

CPI Housing Index Methodology

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Abstract

This paper evaluates the methodological framework used by Ministry of Statistics and Programme Implementation (MoSPI) to compile the House Rent Index within the Consumer Price Index (CPI), comparing the Base 2012 series with the revised Base 2024 series. Utilizing a longitudinal six-panel approach, the 2024 series expands sample sizes across both urban and rural sectors and introduces an “off-cycle” flagging system to track intra-panel rent alterations between scheduled six-month visits. The paper critically analyses MoSPI’s structural shift from using a weighted geometric mean to a weighted arithmetic mean for elementary-level aggregations across different housing categories and ownership statuses. The paper concludes that while arithmetic averages are appropriate for higher-level macroeconomic groupings, lower-level elementary house rent calculations must retain a geometric mean framework to preserve robustness, stability, and scientific validity in the all-India inflation measurement.

Key words: Base year; Fixed-based index; Chain-based index; Six-panel approach; Weighted geometric mean; Weighted arithmetic mean.

AMS Subject Classifications: 62D05, 91B82

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1. Introduction

Ministry of Statistics and Programme Implementation (MoSPI) produces Consumer Price Index (CPI) at a monthly frequency. CPI provides a measure of inflation that is prescribed under statute to be used by the Reserve Bank of India (RBI) for the conduct of

monetary policy. The Base year of the current series is $2024 = 100$.

CPI covers goods (food items, non-food items) and services consumed by the households. Among services covered in the current CPI, housing services are notably important. It has a weight of 11.881 per cent in the overall CPI.

MoSPI releases CPI data separately for the rural and urban areas. A combination of the CPI-Rural and CPI-Urban indices, called CPI-Combined indices, provide the measurement of all-India CPI. For the urban households, housing services account for a much higher share – 19.778 per cent of the total urban CPI, while for the rural households, housing services account for a relatively lower share – 5.527 per cent of the total rural CPI. Combining rural and urban households, the weight for housing services in all-India CPI, averages out to 11.881 per cent.

Before implementing the 2024 Base revision, on October 30, 2025, MoSPI had come out with a “Discussion Paper on the Proposed Changes in the Housing Index Compilation Methodology in the new CPI Series”. An IIT Bombay Technical Report brought out by the authors on December 18, 2025, scientifically examined the methodology of house rent index compilation in the 2012 Base and changes proposed in the Discussion Paper (DP) for the 2024 Base. It deliberated on the pros and cons of the proposed changes by MoSPI in their DP.

After the release of the Technical Report, formal / informal discussions took place, on the Report, with domain-area experts, that included, officials in MoSPI, RBI, Ministry of Consumer Affairs, Food & Public Distribution, Labour Bureau, several market economists and analysts, inter alia. In this follow-up article, we provide some new insights into the CPI Housing Index Methodology with Base ($2024 = 100$).

Housing index in CPI is a special case. For the measurement of house rental prices in CPI, data is collected from a fixed set of rented dwellings from each of the urban and rural markets. This fixed set, or full-stock, of selected dwellings in the sample are divided into six panels. To optimise resources, longitudinal surveys are conducted where rents from each panel of dwellings are measured at six-monthly intervals. This unique method of house rent measurement was formally adopted for the housing CPI (Base $2012 = 100$) and is unlike the method of price collection adopted for any other item in CPI. In their Report of the Group of Technical Advisory Committee on Statistics of Prices and Cost of Living, 2014, MoSPI mentions that “this arrangement has been made to reduce the workload of enumerators in collection of information and moreover, **rent does not change very frequently** like prices of cereals, vegetables, fruits, etc.”.

The main objective of collecting data on house rent, from a fixed sample of dwellings, is to measure pure changes in rents over a period of time. The sample dwellings are selected in such a way that they represent various categories with different number of living rooms. As the six-monthly panel survey approach is adopted, the dwellings visited in the month of January for collection of rental information are visited again in the month of July. Similarly, dwellings visited in February are visited again in August, and so on.

The staggered rental price collection methodology by MoSPI is also in accordance with the international practice for house rent measurement. The ‘CPI Manual: Concepts and Methods 2020’, and the ‘Consumer Price Index: Design (Handbook of Methods)’ showcases

the international (World Bank and BLS) practice of rental housing data using a panel design. Their six-panel approach indicates that:

*“... Each month, a panel is priced, with all six panels priced twice a year: panel 1 is collected in January and July, and panel 2 is collected in February and August, and so on. **Every month, we collect rent prices and other information for one panel and the 6-month price ratio is computed (the current rent divided by the rent 6 months ago) for each unit in the panel.**”* (See, ‘Consumer Price Index: Design’ (Handbook of Methods) US BLS, Last Modified Date: January 30, 2025)

Section 2 discusses the CPI 2012 series six-panel approach adopted by MoSPI for housing index computation. In contrast, Section 3 examines the modified six-panel housing index compilation methodology that has been implemented for the CPI 2024 series. Section 4 provides the similarity and distinctions in the method of housing index computation for the two series. Section 5 takes up the issue of the use of the weighted arithmetic mean as against the weighted geometric mean, while Section 6 discusses its impact on the transitivity. Finally, Section 7 gives the concluding remarks.

2. The approach of housing index compilation for base 2012

This Section recapitulates the housing index methodology used for CPI Base 2012. Unlike housing CPI 2024 series, the index for housing CPI (Base 2012 = 100) was limited to urban areas. Housing had 21.67% expenditure share for urban CPI and 10.07% expenditure share at All India level in the Base 2012 CPI series. A full-stock of rented dwellings then was about 13,368, and every month the rental prices were collected from about 2228 dwellings. Thus, in the six-panel approach, there were six sets of 2228 dwellings and each set constituting a panel. Every year, the full-stock of rented dwellings were visited such that panel-1 through panel-6 were visited from January to June, respectively, and again visited during the period July to December for canvassing the house rent schedule. While providing the six-panel coverage of the dwellings for the Base year 2012, for ease of illustration, we consider 6 panels of 2000 dwellings each in Figure 1.

