Technical Notes on the Hedonic Residential Property Price Index (RPPI)

Introduction

The RPPI measures the change in prices of residential properties over time.

The Residential Property Price Index (RPPI) is an indicator designed to measure the change in average prices of various types of residential properties in the country over time.[1]

The RPPI serves as a valuable tool for assessing the real estate and credit market conditions in the Philippines.

Scope and Coverage

The RPPI covers all residential property purchases through bank financing across the country.

The RPPI covers residential property transactions acquired by households through mortgages. These transactions are reported by all universal/commercial banks (U/KBs), thrift banks (TBs), and digital banks (DBs). The indices do not include cash purchases and non-bank transactions. Moreover, socialized housing segments are excluded in the generation of the indices.[2]

The geographic coverage of the RPPI is nationwide. Sub-indices covering the National Capital Region (NCR) and Areas Outside the National Capital Region (AONCR) are also generated. The AONCR index is further disaggregated into indices for the Balance Greater Manila Area (GMA), the metropolitan area in Cebu Province, the metropolitan areas in the Davao region and Cagayan de Oro (CDO), and other areas in the Philippines.

The RPPI is constructed using the residential property's acquisition cost, which is calculated as the price of the building and the price of the land where the building is located.

Source of Data

Data for the RPPI are collected from all U/KBs, TBs and DBs through the Bank Quarterly Report on Residential Real Estate Loans (RRELs), as required by BSP Circular No. 892 dated 16 November 2015 and BSP Circular No. 1154 dated 14 September 2022.[3,4]

An electronic reporting template is used to collect the following information:

a. Month of Loan Granted/Booked;
b. Location of Property;
c. Type of Property (whether new, pre-owned, or foreclosed);
d. Type of Housing Unit and Housing Segment;[5]
e. Peso Amount of the Acquisition Cost;
f. Peso Amount of the Appraised Value of Housing Unit, Lot and Total Appraised Value of the Property;
g. Total Floor Area and Lot Area, Number of Floors, Bedrooms and Effective Age of the House; and
h. Name of Developer and Other Developer.

[1] The BSP renamed the "Residential Real Estate Price Index (RREPI)" to "Residential Property Price Index (RPPI)." This change aligns the index's name more closely with international standards and better reflects its comprehensive coverage of residential property prices.
[2] Identification of socialized housing segments is based on the price ceilings set through the existing guidelines of the Housing and Urban Development Coordinating Council (HUDCC).
[3] https://www.bsp.gov.ph/Regulations/Issuances/2015/c892.pdf
[4] https://www.bsp.gov.ph/Regulations/Issuances/2022/1154.pdf
[5] Housing segment is based on price ceiling as defined under the existing guidelines of the Department of Human Settlements and Urban Development.

Data Validation

Extensive validation checks are implemented.

To help ensure accurate logical inputs, the RREL Excel template embeds extensive validation checks.[6] Moreover, data specialists review the reports for any unusual properties that may indicate potential errors. If any discrepancies are found, banks are notified and prompted to reevaluate their reports for possible corrections.

Stratification

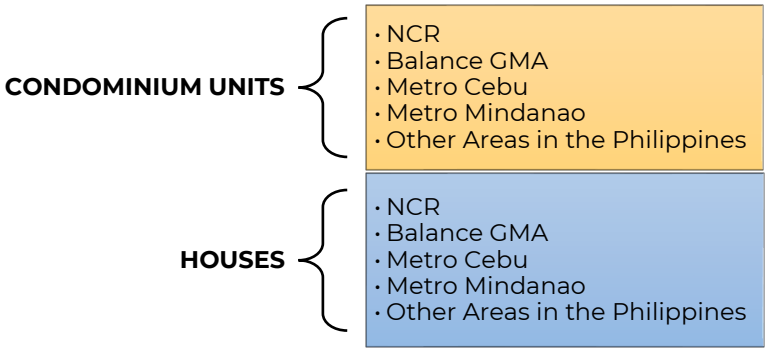
All data collected from purchased residential properties are first grouped by type of housing unit then by location.

All data collected from purchased residential properties are first categorized by type of housing unit, then by location, resulting in 10 major strata where separate indices will be formulated (see Figure 1).

