological / statistical issues in compiling such indices are discussed.*

JEL Classifications: C43, E31, E52, R21

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This is an exploratory work in progress and not to be quoted.

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1. Introduction:

Real estate activity forms a key engine of economic growth and it has assumed considerable significance in the last decade due to its inter-linkage with stability of real economy globally. Housing is one of the most critical segment in the asset price market in the emerging market economies, particularly in India where house ownership is one of the most critical factor to very large population for facilitating financial inclusion and economic growth. More importantly, housing provides much needed employment as well as identity for a significant size of population at lower stratum. Policymakers and financial institutions monitor trends in house prices to expand their understanding of real estate and credit market conditions as well as to monitor its impact on economic activity, financial stability and soundness. Residential property price indices can be used as a macro-economic indicator of economic growth, a component of wealth, a deflator in the national accounts and as a financial stability or soundness indicator to measure risk exposure. Tracking housing prices becomes imperative due to increased integration with global economy, accelerated real-estate activity with high and resilient growth expectations. The absence of transparent real-estate market in most countries makes it vital to tap alternative sources of housing price data.

House Price Indices serves as a measure of aggregate housing prices. Central banks monitor fluctuations in house price indices to estimate households' borrowing capacity and debt burden and their effects on aggregate consumption. House price data is important to central banks due to its importance for monetary policy, financial regulatory purposes and financial stability (Gerlach, 2012). The Monetary Conditions Index (MCI) used by certain central banks as a day-to-day operating target for monetary policy purpose includes measures of house prices; whereas Consumer Price Index based-inflation targeting central banks uses house price data indirectly for setting interest rates. In short, house price indices are extremely useful indicators for monetary policy and inflation targeting. Many official agencies and central banks compile house price index regularly.

2. House Price Index construction methods: Overview

Construction of a house price index is a challenging job. Firstly, this is due to the heterogeneous nature of dwellings, as observed by Wood (2005). Secondly, the depreciation problem and renovation problem poses challenge to the exact matching of properties over time, according to

Diewert (2009). Infrequency of sales is another problem as stated by Rappaport (2007). The difficulty in applying typical matched model methodology[1] for constructing house price indices arises due to the above reasons. The price determining attributes of individual houses may change with time. An ideal index should be adjusted for such changes and should reflect changes in property prices that are comparable over time. The mix of dwellings sold also can differ from period to period. A good house price index should control for the change in quality and composition of houses sold. Residential Property Price Indices are classified into two broad categories: (a) a constant quality price index for the *stock* of residential housing at a particular point of time, (b) a constant quality price index for residential property *sales* that took place during a particular period of time (Eurostat, 2011).

The conceptual bases and methodology for constructing residential property price indices may vary according to the purpose of compiling these indices and accordingly there cannot be a single index to satisfy every purpose. For the purpose of monitoring house price inflation, the best method is to construct a price index for the sales of housing units, using data on current transaction prices (Eurostat, 2011). According to Rappaport (2007), various methodologies of compiling house price indices have its own conceptual as well as practical advantages and disadvantages. Further, Silver (2012) observed that measurement issues matter while comparing house price indices, specifically during recession. This section discusses different methodologies for constructing house price indices.

2.1 Simple Mean/Median method: In this method, the mean or median[2] of prices of houses sold in a period is considered as a measure of house price changes. Though the method has the advantage of simplicity, simple median indices have the disadvantage of providing noisy estimates of price changes when the composition of houses sold differ from period to period and house transactions are not representative of total stock of housing. Bias in the estimates, due to changing quality of housing stock over time as well as higher frequency of transactions of certain types of houses with varying price pattern, is another major disadvantage of this method. The National Association of Realtors (NAR) median price of existing home sales and U.S Census Bureau median price of new home sales are examples of simple median indices. Rappaport

[1] The compilation of price indices are generally based on matching prices of identical items over time.

[2] Median is preferred over mean due to the positively skewed nature of house prices.

(2007) observed the inefficiency of both NAR and Census Bureau median prices in estimating house price appreciation rate; however both provided excellent estimates of expenditure on house purchase.

