

## House Price Index\*

*The Reserve Bank is compiling quarterly house price indices for nine major cities (Mumbai, Delhi, Chennai, Kolkata, Bengaluru, Lucknow, Ahmedabad, Jaipur and Kanpur) as well as at all-India level based on the official data received from registration authorities of respective state governments on property transactions with base Q4:2008-09=100. Overall trends in the house price index (HPI) are regularly disseminated in the quarterly review of Macroeconomic and Monetary Developments. This article presents the methodology and salient features of the Reserve Bank's HPI, and its trends in recent quarters. It is a weighted average Laspeyres index based on transaction price, where transactions are stratified into three categories, viz., small, medium and large houses and in different geographical wards/zones. Further, the city-wise indices are averaged using the population proportion to total as the weight to obtain an all-India index. It is observed that the annual average house price increase is around 20 per cent in the last three years.*

### Introduction

House is not only an asset but also is a durable consumption good for households, providing shelter and other services. A change in the house price affects the households' perceived lifetime wealth and hence influences the spending and borrowing decisions of households. An increase in the house price raises the value of the housing relative to construction costs; hence a new construction is profitable when house price raises above the construction costs. Residential investment is, therefore, positively related with house price increase. House prices may also affect bank lending and vice versa. Further, house price gains increase housing collateral. The potential two-way link between bank lending and house prices give rise to mutually reinforcing cycles in credit and real estate markets. These indicate that house prices may affect economic activity through private consumption of

households, residential investment and credit allocation of the financial systems.

The information on house price is not easily accessible; the lack of transparency in the residential property market and limited availability of price information pose significant challenges for identifying the nature of real estate price dynamics and their relationship with financial stability and monetary policy. Therefore, it is essential to have an accurate measure of aggregate house price in order to understand the behavior of housing markets and their influence on the economy. In practice, development of an aggregate house price index is difficult because of its inherent heterogeneity and infrequent nature of sales. This means houses vary in quality across sections and over time. As no two houses are the same, the observed difference in characteristic (quality) between two houses will be reflected in difference in price. Also, since transaction on any specific house occur relatively infrequently, it is hard to know the amount at which a specific house will transact on a particular day. Thus, the characteristics of heterogeneity and infrequency of sales together make it all the more difficult to find a representative sample of house prices on which an aggregate price index can be estimated. Internationally, the house price index is compiled using three methodologies. The first methodology is based on simple average of observed prices. The second looks at repeat sales of the same property. The third treats a house as a bundle of attributes, each with its own price that changes over time and makes use of the hedonic methodology<sup>1</sup>.

### 2. Reserve Bank's House Price Index

Beginning with Mumbai city, the Reserve Bank initiated the work of compiling a house price index

\* Prepared in the Statistical Analysis Division of the Department of Statistics and Information and Management.

<sup>1</sup> Hedonic methods are special techniques for quality adjustments that are incorporated in the calculations of the official price statistics for some of the segments of goods like house, used cars, IT products etc. The objective of such indices is to measure pure price changes, controlling the influence of quality differentials.

(HPI) in 2007 and brought out a quarterly HPI for Mumbai city (base 2002-03=100) in the fourth quarter review of Macroeconomic and Monetary Developments 2008-09. Over the quarters, the coverage has been extended by incorporating eight more cities, *viz.*, Delhi, Chennai, Kolkata, Bengaluru, Lucknow, Ahmedabad, Jaipur and Kanpur and the base is shifted to Q4:2008-09=100. Trends in all-India HPI and its constituent cities are disseminated regularly in the quarterly Macroeconomic and Monetary Developments. Latest results published by the Reserve Bank relate to Q4:2011-12.

The price data on transacted houses while registering of a house are collected from the Registration Departments of respective state governments. This approach attempts to develop a house price index on the basis of registration price data and stratified weighted average measures, where transactions are stratified in three categories, *viz.*, small, medium and large houses and different geographical wards/zones. However, this measure captures prices relating only to those houses sold during a period and not relevant to all houses in the economy.