The index for CPI (Base 2012 = 100) was released from January 2013 onwards. Since in each month only one-sixth of sample dwellings were visited, January 2013 had one-sixth of the rental data available. February 2013 had two-sixth of rental data available, and so on. **The full rental data of all sample dwellings was available for the first time in June 2013.** Since dwellings are visited once in six months for canvassing house rent schedule, the dwellings covered in the month of January for collection of rental prices are visited again in the month of July. Similarly, dwellings covered in February were surveyed again in August, and so on. As done for the Base year 2012, the six-panel coverage of the dwellings for the year 2013 is provided in Figure 2.

There are few other dimensions of a dwelling in a sample, the actual computation of house rent index is very nuanced. Actual House rent index computation involves the following steps:

- First, the category of dwellings (1-, 2-, 3- and ≥ 4 -room) are accounted for. For each State and Union Territory (UT) and each category, geometric mean of rent relatives is separately worked out using the full set of dwellings in the rolling sample of six months.

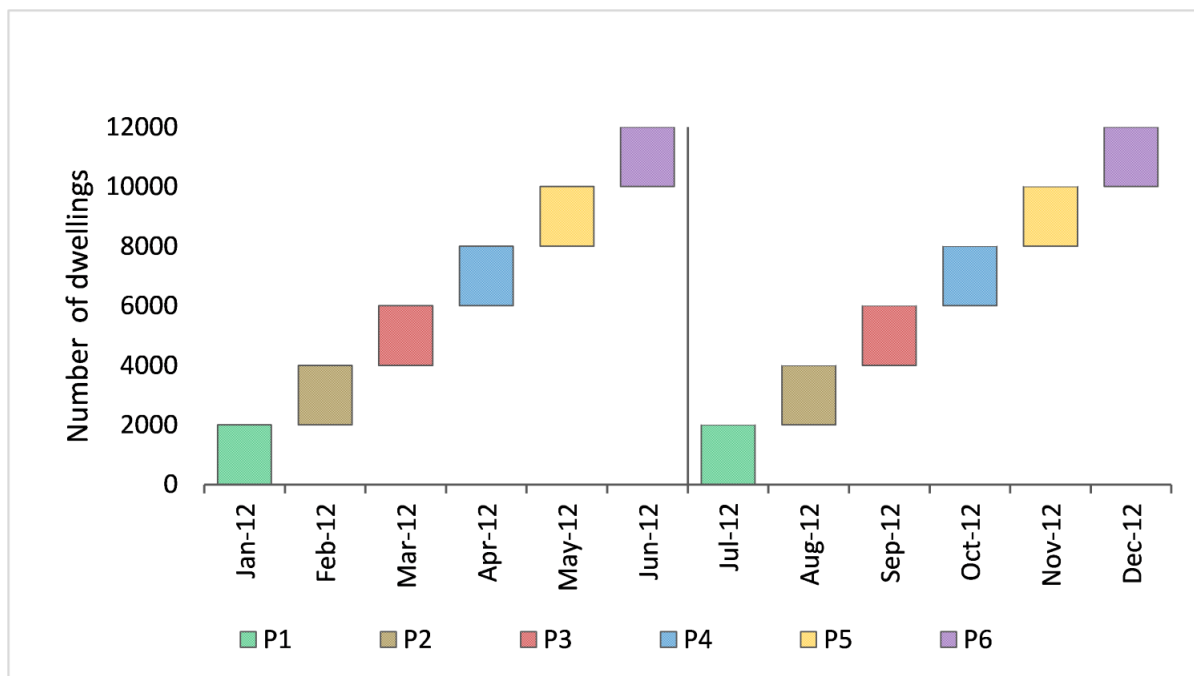


Figure 1: Monthly dwelling visits for rent collection

Note:

1. P_i pertains to dwellings in Panel i ; $i = 1, 2, \dots, 6$
2. P_i dwellings are visited in scheduled cycle
3. The slanted line blocks represent fresh visits during the month

- Second, the shares (weights) of each category of dwellings within owner-occupied and rented houses (as per the results of Housing Condition Survey NSS 69th Round) are taken. Then weighted geometric mean of the rent relatives are separately worked out for owner-occupied and rented dwellings for each State/UT. Since the rents of owner-occupied dwellings are taken by rental equivalence approach, the rent relative of rented accommodation is applied to the respective category of owner-occupied dwellings also.
- Third, the overall rent relative for a State/UT is worked out using weighted geometric mean of owner-occupied and rented dwelling. The weights of owner-occupied and rented dwellings are computed from the result of household consumption expenditure surveys (HCES) 2011-12.
- Fourth, State/UT wise house rent index is arrived at by multiplying the above rent relative to (i) 100 (in case of fixed-based index), and (ii) house rent index 6-month ago (in case of chain-based index).
- Lastly, the State/UT level house rent indices are aggregated, for arriving at the all-India index, using state-wise housing weights from the HCES. At this stage weighted arithmetic mean is used.