2.2 Stratification or Mix-adjusted method: In this method, the total sample of houses are divided into sub-samples or strata and for each stratum, the index is computed as the ratio of average prices of properties in the current period to that of base period. The aggregate mix-adjusted house price index is a weighted average of the indices of each stratum with weight as value share of the respective stratum. The main advantage of this method is its ability to control for variations in composition or quality mix of properties. However, the effectiveness of stratification depends on the stratification variables used. If only physical and locational variables are applied for stratification, this method does not control for quality changes such as renovation, depreciation etc. This can be rectified by performing more detailed level stratification based on such variables; however increasing number of strata reduces number of units per stratum and increases standard error of the overall index. McDonald and Smith (2009) computed a robust measure of housing prices for New Zealand by applying stratification methods on suburb-level dataset from the Real Estate Institute of New Zealand. The House Price Index (HPI) of Australian Bureau of Statistics (ABS) is constructed based on stratification method.

2.3 Hedonic method: -In hedonic regression method, a house is considered as a bundle of attributes pertaining to both the structure and the location of the house, each with its own price that changes over time. The demand and supply pattern of houses implicitly determine the marginal contributions of these attributes to the price of the house. Regression techniques are applied to estimate these marginal contributions or shadow prices. The two best-known hedonic specifications are the fully linear model and the logarithmic-linear model. If the list of available property characteristics are sufficiently detailed, hedonic methods can adjust for both sample mix changes and quality changes of the individual properties. This method has the advantage of constructing price indices for different types of dwellings and locations by proper stratification of the sample. The method is data intensive as it requires data on all relevant property characteristics and hence it is relatively expensive to implement. According to Palmquist (1980), the reliability of price indices based on hedonic regressions depends crucially on the

specification of the regression equation and the method of calculating the index. One of the main drawback of hedonic regression method is its susceptibility to multicollinearity. Wu, Deng and Liu (2014) applied hedonic method to estimate the first multi-city constant-quality house price index in China, by controlling for both quality changes over time of sales and developers' pricing behaviors.

2.4 Repeat-sales method: - In repeat- sales method, price data of properties which have been sold more than once during the sample period are considered. This method attempts to hold the quality of properties constant over time (Rappaport, 2007; Diewert, 2009). Controlling for period-to-period differences in the sample of properties is not required in this method, due to its feature of matched-properties. Bailey, Muth and Nourse (1963), pioneered this method and viewed it as a generalization of the *chained matched model methodology*[3]. This method is comparatively less data intensive, as the data requirement to estimate a standard repeat sales regression equation is limited to price, sales date and address of the properties. The method also controls for cross-sectional variations in attributes, specifically location at the finest level of detail, by default. However, as observed by Diewert (2009), depreciation and renovation problems can adversely affect this method, which in turn can affect the constant-quality assumption underlying the repeat sales method, especially when there is longer duration between sales of the same property. Palmquist (1980) provided a method to adjust depreciation in repeat-sale estimation to isolate true price change. Repeat sales method has limitations due to lower number of repeat sales as compared to total sales. Another drawback is the sample selection bias or transaction bias, which occur when the holding duration of houses are unevenly distributed. Jensen, De Vries, Coolen, Lamain, Boelhouwer (2008) used Case and Shiller's geometric Weighted Repeat Sales Model to compute a monthly house price index for Netherlands. Assil (2012) discussed the efforts of Central Bank of Morocco and the Land Registry Office in constructing a repeat-sales house price index (REPI) for Morocco.

2.5 Appraisal based method: - The Sale Price Appraisal Ratio (SPAR) method combines transaction prices and information on appraised values of properties to construct house price index, as stated by Bourassa, Hoesli, Sun (2004). The method is based on matched model and

[3] For details see Wyngarden (1927) and Wenzlick (1952)