### 3. Methodology for the Compilation of HPI

Registration of property is a legal and official necessity for any property transaction in India. Therefore, in principle, the official authority of property registration has the details of all transactions during a reference period. Registration authorities of respective state governments possess the data on the registration of transactions of properties including shops, land and residential houses located in their jurisdiction. The data are reported on transaction basis. For most centers, basic information is available in local language. Even though the data structure is not strictly common across states, it contains the following fields: date of registration, registration number, address, survey no, area, seller's name, buyer's name, consideration amount (transacted price) and market value. From this, data related to residential occupancies is suitably extracted and analysed for the compilation of house price index. The house price index is compiled on a

quarterly basis with Q4:2008-09=100 as the base. The data on prices of residential properties are scrutinised and unacceptable data points are removed using z-scores<sup>2</sup> calculated separately for each stratum in each quarter. All the observations above/below plus/minus 3 z-scores are removed. Since the data do not include the information on type of house, *i.e.*, under-construction or new or resale house, the date of registration is considered as date of sale of the house. The analysis of data as well as compilation of the index is done on the transacted price. While interpreting the results, the fact may be taken into account that the index is based on the price which is officially declared by the buyer.

The house price indices are calculated using weighted average method. The sample data are stratified/seggregated in different dimensions reflecting size, wards/zones for each city. First, the indices are estimated at ward/zone level, which is averaged (weighted) to obtain the city indices. An all-India level weighted average house price index is also compiled based on the nine city indices. The methodology for computing the respective indices is described in detail below.

#### *Weighted Average Method*

Compilation of weighted average price index is done using Laspeyres weighted average methodology. First, the simple average of price (per square meter) of houses ( $P_{ij}$ ) in each category, classified by Floor Space Area (FSA) into small, medium and large for each ward/zone in each quarter is calculated. As a method of averaging, median is used. Second, the proportion of number of houses transacted in the three categories of FSA within a ward/zone during the period January 2009 – March 2009 is taken as the weight ( $w_{ij}$ ). Then, based on an average per square meter price for three FSA category houses in each ward/zone, price-relatives are calculated for each quarter. The price relative is nothing

<sup>2</sup> The z-score is  $z = \frac{x - \mu}{\sigma}$  where: x is the variable to be standardised,  $\mu$  is the mean and  $\sigma$  is the standard deviation. The quantity z represents the distance between the individual observations and the population mean in units of the standard deviation.

**Table 1: House Price Index – City wise**

Quarter	Mumbai	Delhi	Bengaluru	Ahmedabad	Lucknow	Kolkata	Chennai*	Jaipur	Kanpur
Q4: 08-09	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Q1: 09-10	116.0	101.0	103.6	101.4	103.7	100.7	96.1	99.0	113.0
Q2: 09-10	131.0	100.9	101.7	104.2	118.6	107.2	83.9	112.7	114.8
Q3: 09-10	135.1	99.7	100.8	117.3	116.7	110.9	106.8	119.1	114.1
Q4: 09-10	136.4	109.5	98.5	124.3	112.5	107.5	118.2	142.5	120.2
Q1: 10-11	143.0	122.3	104.0	117.1	116.9	116.9	138.2	144.9	119.0
Q2: 10-11	157.2	116.1	101.9	128.5	128.5	156.2	135.7	149.7	129.4
Q3: 10-11	159.3	111.4	104.7	128.8	136.9	161.2	118.4	157.3	133.5
Q4: 10-11	172.3	135.2	113.6	128.7	140.3	171.9	106.8	155.3	135.7
Q1: 11-12	191.6	152.8	116.9	152.3	149.3	157.0	106.3	161.1	135.4
Q2: 11-12	206.1	153.0	116.0	162.8	159.2	159.0	113.9	165.1	138.3
Q3: 11-12	191.7	168.6	146.1	171.8	172.3	155.0	120.3	163.5	140.0
Q4: 11-12	224.7	195.3	140.6	177.2	169.7	158.4	117.0	164.4	148.7

Note: \* Chennai Index is based on both residential and commercial properties.

but a ratio of current period price to the base period price. Price relative per square meter for the  $i^{\text{th}}$  FSA,  $j^{\text{th}}$  ward/zone,  $t^{\text{th}}$  quarter is given by

$$RP_{i,j,t} = \frac{P_{i,j,t}}{P_{i,j,0}}$$

where  $P_{i,j,0}$  is the price in the base period.

The quarterly ward/zone weighted average price relatives are calculated next. These weighted relative prices are again averaged using proportion of number of houses in each ward to the total number of houses transacted in the city during the period January 2009 – March 2009 as the weight ( $W_j$ ). The following formula is used for compiling the city-wise HPI for the  $t^{\text{th}}$  quarter.

$$\text{City HPI}_t = \left( \sum_j (\sum_i RP_{i,j,t} \times w_{i,j}) \times W_j \right) \times 100 \text{ for all } t$$

The city-wise price indices are averaged using the population proportion (based on 2011 census) of the nine cities to its total to obtain the all-India index.