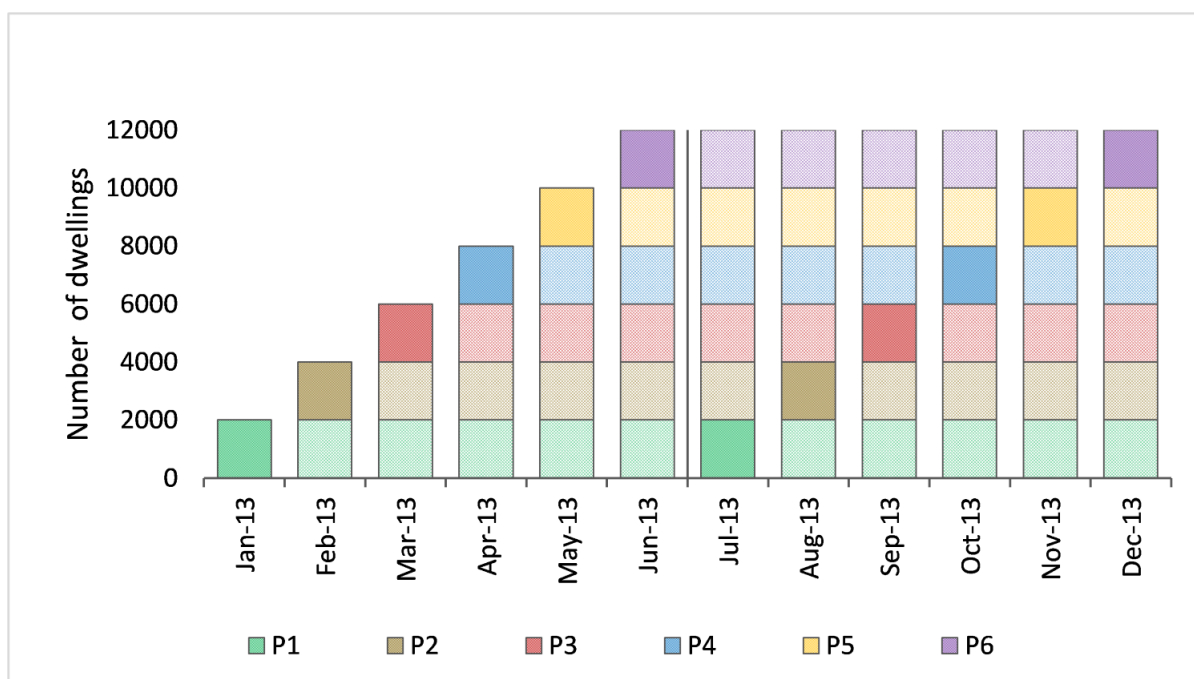


Figure 2: Rental data used for monthly index compilation

Note:

1. P_i pertains to dwellings in Panel i ; $i = 1, 2, \dots, 6$
2. P_i dwellings are visited in scheduled cycle
3. The slanted line blocks represent fresh visits during the month
4. The cross-line blocks represent the earlier visits for the panel

Computation of Index (Base 2012) – House Rent Index for a State/UT

- (a) The Base rent is defined as follows: For a dwelling, if $r_1, r_2, \dots, r_{12}$ are the rents collected in the Base year 2012 for January, February, ..., December, respectively, then the Base rent for the year 2012, as explained in the DP, is

- for January and July, $(r_1 + r_7)/2$;
- for February and August, $(r_2 + r_8)/2$; and so on; and
- for June and December, it will be $(r_6 + r_{12})/2$.

- (b) Based on the full rental data of all sample dwellings, effective June 2013, using the (weighted) geometric mean (GM) of the rent relatives, Index for the months June 2013 to November 2013 using fixed-based method is:

$$\text{Weighted GM of } \{(\text{Current month rent}) / (\text{Corresponding Base rent})\} \times 100.$$

- (c) Based on the full rental data of all sample dwellings, effective December 2013, using the (weighted) GM of the rent relatives, Index for the months December 2013 onwards using chain-based method (6-monthly chain-based index) is:

$$\text{Weighted GM of } \{(\text{Current month rent}) / (\text{Rent 6-month ago})\} \times \text{Index 6-month ago}.$$

From December 2013 onwards, house rent index was compiled using a chain-based method. Under this method, current month rent was compared with the rent six months ago. Thus, the index for December 2013 is obtained by first taking the (weighted) GM of the December 2013 over June 2013 rent relatives and then multiplying by the June 2013 index. Similarly, the index for January 2014 is obtained by first taking the (weighted) GM of the January 2014 to July 2013 rent relatives and then multiplying by the July 2013 index. And so on.

3. The approach of housing index compilation for base 2024

In CPI 2024 series, the methodology for compiling the House Rent Index was comprehensively revised by MoSPI to enhance robustness, consistency, and representativeness. Unlike the CPI 2012 series, leveraging house rent and imputed rent data available from HCES 2023-24, the sample constitutes a total of 19039 dwellings (15715 in urban and 3324 in rural) for rent collection in Base (2024 = 100).

The DP indicated that the monthly rentals from the entire set of sampled dwellings would be adopted as against the panel approach. More specifically, MoSPI proposed that it will measure the rental prices from the entire set of sampled dwellings every month, instead of visiting these households once every six months. The DP mentions:

“Monthly Rent Collection: Rent data will be collected monthly, replacing the current practice of collecting rent every six months.

Expanded Sample Coverage: Instead of limiting rent collection to one-sixth of the sample, the new approach proposes collecting rent data from all selected dwellings each month.”

The IIT Bombay Technical Report had strong reservations to the above documented method where “Rent data will be collected monthly, replacing the current practice of collecting rent every six months” and “Instead of limiting rent collection to one-sixth of the sample, the new approach proposes collecting rent data from all selected dwellings each month”.

Based on interactions after the release of the Technical Report, it transpires that MoSPI would continue to follow the six-panel coverage of the dwellings, *i.e.*, all dwellings in Panel 1 are visited in January and July; all dwellings in Panel 2 are visited in February and August; and so on; all dwellings in Panel 6 are visited in June and December.