uses information on all transactions that have occurred in a given housing market, and hence is less prone to sample selection bias. Consider samples of properties sold for the base period 0 and for comparison periods *t (t=0, 1 ...T)* denoted by *S (0)* and *S (t)*. Let the price of property *n* in period *t* be represented by p_n^t . In case of houses that were sold in period *t* but not sold in period 0, matching is done based on the assessed values. The valuation period will serve as the base period, and the appraisal for property *n* will be denoted by a_n^0 . Therefore, for all $n \in S(t)$ a price relative – a *sale price appraisal ratio* – p_n^t / a_n^0, can be determined. This can be used in a matched model framework to compute a residential property price index. As the model does not uses information on housing characteristics, it cannot deal with quality changes in housing characteristics. This method is also dependent on the quality of base period assessment data. A study done by De Vries, De Haan, Marien, van der Waal (2009) on house price data of Netherlands concluded that when reliable appraisals are available, SPAR method outperforms repeat sales method and hedonic method. De Haan, Van der Waal, De Vries (2008) reviewed SPAR method from statistical and index number perspective and put forward different types of SPAR indices as well as their stratified versions. Based on a study of New Zealand house prices, Bourassa et al (2004) and further De Vries et al (2009) recommended government agencies to adopt this method for developing house price indexes.

3. Housing Credit Market in India:

The total credit market in India, as assessed by the disbursement of bank credit, steadily moved up from `18135.46 billion in Q1:2008-09 by over three-fold to `57548.13 billion in Q1:2014-15. Credit for housing also increased from `2362 billion by around two-and-half times to `5631.34 billion during this period. The movements in total credit of the banking system, credit for housing and GDP is given in Chart 1. Credit for housing was almost 13 per cent of the total credit in Q1: 2007-08; however the housing credit to total credit ratio gradually decreased and has been fluctuating between 9 per cent and 10 per cent in the last three-and-half years. Housing credit in India has been around 16-21 per cent of the GDP in the last seven years (Chart 2).

Chart: 1

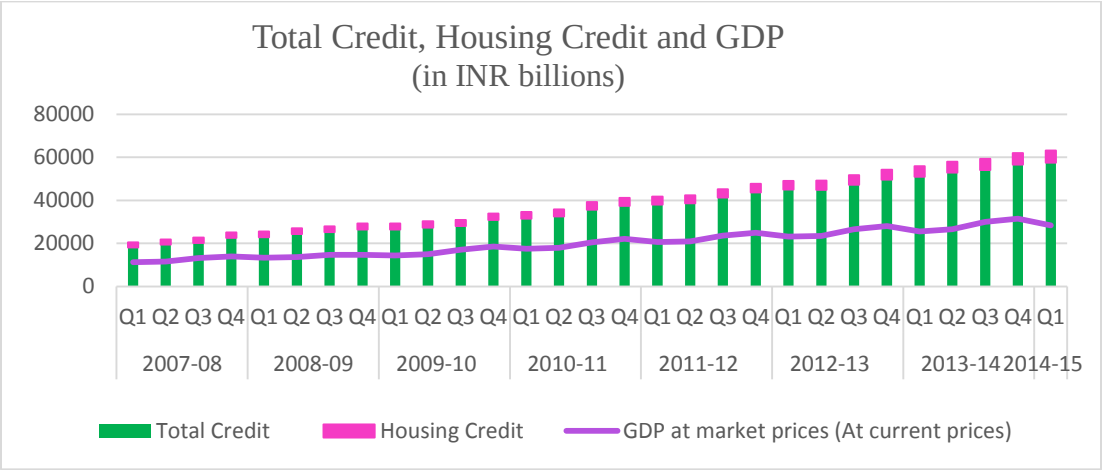
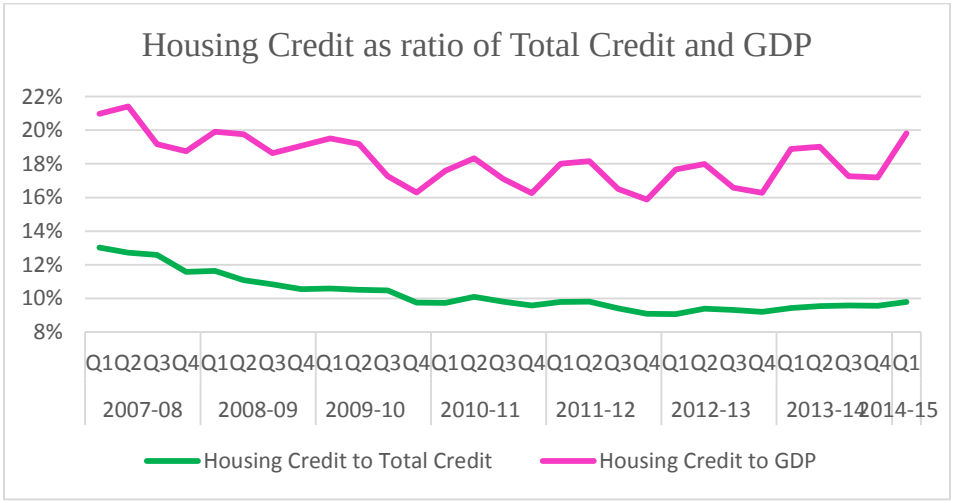