Table 1
RPPI Stratification Variables

Variable	Categories
Type of Housing Unit	1. Condominium units 2. Houses[7]
Area where the housing unit is located	1. National Capital Region (NCR)[8] 2. Balance Greater Manila Area (GMA)[9] 3. Metro Cebu[10] 4. Metro Mindanao (composed of Metro Davao[11] and Metro Cagayan de Oro[12]) 5. Other Areas in the Philippines[13]

Figure 1
RPPI Stratification Scheme



[6] An example of a validation check in the template is preventing acquisition costs inputs of below 0 Philippine pesos.
[7] Composed of single-attached/detached houses, apartments, townhouses, and duplexes
[8] This is composed of all 16 highly urbanized cities and 1 municipality in the NCR.
[9] Balance GMA encompasses NCR's adjacent provinces of Cavite, Laguna, Batangas, Rizal, Bulacan, and Pampanga.
[10] Metro Cebu refers to an extended Cebu City area. However, its composition has yet to be legally defined. For the construction of the RPPI, the BSP lifted its definition from the proposed 2011 senate bill no. 1037, which outlines the creation of the Metropolitan Cebu Development and Coordinating Board (MCDCB). (https://legacy.senate.gov.ph/lisdata/3152628384!.pdf).
[11] The composition of the metropolitan area in the Davao region is lifted from the Republic Act (R.A.) 11708, which outlines the creation of the Metropolitan Davao Development Authority. (https://legacy.senate.gov.ph/republic_acts/ra%20111708.pdf)
[12] Similar with the Metro Cebu, the composition of the metropolitan area in CDO has yet to be legally defined. For the construction of the RPPI, the BSP lifted its definition from the Northern Mindanao Regional Development Council (RDC-X) (https://nro10.neda.gov.ph/master-plan-for-suid-in-metro-cdo/)
[13] This is a catch-all category for the remaining areas in the Philippines.

Weighting System

The RPPI is a value weighted index.

The weights of the RPPI are computed as the ratio of the value of transactions for each stratum to the total value of transactions for all strata in the previous year, as given by this equation:

$$w_s^y = \frac{Transaction\ value_s^{y-1}}{\sum_{s=1}^{10} Transaction\ value_s^{y-1}}$$

Eq. 1: Relative weights

where:

y = year

s = stratum classification from 1 to 10 (see Figure 1)

The transaction values represent the total acquisition costs of properties as reported by banks. According to the formula, the weights are fixed and updated annually, using the previous calendar year as the reference period. [14]

To illustrate, consider the following example in the table below showing the transaction value of each stratum in year 2023 and the computed weights to be used for aggregation in year 2024:

Table 2
Transaction Value in 2023 and Weights of Each Stratum in 2024

Stratum	Transaction Value of Stratum, s, in year 2023 (in billion Php)	Weight in the aggregation for year 2024, w_s^{2024} (in percent)
NCR Condominium	48.5	28.6
NCR Houses	21.1	12.4
Balance GMA Condominium	6.6	3.9
Balance GMA Houses	52.9	31.1
Metro Cebu Condominium	4.7	2.8
Metro Cebu Houses	4.6	2.7
Metro Mindanao Condominium	3.3	1.9
Metro Mindanao Houses	5.5	3.2
Other Areas in the PH Condominium	2.9	1.7
Other Areas in the PH Houses	19.9	11.7
Total	**170.0**	**100.0**

By weighting the strata based on transaction value, more influence is given to strata that contribute significantly to the overall market value. This approach ensures that the estimates more accurately reflect the value of the residential property market.

Figures 2 and 3 shows the weights overlayed in the Philippine map.

[14] For example, when generating the indices for the four quarters of 2024, the weight reference period should be 2023.