However, a nuance has been added. While visiting the dwellings in a panel, in addition to the rental information, information is sought on the future months (in the subsequent five months) when the rent is expected to change. If the rent is expected to change for the sample dwelling, in these months, the dwelling will be flagged for revisit that month. All such dwellings are visited again in the flagged months in addition to their scheduled panel visit. This is an improvised way of data collection, by visiting few dwellings from each of the five panels in addition to visiting all the dwellings in the panel marked for the month (Figure 3 for Base year and Figure 4 for following years). This would lead to rental data collection every month from one-sixth of the full-stock plus additional data collected (say, 5

The Expert Group Report on Comprehensive Updation of Consumer Price Index (January, 2026), MoSPI, Government of India mentions “*In the new series, visit to the*

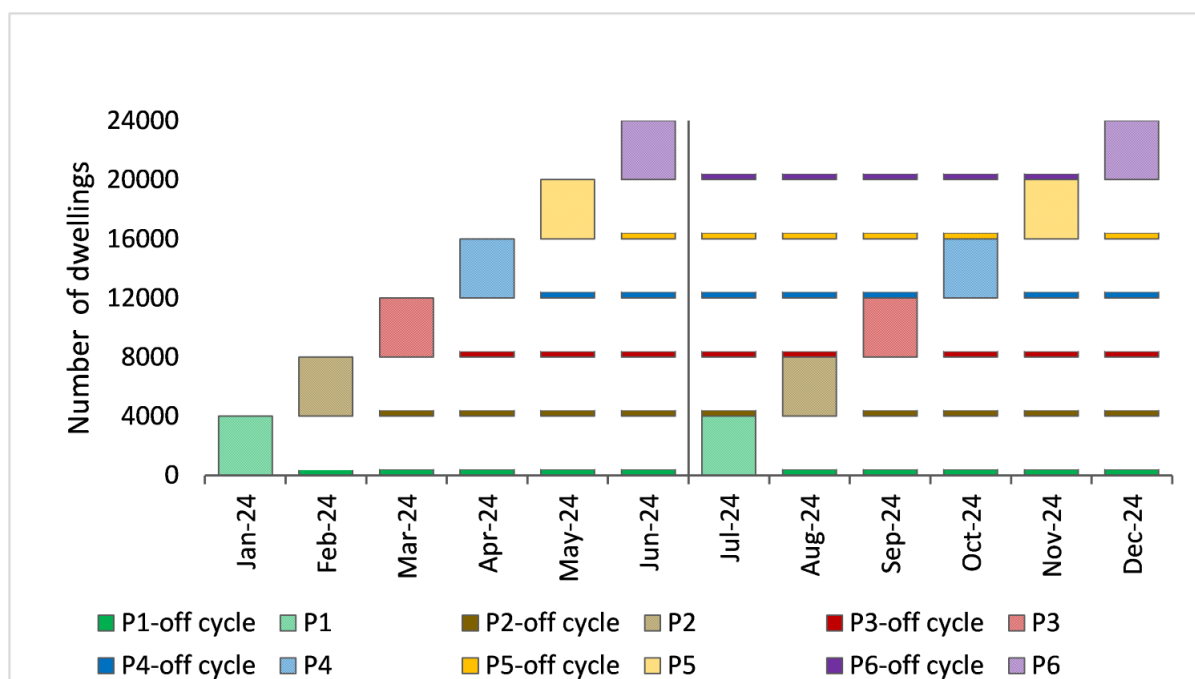


Figure 3: Monthly dwelling visits for rent collection

Note:

1. P_i pertains to dwellings of panel i ; $i = 1, 2, \dots, 6$
2. P_i dwellings are visited in scheduled cycle; P_i -off cycle are the additional dwellings visited
3. The slanted line blocks represent fresh visits during the month
4. The solid colour blocks represent the number of dwellings visited during off cycles

dwellings by the enumerator has been planned in such a way that, rent data will be available for every month. All the dwelling are distributed among 6 months and enumerator would necessarily visit each dwelling every six months. In addition, while visiting a dwelling an additional information will be collected from the respondent about the next expected date of rent revision and will flag the dwelling. Generally there is formal or informal agreement between the owner and the tenants about the period after which the rent is to be revised. If the month in which the revision in the rent is expected, falls between the two scheduled visits, the enumerator will visit the dwelling in that month also to collect the revised rent. Thus, in a month in addition to 1/6th of the dwellings additional number of dwellings which have been flagged by the enumerators will be covered. This approach would ensure that monthly data that is captured would accurately reflect changes and also reduce the need for mandatory monthly visits by the enumerator. This change addresses representativeness issues inherent in panel-based systems, particularly in markets with limited availability of rented dwellings outside major urban centres.”