Chart: 2



4. House Price Indices of India

For constructing a house price index, it is necessary to have an extensive range of data at micro level with a desired level of quality. In a country like India, such data are not easily available. In most countries, house price data is obtained from secondary data sources and as such, the nature of house price data depends on the institutional arrangements in a country for selling, financing,

taxing, and registering the sale of a residential property. Silver (2012) observed that, "this gives rise to the potential for quite significant methodological and coverage differences in HPI measurement" in a country. Silver (2012) further discussed about the availability of more than one national index for many countries, each index using quite different methods and having different coverage.

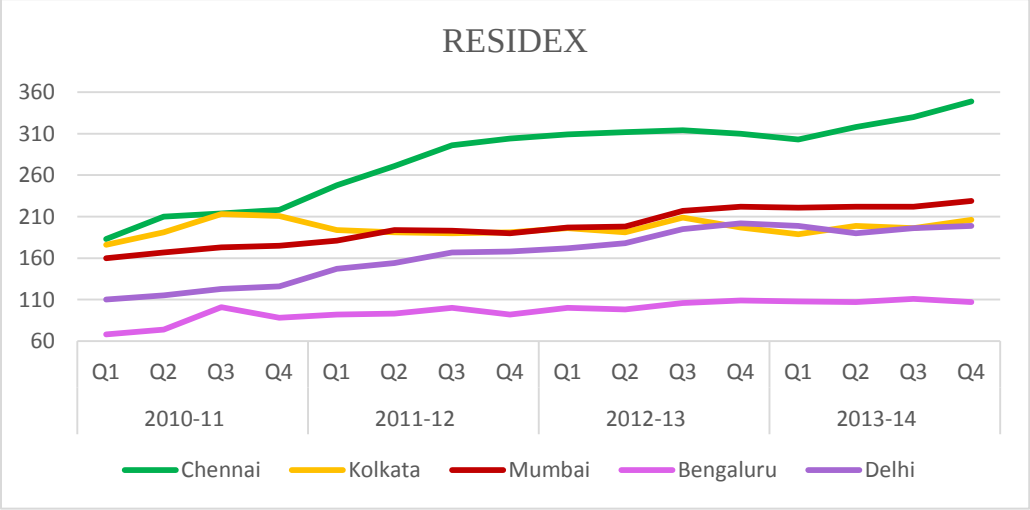
In India, three different approaches for building up house price indices are being pursued, viz., RESIDEX of National Housing Bank, House Price Index (HPI) of Reserve Bank of India based on house registration data and Residential Property Price Index (RPPI), the index based on housing loan transaction data. House Price Indices of India are still in the nascent stage. Athaide (2008) reviewed the applicability of various house price models on the residential real estate market in India and proposed a robust House Price Index for India based on valuation based Hedonic model formulated with Laspeyre's Index and further, a Hybrid model on achieving suitable data quality.

4.1 RESIDEX: - RESIDEX is the first index of residential property prices in India. It was launched by National Housing Bank (NHB) of India in 2007 for tracking prices of residential properties in India, in view of the prominence of housing and real estate in creating both physical and financial assets and its role in overall National wealth. RESIDEX started with a pilot study in 5 major cities, subsequently expanded to include more cities and by Q4: 2012-13 the coverage was extended to 26 cities[4] of India. NHB collects primary data on housing prices from real estate agents by commissioning the services of private consultancy/research organizations of national repute. NHB also collects house price data from housing finance companies and banks based on housing loans contracted by these institutions. Off-late, NHB initiated collection of property price data from 'Central Registry of Securitization, Asset Reconstruction and Security Interest of India (CERSAI)'. Actual transactions prices are considered for construction of RESIDEX. The housing prices for various administrative zones/property tax zones in each city are compiled and RESIDEX is constructed for each city using the weighted average methodology with Price