#### 4. Trends in HPI

City-wise house price indices are presented in Table 1. These indices track variation in house prices in various cities across time.

The year-on-year variation in house prices across various cities are presented in Table 2. The house price in Mumbai increased on an annual basis at more than 15 per cent throughout the study period. In the cities like Delhi, Bengaluru, Ahmedabad and Lucknow house prices grew at a relatively lesser pace during 2010-11,

**Table 2: House Price Index (y-o-y change in per cent) - City wise**

Quarter	Mumbai	Delhi	Bengaluru	Ahmedabad	Lucknow	Kolkata	Chennai*	Jaipur	Kanpur
Q4: 09-10	36.4	9.5	-1.5	24.3	12.5	7.5	18.2	42.5	20.2
Q1: 10-11	23.3	21.1	0.3	15.5	12.8	16.0	43.8	46.3	5.3
Q2: 10-11	20.0	15.0	0.3	23.4	8.4	45.7	61.7	32.8	12.7
Q3: 10-11	17.9	11.7	3.9	9.8	17.2	45.3	10.9	32.1	17.0
Q4: 10-11	26.3	23.4	15.4	3.5	24.7	59.9	-9.6	8.9	12.9
Q1: 11-12	33.9	25.0	12.4	30.0	27.8	34.3	-23.1	11.2	13.7
Q2: 11-12	31.1	31.8	13.8	26.6	23.9	1.8	-16.1	10.3	6.9
Q3: 11-12	20.3	51.4	39.6	33.4	25.9	-3.9	1.6	3.9	4.9
Q4: 11-12	30.4	44.4	23.7	37.7	21.0	-7.9	9.5	5.9	9.5

Note: \* Chennai Index is based on both residential and commercial properties.

which picked up in 2011-12. Kolkata, Chennai, Jaipur and Kanpur saw some moderation in house price increase in 2011-12 compared to 2010-11.

Overall house price index and point-to-point annual per cent price changes at all India level are presented in Table 3. It is observed that index of house price, during the past 3 years up to Q4:2011-12, has increased by around 77 per cent. The year-on-year price increase has been around 20 per cent throughout.

## 5. Limitations

The HPI based on registration prices has some limitations. There is a perception that registration price is not the actual price paid by a buyer. It is argued that registered prices of houses are in general underestimated due to various reasons like high registration fees and stamp duty, obligations for the payment of property tax, *etc.* Further, the differences in the time gaps between the actual transactions and registrations also do not always follow the similar pattern across different states. Moreover, registrations of the properties are done taking into account different criteria in different states, some of which are (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. On the other hand, the registration procedure and records maintenance are not computerised in some states and the records in most states are maintained in the regional languages which necessitates further work with respect to bringing them into common format.

Finally, the all-India HPI is a weighted average of city-level HPIs. Ideally, the number of transactions at city level could have been used as weight. However, in the existing data collection mechanism, separate information on the type of the property (residential/commercial) of Chennai is not available. As a result, the proportion of population of the city (to the total population of nine cities together) is used as the weight, as a proxy to the number of transactions.

## 6. Conclusion

Developing a house price index is always a challenging task. The article presents the salient features of Reserve Bank's house price index based on official data received from registration authorities of various state governments. It is compiled at city as well as at all-India level. The weighted average based Laspeyres index number, which makes use of the number of transactions, as the weight is used to compile the indices at city level. The all-India index is estimated using the population proportion as weight.

Recent trends of Reserve Bank's HPI reveal that increase in the house price index was steep in the last few years. House price on an average during the past 3 years up to Q4:2011-12 has increased by 77 per cent. The city of Mumbai has witnessed a sustained increase in prices throughout the study period. Delhi, Bengaluru, Ahmedabad and Lucknow house prices have shown acceleration in prices during the latest periods.

**Table 3: House Price Index and y-o-y change – All-India**

Quarter	HPI	y-o-y change (%)
Q4: 08-09	100.0	NA
Q1: 09-10	105.0	NA
Q2: 09-10	109.5	NA
Q3: 09-10	113.8	NA
Q4: 09-10	118.5	18.5
Q1: 10-11	125.4	19.4
Q2: 10-11	132.6	21.1
Q3: 10-11	132.6	16.5
Q4: 10-11	141.7	19.6
Q1: 11-12	152.0	21.2
Q2: 11-12	157.8	19.0
Q3: 11-12	164.1	23.7
Q4: 11-12	176.9	24.8