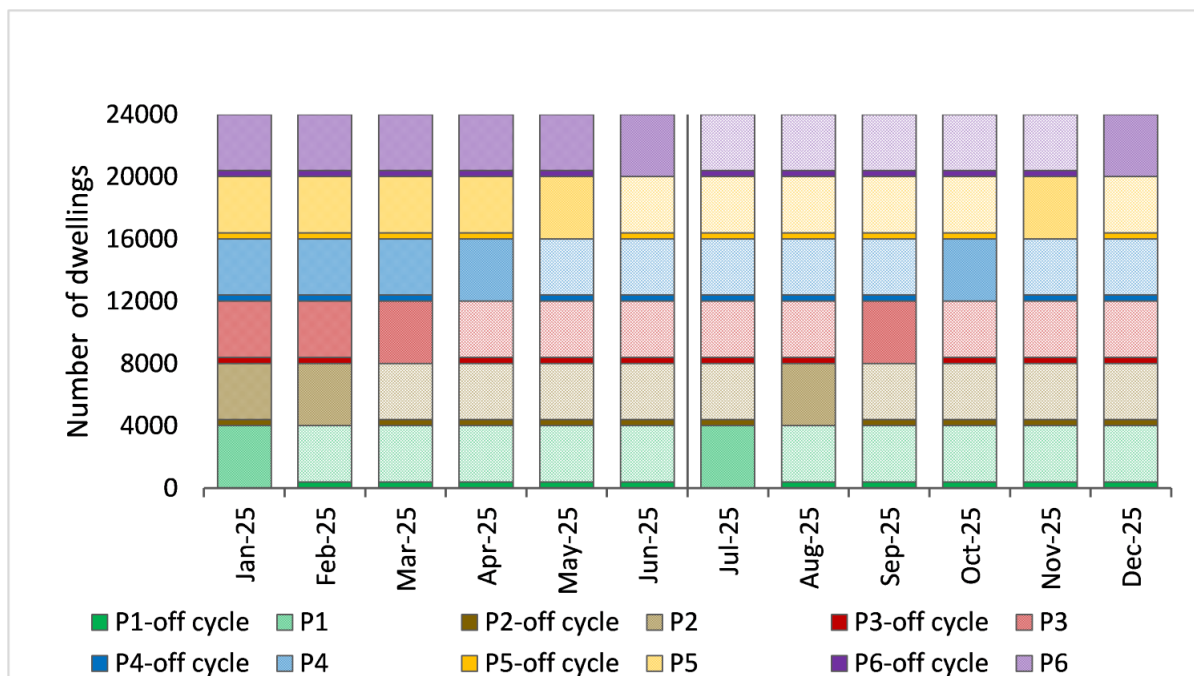


Figure 4: Rental data used for monthly index compilation

Notes:

1. P_i pertains to dwellings of panel i ; $i = 1, 2, \dots, 6$
2. P_i dwellings are visited in scheduled cycle; P_i -off cycle are additional dwellings visited
3. The light coloured blocks represent the latest dwelling visits in the base year
4. The slanted line blocks represent fresh visits during the month
5. The solid colour blocks represent the number of dwellings visited during off cycles
6. The cross line blocks represent the earlier visits for the panel

Actual House rent index computation involves the following steps:

- Dwellings are classified into four categories based on the number of living rooms (1, 2, 3, and 4 or more). Category-wise weights were derived from Census 2011, replacing the Housing Condition Survey (NSS 69th Round) used in the CPI 2012 series.
- Compilation Methodology: Housing categories are treated as priced items, and indices are compiled category-wise at the State/UT $\times$ Sector level. Here Sector level refers to Urban and Rural levels (unlike CPI 2012 series, where only Urban level existed). Monthly rent relatives are computed as the geometric mean of rent relatives within each Category and State/UT. Category-wise indices are compiled using a chain-based (short-term Jevons) index, where the current month index is obtained by multiplying the geometric mean of rent relatives with the previous month's index. Separate indices are derived for rented and owner-occupied dwellings. For owner-occupied dwellings, the rental equivalence approach is applied. Category-wise indices are aggregated using weighted arithmetic means (unlike the CPI 2012 series where weighted geometric mean is used), with weights based on category shares for rented dwelling and owner-occupied dwellings.

- The overall State/UT $\times$ Sector level House Rent Indices are obtained by aggregating rented and owner-occupied indices using weighted arithmetic means (unlike the CPI 2012 series where weighted geometric mean is used), with weights being the expenditure shares derived from HCES 2023–24. The proposed revisions aim to produce a more stable and representative Housing Index in the new CPI 2024 series.

Computation of Index (Base 2024) – House Rent Index for a House-Category

- (a) **The Base rent:** For each dwelling, the Base rent is the average of the rents for the 12 months of the Base year 2024. Here, the rent for a month is based on the rent collected by an actual visit to the dwelling in a given month or rent collected based on the last visit to the dwelling.
- (b) **The fixed-based January 2025 Index:** Based on the full rental data of all sample dwellings, using the geometric mean (GM) of the rent relatives, the fixed-based Index for the month January 2025 uses the borrowed base-data method, *i.e.*,

$$\text{Index Jan.25} = \text{GM of } \{(\text{Jan.25 rent}) / (\text{Base rent})\} \times 100.$$

Here, the rent for January 2025 is based on the rent collected by an actual visit to a dwelling in January 2025 and rent collected based on the last visit to a dwelling in the Base year 2024 (*i.e.*, during August-December 2024). Thus, while computing the January 2025 Index, the numerator of the rent relatives uses the actual data collected in the Base year months August-December 2024. In this sense the January 2025 Index is a borrowed base-data method.

- (c) **The chain-based February-May 2025 Index:** Based on the full rental data of all sample dwellings, using the GM of the rent relatives, the chain-based Index for the month February 2025 uses the borrowed base-data method, *i.e.*,

$$\text{Index Feb.25} = \text{GM of } \{(\text{Feb.25 rent}) / (\text{Jan.25 rent})\} \times \text{Index Jan.25}.$$

Here, the rent for February 2025 is based on the rent collected by an actual visit to the dwellings in February 2025 and rent collected based on the last visit to the dwellings in the Base year 2024 (*i.e.*, during September-December 2024) and in January 2025. Similarly, for the months March-May 2025.

- (d) **The June 2025 onwards chain-based index:** Based on the full rental data of all sample dwellings, effective June 2025, using the GM of the rent relatives, Index for the months June 2025 onwards using chain-based method (1-monthly chain-based index) is:

$$\text{GM of } \{(\text{Current month rent}) / (\text{Rent 1-month ago})\} \times \text{Index 1-month ago}.$$

From June 2025 onwards, house rent index was compiled using a chain-based method. The rent for June 2025 is based on the rent collected by an actual visit to all the dwellings during January-June 2025. Thus, while computing the June 2025 Index, the numerator of the rent relatives uses the actual data collected during January-June 2025. Under this method, current month rent was compared with the rent 1-month ago. Thus, the index for June 2025 is obtained by first taking the GM of the June 2025 over May 2025 rent relatives

and then multiplying by the May 2025 index. Similarly, the index for July 2025 is obtained by first taking the GM of the July 2025 over June 2025 rent relatives and then multiplying by the June 2025 index. And so on.