[4] Bangalore, Bhopal, Delhi, Kolkata, Mumbai, Ahmedabad, Faridabad, Chennai, Kochi, Hyderabad, Jaipur, Patna, Lucknow, Pune, Surat, Bhubaneswar, Guwahati, Ludhiana, Vijayawada, Indore, Chandigarh, Coimbatore, Dehradun, Meerut, Nagpur and Raipur

Relative Method (Modified Laspeyre's approach) using 2007 as base year. Presently, the All-India RESIDEX is not constructed. NHB is in an attempt to expand RESIDEX to 63 cities which are covered under the Jawaharlal Nehru National Urban Renewal Mission, in a phased manner. It is envisaged to develop a residential property price index for select cities and subsequently an all India composite index by suitably combining these city level indices to capture the relative temporal change in the prices of houses at different levels. RESIDEX for major cities in the last four years is given in Chart 3.

Chart: 3

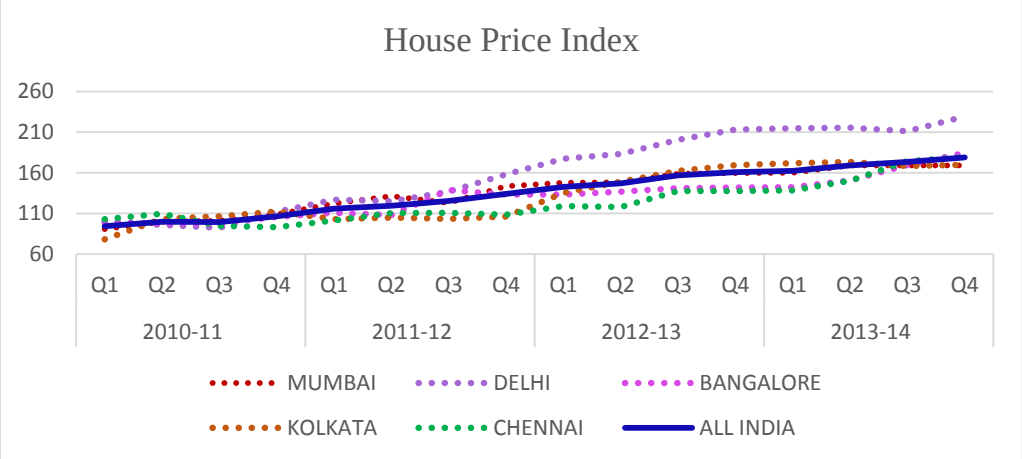


4.2 House Price Index (HPI): In India, it is mandatory to register all properties with the concerned registration authorities and hence these authorities have transaction details of properties in their jurisdictions. The Reserve Bank compiles House Price Index based on property transaction registration data obtained from 'Department of Registration and Stamps' of State Governments of select ten cities[5]. The transaction level data collected from various centres include, date of registration, registration number, address, survey no., area, seller's name, buyer's name, consideration amount (transacted price) and market value. HPI is compiled on quarterly basis with Q4:2008-09 as the base. The data on prices of residential properties are scrutinized and unacceptable data points are removed using z-scores calculated separately for each stratum in each quarter. The index is compiled based on Laspeyre's weighted average methodology wherein stratification is used to control the property characteristics. Houses in each ward/zone

[5] Mumbai, Delhi, Chennai, Kolkata, Bengaluru, Lucknow, Ahmedabad, Jaipur, Kanpur and Kochi

are stratified into three categories, viz. small, medium and large based on Floor Space Area (FSA) and the median per square meter price of houses in each category are computed. Further, price-relatives are calculated for each quarter using proportions of houses transacted in the three categories of FSA within a ward/zone during the period Q4:2008-09 as the weights. These weighted relative prices are again averaged using proportion of number of houses in each ward to the total number (value) of houses during the period Q4:2008-09 as the weight .The city-wise price indices are averaged using the population proportion (based on 2011 census) of the nine cities to total population to obtain the all-India HPI. The major limitation of this approach is the underestimation of house prices, as registered prices of properties are generally lower than the actual prices due to high registration fees, stamp duty, subsequent obligations for payment of property tax etc.,. Another limitation is the disparity in prices arising due to varying criteria for registrations of the properties across different states, such as (a) partial consideration of un-divided share of land, (b) partial consideration of sale of terrace rights, (c) consideration of agreement to sale at the time booking for total price, and (d) sale deed only post completion of property (Reserve Bank of India, 2012). Non-uniformity in the format of data available with various State registration offices, non-computerization of registration details and maintenance of records in regional languages in some states etc., also poses challenges to this procedure. The All-India HPI and HPI for major five cities during the last four years are presented in Chart 4.