Figure 2
Stratum Weights for Condominium Unit in 2024

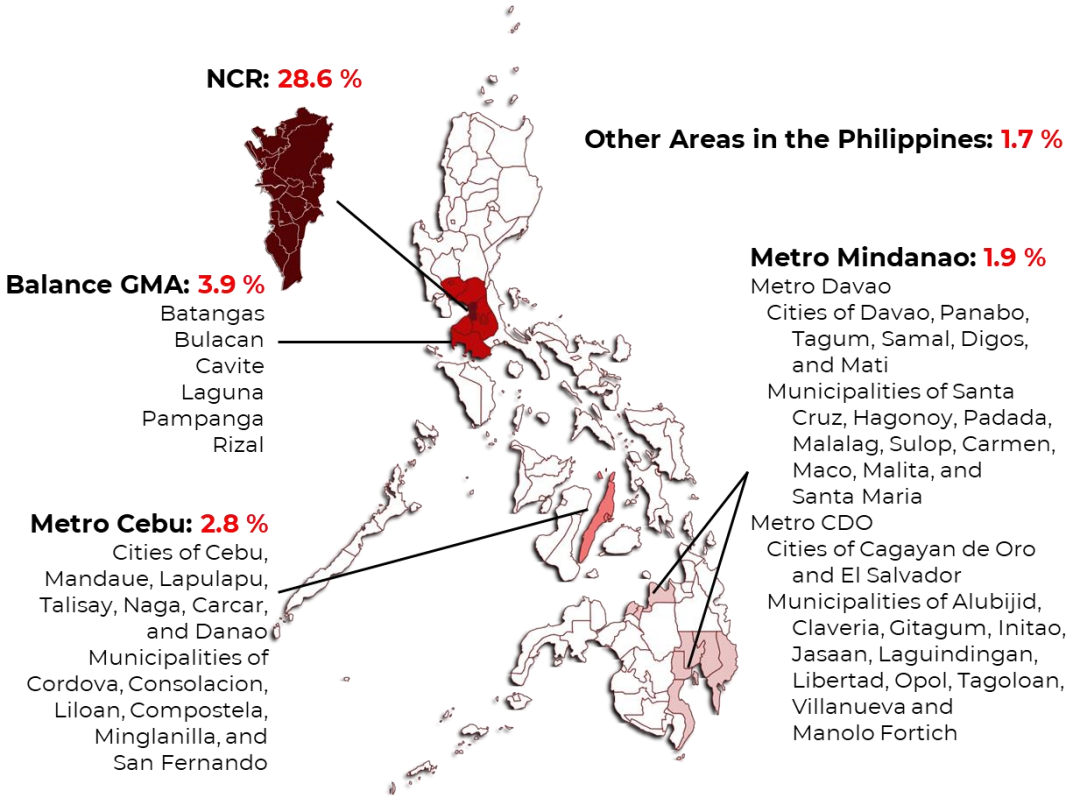
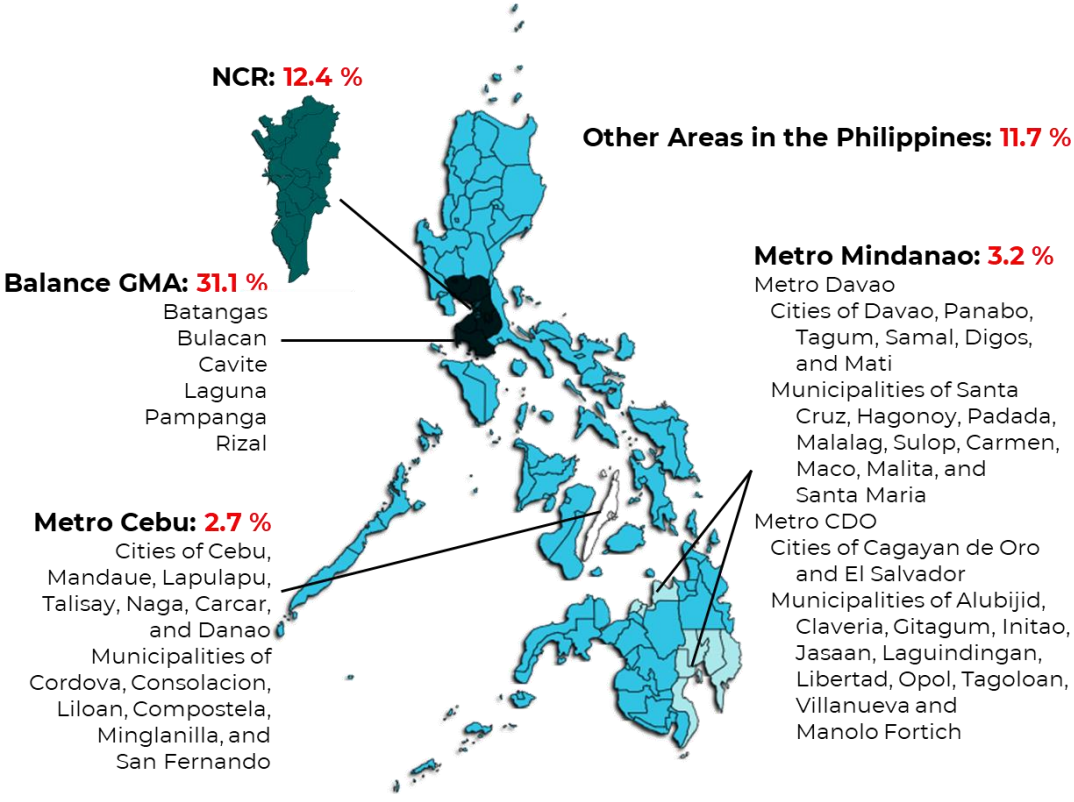