January 2025 Category-wise index is a fixed-based index that is based on the Current month rent of January 2025, where the Current month rent of January 2025 is from **actual visits** to dwellings in January 2025 (all Panel 1 dwellings and some dwellings from Panels 2, 3, 4, 5 and 6) and from the dwellings (in Panels 2, 3, 4, 5 and 6) **not visited** in January 2025 but by **borrowing rental values collected** from the last visit of the dwellings in the Base period August-December 2024. This leads to an inherent assumption that the rents in January 2025 did not change for those dwellings that were last visited during August-December 2024. For February-May 2025, since a 1-monthly chain-based index is being used, there is a carry-over effect in the house rent index through **borrowing of the rental values collected** in the Base months.

From June 2025 onwards, a 1-monthly chain-based index is used. However, because of the equivalence of chain- and fixed-based index, we may as well consider the June 2025 index as a fixed-based index that is based on the Current month rent of June 2025, where the Current month rent of June 2025 is from **latest actual visits** to dwellings (in Panels 1, 2, 3, 4, 5 and 6, respectively) during January-June 2025. For July 2025, the Current month rent of July 2025 is used, where the Current month rent of July 2025 is from **latest actual visits** to dwellings (in Panels 2, 3, 4, 5, 6 and 1, respectively) during February-June and July 2025. From July 2025 onwards, a 1-monthly chain-based index is used. Technically, from June 2026 onwards, the housing index would not have any carry-over effect that was prevailing in the index produced for January-May 2025.

The 1-monthly chain-based index provides some convenience over the fixed-based index. To illustrate, for Base 2024 = 100, consider that from September 2026 (*i.e.*, panel number 3), because of non-availability, a 1-room dwelling (D_o) captured in March 2026 is to be replaced by a new 1-room dwelling (D_n) in the same locality. Till August 2026, index was worked out on the basis of the rent from D_o . In September 2026, D_n 's rental data is captured for both August and September 2026. To work out the chain-based September 2018 index, using the new dwelling D_n , its rent relative is obtained by computing the ratio of the September 2026 to August 2026 rent, and then multiplied to the August 2026 index (that was based on the rental data from D_o). This facilitates ease of replacing an unavailable dwelling with a new dwelling without going back to the Base rent. It is noted that starting September 2018, the chain-based index (on the basis of the rental data from D_n) will still remain equivalent to the fixed-based index that is based on the rental data from D_n . This equivalence can be established by arriving at the Base rent of D_n . The Base rent of D_n will be the Base rent of D_o multiplied by an adjustment factor – the adjustment factor being the ratio of the August 2026 rent of D_n to the August 2026 rent of D_o . However, the beauty of the chain-based approach is that we don't have to go back to the derived Base rent of D_n . For details, refer to Das and Das (2025).

4. The 2012 and 2024 series of housing CPI: Similarity and distinctions

Our analytical observations on some of the similarities and distinctions between the current housing index (CPI 2024) computation methodology and the method adopted in the

CPI 2012 series are presented below.

Both the methods use the six-panel approach by dividing the dwellings into six groups and marking a group for a mandatory visit for a month and a re-visit after every six months. Housing prices do not change frequently. Often, the rental agreements are annual, and they keep the rental values constant for about a year. Thus, a rolling sample of six months, broadly captures the latest rental values of each sample household (of the full-stock).

However, a nuance has been added in the CPI 2024 series. While visiting the dwellings in a panel, in addition to the rental information, information is also sought on the future month (in the subsequent five months) when the rent is expected to change. If the rent is expected to change for the sample dwelling, in these months, the dwelling is flagged for revisit that month. All such dwellings are visited again in the flagged month in addition to the scheduled panel visit for the month. This is an improvised way of data collection, by visiting few dwellings from each of the five panels in addition to visiting all the dwellings in the panel scheduled for the month.

In the CPI 2012 series, a rent from a dwelling is captured for a month by an actual visit and in the subsequent five months it is assumed that the rent of the dwelling does not change. In other words, the contribution towards month-on-month index (September-on-August index, say) is only from dwellings in a single Panel (September-Panel). In contrast, the CPI 2024 series, depending on the response to the additional information, assumes that the rent of the dwelling does not change either in the subsequent five months, or in the subsequent four months, or in the subsequent three months, or in the subsequent two months, or in the subsequent one month. Accordingly, here the contribution towards month-on-month index (September-on-August index, say) is from dwellings in a single Panel (September-Panel) plus all dwellings in the other Panels (Panels 1, 2, 4, 5, 6) who are visited in September.

The CPI 2024 series uses a 1-monthly chain-based index while the CPI 2012 series used the 6-monthly chain-based index. Accordingly, under the equivalence of fixed-based and chain-based index, if there are no dwellings that have a change of rent in the subsequent five months since last visited for rent collection, the CPI 2024 method reduces to the same method as adopted in the CPI 2012 series, and are thus equivalent.

The distinction in the two methods, at the category level index computation, arise only from collection of additional rental data (CPI 2024 series) from some of the dwellings visited ahead of its scheduled six-monthly panel visits. The housing index methodology in CPI 2024 series is thus like “*Old Wine in a New Bottle*”.