Chart: 4



4.3 Residential Property Price Index (RPPI): Reserve Bank of India initiated a 'Residential Asset Price Monitoring Survey (RAPMS)' to collect sale/resale prices of residential properties from select scheduled banks and housing finance companies based on their housing loan transactions. The survey is conducted on a quarterly basis and it collects data related to individual housing

loan transactions disbursed by select 35 banks/HFCs in select 13 cities. The information collected includes floor space area of the structure, date of first disbursement of loan, cost of property, valuated/ estimated price of the property by the bank, first borrower (*male/ female/ partnership firm/proprietary concerns/company/others*), occupation of first borrower (*employed/self-employed/ others*), gross assessed monthly income, loan amount, maturity period, Equated Monthly Installment (EMI) are also collected in the survey. The survey data is used to compile City-wise and All-India Residential Property Price Index (RPPI) and other useful indicators such as Loan-to-Value Ratio (LTV), EMI-to-Income ratio, House Price-to-Income ratio and Loan-to-Income ratio, which have internal usage with policy implications. The main advantage of this survey is the availablity of electronic data in a much shorter time span and thereby quicker compilation of RPPI vis-à-vis other indices. Further, availability of data required for computation of LTV, EMI-to-Income ratio, House Price-to-Income ratio etc. is a unique feature of RAPMS.

5. Evolution and Development of 'Residential Asset Price Monitoring Survey (RAPMS)'

In view of the importance of house price dynamics for financial stability and monetary policy analysis, the Reserve Bank set up an Expert Group on Asset Price Monitoring System (APMS)[6] with the objective of developing an information system on asset prices. The Expert Group recommended collecting property price data in the form of transaction-level sale/resale prices from selected scheduled banks and housing finance companies. Accordingly, RBI initiated this work in July 2010 in the form of a survey. The Expert Group selected top 13 centres[7], based on dual criteria of housing loan disbursement of banks/HFCs as well as geographical representation. Further, the Group recommended compilation of a quarterly House Price Index with financial year 2009-10 as the base year. The Group observed that the property loan data obtained so, have an advantage of lower time-lag in reporting and hence the Residential Property Price Index (RPPI) constructed based on the survey data could serve as an early signal to the house price registration data.

[6] For details see "Report of Expert Group on Asset Price Monitoring System, 2010"

[7] Greater Mumbai, Chennai, NCR Delhi, Bangalore, Hyderabad, Kolkata, Pune, Jaipur, Greater Chandigarh, Ahmedabad, Lucknow, Bhopal and Bhubaneshwar

For most of the banks, the individual transaction-level information on housing loan accounts required for this survey, was not part of banks' internal systems. Hence, initially banks experienced difficulties in culling out such data and this led to delay in submission of data and poor response from banks. However, with regular interactions with banks, data reporting has improved over time. Banks were requested to put a system in place to capture the data in desired format. Banks were also requested to send the data for previous rounds of the survey, for increasing the coverage. Through these continuous efforts, data reporting has improved from 8 banks in first round to 25 banks in the sixth round. Thereafter the data reporting has stabilized and presently around 30-32 banks are reporting data in each quarterly round of the survey.

5.1 Methodology for computing various ratios/indices in RAPMS:

Residential Property Price Index (RPPI): RPPI is constructed using Laspeyre's Price Index method with base year 2009-10. The detailed procedure of compiling City-wise and All-India RPPI is as follows.

A. City-level RPPI: For compiling city-level RPPI, residential property transactions in each city are stratified into 3 area classes (*Small, Medium and Large*) depending on Floor Space Area (FSA). Properties with FSA less than 750 square feet are classified as '*Small*' sized properties and properties with FSA between 750-1200 square feet are classified as '*Medium*' sized properties and properties with FSA greater than 1200 square feet are classified as 'Large' sized properties. The data on per square feet (psf) prices of properties in each area class are scrutinized and unacceptable data points are removed using z-score[8]. Then the City-level RPPI is constructed by using weighted average of price-relative's (Laspeyre's method) method. Following two steps are involved in construction of City-level RPPI.

Step 1: Compute price relatives (PR) of the average (median) unit level prices for each area class j= 1, 2 and 3 (i.e. for *Small, Medium and Large* respectively) this is given by:

$$PR_{i,j} = (current\ median\ psf\ price_{i,j} / base\ median\ psf\ price_{i,j}) \times 100$$

[8] The z-score is $z = \frac{X-\mu}{\sigma}$ where: X is the variable to be standardized. μ is the mean and σ is the standard deviation. The quantity z represents the distance between the individual observations and the population mean in units of standard deviation.

Step 2: Price index for i^{th} city is the weighted average of the price relatives of the area class j= 1, 2, 3

$$\text{i}^{\text{th}}\ \text{City Index} = \frac{\sum_{j=1}^{3} PR_{i,j} * W_{i,j}}{\sum_{j=1}^{3} W_{i,j}} \qquad \text{for } i = 1,2,....,13$$

The weight $W_{i,j}$ is proportion of total loan amount sanctioned in j^{th} area class for i^{th} city in the base year 2009-10.

B. All-India RPPI: The All-India RPPI is constructed using weighed average of city-level index where, weights W_i is percentage of residential housing stock in i^{th} city during census 2011.

$$\textbf{All} - \textbf{India RPPI} = \frac{\sum_{\mathbf{i=1}}^{\mathbf{13}} \mathbf{i^{th}\ City\ Index} * \mathbf{W_i}}{\sum_{\mathbf{i=1}}^{\mathbf{13}} \mathbf{W_i}}$$

5.2 All *India RPPI- Hedonic Median Regression Method*: The All-India RPPI using Hedonic median regression approach is calculated with property characteristics like City, area-size, income-class and time dummy of quarter as independent variables and the natural log of the per square feet price (evaluated by banks/HFCs data) as the dependent variable.

The mathematical model of time-dummy Hedonic median regression is given as

$$\ln(\textbf{psf\_price}) = \textbf{Costant} + \sum_{\mathbf{t=09-10}}^{\mathbf{t=Q4:FY14}} \beta_t * D_t + \sum_{\mathbf{City=1}}^{\mathbf{13}} \beta_{City} * D_{city} + \sum_{\mathbf{area=1}}^{\mathbf{3}} \beta_{area} * D_{area} \sum_{\mathbf{income=1}}^{\mathbf{3}} \beta_{income} * D_{income}$$

Where; D_t, D_{city}, D_{area} **and** D_{income} are the dummy variable for *quarter (time), city, area-class* and *income-class* respectively.

The quality adjusted index is given by ***Index = exp*** (β_t)**** 100*** where β_t is the regression coefficient of the time dummy when the hedonic functional form is semi-log.

5.3 Loan-to-Value Ratio (LTV): The Loan-to-Value ratio is defined to be ratio of the sanctioned loan amount to the value of the property assessed by the bank. It is calculated for each individual loan transaction reported for the survey during the quarter. LTV for a housing loan transaction is an indicator of the risk exposure of banks in the transaction and can be used as a macro-

prudential tool. LTV limits target the creditworthiness of borrowers and it helps to ensure that the underlying collateral is sufficient to cover the loan (Gerlach, 2012). A study done by Ahuja and Nabar (2011) based on data pertaining to 49 emerging and advanced economies revealed that LTV has a decelerating effect on property prices. Further, their study based on data of Hong Kong SAR proved that tightening of LTV caps could affect property activity through expectations channel.

5.4 EMI-to-Income Ratio: The EMI-to-Income ratio is defined as ratio of Equated Monthly Installment to gross monthly income of the borrower, calculated for each individual loan transaction reported for the survey during the quarter. EMI-to-Income ratio is an indicator of the affordability of housing. It indicates the portion of income spent on repayment of housing loan. In India, EMI-to-Income ratio not exceeding 30 per cent and 40 per cent respectively are considered to be affordable for economically weaker sections/ low income group and middle income group (Task Force Report, 2008).