Unlike the CPI 2012 series where weighted geometric means are used, in the CPI 2024 series, for each State/UT (urban and rural), arithmetic mean of rent relatives is used throughout for combining the shares of each category of dwellings within owner-occupied and rented houses. The weighted arithmetic mean of the rent relatives is separately worked out for owner-occupied and rented dwellings for each state. The overall rent relative for a State/UT (urban and rural) is worked out using weighted *arithmetic mean* of owner-occupied and rented dwellings.

5. Weighted arithmetic mean against the weighted geometric mean

For higher level indices (arrived by aggregation of elementary indices), the CPI 2024 series use weighted arithmetic mean for house rent (in line with other items in CPI) in place of weighted geometric mean. Bringing in uniformity for arriving at higher level indices across commodities is a well thought out. However, house rental is a special commodity as it has significant weight in CPI and has multiple dimensions – it has different categories (based on number of rooms in the dwellings), and different status of dwelling (self-owned or rented).

In this context, it will be pertinent to run through some of the fundamental concepts behind compilation of elementary indices and higher level indices (See, Appendix, reproduced from Das and Das (2025)).

For CPI compilation, it is critical to differentiate between the construction of elementary indices and higher-level indices. Elementary index is the lowest level price index in CPI. It is arrived at by aggregating price relatives of priced items. The aggregation may involve more than one step – first price relatives are aggregated separately for each of the varieties/types/categories within an item. Next these aggregate price relatives are further combined using weights (for their varieties/types/categories) to the final elementary index. These steps of aggregation of price relatives across varieties/types/categories is still a step towards construction of elementary index only and should not be construed as preparation of a high-level index. The higher-level indices include grouping the elementary item indices to sub-group/group indices and further to headline indices; or grouping them to regional indices (state-wise aggregation) and further to all-India indices.

In case of house rent index, the elementary level aggregation involves multiple steps. Aggregating rent relatives across different dwelling categories (*e.g.*, 1-room, 2-room) or across ownership (owner-occupied or rented) are steps in constructing the elementary house rent index. Till such time the rent relatives are being aggregated, geometric mean should be used to arrive at elementary house rent index. Thereafter, for higher level indices (housing index by aggregating house rent index, watchman charge index, water charge index, *etc.*, or for combining state house rent indices to arrive at all-India house rent index), weighted arithmetic mean should be used. For combining rent relatives, taking arithmetic mean instead of geometric mean, sacrifices on the benefits of geometric mean to capture the true overall change in the rent-relative ratios.

For combining the four categories of rent relatives, taking arithmetic mean, instead of geometric mean, sacrifices on the benefits of geometric mean to capture the true overall change in the house rentals, measured through the rent relatives. For example, consider 1-room house rents increase by 5 per cent, while in a small part of the market, high end 3-room house-rents increase by 50 per cent. Arithmetic mean will be heavily skewed by that 50 per cent jump. It is a subtle but really a vital point. The arithmetic mean gives too much weight to items that have had extreme percentage increases. It would make the overall change in house rent seem much higher than the average consumer is truly feeling. Arithmetic mean can distort the perception of the real change. It sacrifices the accuracy and stability that the geometric mean provides. Moreover, the Report of the Group of Technical Advisory Committee on Statistics of Prices and Cost of Living (2014) also recommends that for compilation of elementary indices,

“Consistent with the international practices, Geometric Mean may be used to compile elementary indices because of the following reasons:

- *geometric mean is stable and is robust against extreme values; and*
- *average of the Price Relatives with respect to Base Prices and Ratio of the Averages of Prices with respect to Base Prices coincide in the geometric mean.”*

Therefore, rather than treating house rent like any other item in CPI, a separate treatment of house rent index compilation, as was scientifically done in the CPI 2012 series should continue. Bringing in arithmetic mean in elementary index calculation, is sub-optimal and lacks the desirable property of transitivity (as explained in the next Section). After arriving at the elementary house rent indices aggregated across categories and ownership, higher level indices may be compiled through arithmetic mean.

6. Transitivity

An important property of the indices is that of it being transitive (See, Para 8.25 of the international *CPI Manual: Concepts and Methods (2020)*). Transitivity means that the chained monthly indices are identical to the corresponding direct indices. This property is important in practice, because only then elementary price indices can be calculated as chained indices that link together the month-on-month indices. The elementary house rent indices are computed using the Jevons index. Jevons index is defined as the unweighted geometric mean of the price relatives, which is identical to the ratio of the unweighted geometric mean prices, for the two periods, 0 and t , to be compared. The Jevons price index is calculated by directly comparing the prices of the two periods, 0 and t . Indices that are calculated by comparing the price of the reference period and the current period directly are referred to as direct indices. The Jevons index is transitive.

The Expert Group Report on Comprehensive Updation of Consumer Price Index (January, 2026), MoSPI, Government of India provides illustrations on the compilation of indices for Weighted and Priced items. As an example, it mentions that in the fruit’s category, HCES collected expenditure data for the combined item “Pears/Nashpati”. The expenditure reported under this item represented the total household expenditure on both fruits consumed during the reference period. In contrast, in the market, these fruits were sold and purchased separately. Accordingly, while “Pears/Nashpati” appeared as a single weighted item in HCES, it was mapped with multiple priced items in CPI price collection—namely, “Pears” and “Nashpati”. This distinction between weighted items and priced items ensured that the CPI basket remains conceptually meaningful, while price collection continues to be operationally feasible and representative of actual consumption.

In such cases, elementary indices would be compiled separately for Pears and Nashpati. The CPI 2024 series adopts a method where the combined index for the weighted item “Pears/Nashpati” would be derived by taking the *weighted arithmetic mean* of the two elementary indices. Here, equal weights are assigned to each of the priced items, Pears and Nashpati. Such an approach of taking the *weighted arithmetic mean* (instead of a *weighted geometric mean*) fundamentally distorts the computation of the index for Base 2024 = 100 for the weighted item “Pears/Nashpati”. The distortion is in the sense of loss of *transitivity* for the index computation of the weighted item “Pears/Nashpati”.