6.4 House Price-to-Income ratio: - The House Price-to-Income ratio is defined as ratio of value of the property as assessed by the bank (in ₹) to gross monthly income (in ₹) of the borrower, calculated based on individual transactions reported during a survey quarter. It measures the average number of monthly income required to own the house. This is also an indicator of affordability.

6. Issues and challenges for RAPMS

6.1 Robustness of Data:

6.1.1 ***RPPI and HPI***: A comparison of RPPI with HPI showed that both the indices have moved almost together in most quarters, notwithstanding the fact that these indices are based on different data sources, coverage and different base periods.

6.1.2 ***RPPI based on different weights:*** During the initial phase of the survey, All-India RPPI was constructed as a weighted average of city-level index, with weights being percentages of housing transactions during the base year 2009-10. However, these weights were used in absence of any other relevant data and it had the limitation of being reported transactions data. In view of this, the weights have been replaced with city-wise percentage of residential housing stock based

on '*House listing and housing census data (2011)*'. The total stock of residential houses from 13 centers of the survey covers 28 per cent of total residential housing stock of India. RPPI constructed using both these weights provided similar results with only negligible variations in index values.

6.2 Statistical/ Methodological issues: The All-India RPPI is also compiled using time dummy hedonic regression model, where model is specified with proxy variables for borrower's characteristics such as city, area-class, income-class as independent variables and the natural log of the collected price as the dependent variable. According to Palmquist (1980), the structural characteristics of a house such as number of square feet of living space; the style of the house; the number of plumbing fixtures, fireplaces, and built-in appliances; and the basement and garage areas and neighborhood characteristics such as the distance to parks, schools, and shopping; the availability of subdivision-owned recreation facilities; the accessibility of the location to employment; the environmental quality etc. can have significant effects on the price of a house. In the present set-up, it is unable to access these type of supplementary data. The Hedonic index is expected to provide quality-adjusted RPPI which represents pure price changes with respect to time. However, the applicability of hedonic method using proxy variables, in the absence of such information on structural and neighborhood characteristics of properties, needs to be explored.

6.3 Compilation of median Loan-to-Value ratio/ EMI-to-Income ratio and House Price-to-Income ratio: Presently, median LTV, median EMI-to-Income ratio and median House Price-to-Income Ratio are calculated as a median of the respective ratios for individual housing transactions. Alternatively, these can be obtained as ratios of medians of the concerned variables. Therefore, to determine the most appropriate measure of centrality (i.e. median of ratio or ratio of medians), further investigation is required.

6.4 Limitations: The survey results are based on a sample of housing loan transactions data reported by selected Banks/HFCs in selected cities during the quarter. Accordingly, the sampling method adopted is not random; however the survey coverage is adequate to ensure the representativeness of sample. The survey doesn't cover property transactions not financed by banks. The price reported under the survey is the price of the property assessed by the banks/housing finance

companies. The valuation of property done by the banks may not be uniform across banks and across cities. This may affect the values of city-wise and All-India RPPI. While calculating price-relatives in City-wise RPPI calculation, only those observations with per square feet price lying within 3σ limits are considered for analysis, to eliminate the data-entry/extreme value errors. Similarly, in calculation of median LTV ratio and median EMI-to-Income ratio, only those observations with ratio less than or equal to one are considered.

7. Conclusion:

House Price Indices are yardsticks to measure the movements of house/property prices in a country. House price indices can provide significant inputs to central banks in attaining its objectives of price stability, financial stability and growth. Construction of a house price index poses challenges due to heterogeneity of houses, renovation as well as depreciation problems and infrequency of sales. In many countries, more than one national house price index are available; each index constructed using quite different methodology and with different coverage. The paper discusses various house price indices of India based on data obtained from diverse sources and the limitations therein. It highlights the various issues in constructing a representative economy-wide house price index encompassing all the segments. The paper also deliberates on the evolution and progress of 'Residential Asset Price Monitoring Survey' initiated by RBI, to track residential property prices based on housing loan data obtained from banks and housing finance companies. The methodology for compiling residential property price indices and other measures based on RAPMS data are also discussed along with major methodological and statistical issues/ challenges.

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