For items such as “Rail fare” and “Electricity charges” *etc*, a single weighted item may correspond to multiple priced items. In such cases, priced item-wise weights are separately available from administrative data sources, such as number of passengers, revenue by fare category, or number of domestic users, *etc*. These weights are usually appropriate proxy weights based on administrative indicators such as passenger counts, usage levels, or revenue shares. Here again for the CPI 2024 series, the weighted item index being derived from the individual priced item indices by applying a *weighted arithmetic mean*, (using the available priced item-wise weights) would distort the derivation of the true index of the weighted items like “Rail fare” and “Electricity charges”. Instead, a *weighted geometric mean* for the index computation (Base 2024 = 100) of the weighted items like “Rail fare” and “Electricity charges” would retain the fundamental property of transitivity for the index computation of the weighted items “Rail fare” and “Electricity charges”.

On similar lines, the computation of the index for the weighted item ‘House rent’ for the Base 2024 = 100 provides a distorted index number. Aggregating rent relatives across different dwelling categories (*e.g.*, 1-room, 2-room) or across ownership (owner-occupied or rented) are steps in constructing the elementary house rent index. By taking a *weighted arithmetic mean* instead of the weighted geometric mean for combining the category-wise rent relatives induces a loss of transitivity for the index computation. The same is true while combining across ownership type.

7. Concluding remarks

We have focused in this Report on the changes MoSPI has undertaken on housing index compilation methodology. The Report examines each of the changes introduced in the CPI 2024 series and provides reinforcements to establish some pros and cons in the housing index compilation methodology. Importantly the Report scientifically justifies the need to continue with panel sample rent collection approach and continuation of elementary index compilation based on geometric means. Our strongly believe that bringing in arithmetic mean in elementary index calculations, will be sub-optimal in various aspects.

Data-driven decision-making would be accurate not only by collecting the correct data but also by correctly aggregating the same through precise summary statistics and measures. The sample survey-based house rent index compilation is an exercise of national importance as it contributes significantly towards inflation measurement of the country. It is our constitutional fundamental duty to *develop the scientific temper, and the spirit of inquiry and reform*, and the study is carried out in that spirit. MoSPI may like to deliberate on the suggestions made in the Report.

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Appendix

Elementary Indices and Higher Level Indices

Consumer Price Indices (CPIs) measure the movement in prices of an aggregate basket of goods and services consumed by a typical household in a country. The goods and services items that are included for construction of a CPI are aggregated using their expenditure share obtained from the household consumption expenditure surveys (HCES).

Calculation of CPI is usually done in two stages – it starts with compilation of elementary index for each item and then the elementary indices are aggregated to higher level indices using the item's expenditure weights in HCES.

Elementary Price Indices

Elementary index is called elementary since it is the lowest level price index and corresponds to a **weighted item** in CPI. Weighted items are all the items that get weight in CPI and for which indices are released by National Statistics Offices. Expenditure weights are usually not available below the elementary aggregate level. In case of India, the CPI (Base 2012 = 100) series consists of 299 weighted items and all India indices for these items are released every month by National Statistics Office (NSO).

To compile the 299 item indices, NSO collects prices for many more items than the 299 items. These are called **priced items**. Priced items reflect different varieties of a weighted item (*e.g.*, 'rice' may include priced items such as basmati, parmal, ponni), or different types of a weighted item (*e.g.*, 'other vegetables' may include raw papaya, sweet potato, *etc.*) or different categories of a weighted item (*e.g.* 'house rent' includes, 1-room, 2-room, 3-room or ≥ 4 -room dwellings; or owner-occupied and rented dwellings).

The priced items are aggregated to elementary item indices and the aggregation may involve more than one step. As an example, we take the case of rice and consider that it has three varieties. To work out the elementary index of rice, first the geometric mean of price relatives for each variety of rice (priced items) from different markets is worked out. The geometric means of these three varieties of rice are then aggregated as a weighted mean, if weights are available; or as a simple mean, if weights are not available. The computation of elementary index of rice is, thus, a two-step process. The same analogy of elementary index compilation for different varieties of priced items can be extended to different types and different categories of priced items.

For a weighted item of CPI, which has different varieties, if the expenditure weights of each of these varieties are not available, the choice of the averaging method can be very important. The larger the variation in the individual prices, the larger the difference among the standard averaging methods. Though both arithmetic and geometric averaging can be used, the international 'CPI Manual: Concepts and Methods 2020' recommends the use of geometric average formulas. (Para 1.145 of the international CPI Manual: Concepts and Methods (2020))

All the steps of aggregation of price relatives to arrive at the elementary index of weighted items are part of elementary index compilation and should not be construed as preparation of a higher-level index. Also, till the elementary index is prepared, the aggrega-

tion deals with price relatives only and the method of aggregation should remain the same – geometric mean, as recommended by the international ‘CPI Manual: Concepts and Methods 2020’.

Higher Level Indices

Elementary indices provide the basic building block for higher level indices and are the starting point for calculating CPI. Working upward from the elementary price indices, **all indices above the elementary aggregate level are higher-level indices** that can be calculated from the elementary price indices using the elementary aggregate expenditure as weights. (Para 8.10 of the international CPI Manual: Concepts and Methods (2020))

The higher level aggregates include grouping the elementary item indices to subgroup/group indices (vertical aggregation); or to regional indices (horizontal aggregation).

Higher level indices are calculated from the elementary price indices using the household expenditure as weights and using weighted arithmetic mean for aggregation. Usually, for higher level indices, Laspeyres Index or Young Index formula of weighing the elementary indices is used.