Figure 3
Stratum Weights for Houses in 2024



Index Formulation

Hedonic or regression-based method is used for index compilation at the level of the strata, i.e., sub-indices. The hedonic method allows for the calculation of constant-quality price indices by adjusting for the changing mix of properties in the sample over time.

Variable selection:
The variables that were considered in the models were based on the readily available information in the RRELs. To refine the variables, location dummy variables was formed by clustering cities, municipalities, or provinces with similar characteristics within each stratum.

The location dummy variables of each stratum in 2024 are as follows:

Stratum	Location dummy variables
NCR Condominium	City of Manila City of Mandaluyong City of Marikina City of Pasig Quezon City City of San Juan District 3 (cities of Caloocan, Malabon, Navotas, and Valenzuela) Las Piñas City City of Makati Muntinlupa City Parañaque City City of Pasay Taguig City (combined with Pateros)
NCR Houses	District 1 (City of Manila) District 2 (cities of Mandaluyong, Marikina, Pasig, Quezon City, and San Juan) District 3 District 4 (cities of Las Pinas, Makati, Muntinlupa, Paranaque, Pasay, Pateros, and Taguig)
Balance GMA Condominium	Batangas Bulacan Cavite Laguna Pampanga Rizal
Balance GMA Houses	
Metro Cebu Condominium	City of Cebu Other Areas in Metro Cebu
Metro Cebu Houses	
Metro Mindanao Condominium	Metro Davao Metro Cagayan de Oro
Metro Mindanao Houses	City of Davao Other Areas in Metro Mindanao
Other Areas in the PH Condominium	Rest of Luzon Rest of Visayas and Mindanao
Other Areas in the PH Houses	Rest of Luzon Rest of Visayas Rest of Mindanao

Building the regression model:

The RPPI utilizes the time dummy hedonic method.

The specific hedonic method used in the construction of the RPPI is a time dummy hedonic method. By incorporating time dummy variables into the model, it is possible to estimate the effects of time on housing prices while accounting for the marginal contributions of housing characteristics such as location, type of property, and floor area.[15]

In general, due to the positively skewed nature of property prices, the regression model takes in the form of a log-linear model: [16]

$$ln(p_n^t) = \beta_0 + \sum_{t=1}^{T} \delta^t D_n^t + \sum_{k=1}^{K} \beta_k X_{nk}^t + \varepsilon_n^t$$

Eq. 2: Time dummy regression

where:

t	=	period y, q (year, quarter)
n	=	number of transactions in period t
T	=	number of quarters
K	=	number of characteristics
$ln(p_n^t)$	=	price logarithm of transaction n in period t
β_0	=	intercept
δ^t	=	coefficient of the time dummy variable
D_n^t	=	time dummy variable
β_k	=	"shadow price" or marginal contribution of characteristic k
X_{nk}^t	=	quantity of characteristic k in period t
ε_n^t	=	error term

Rolling Window Approach:

The RPPI employs a four-quarter rolling window to avoid revisions of price indices and account for the change in buyer's preference over time.

To illustrate, the regression in the first window is implemented for the first four periods, i.e., the four quarters of the first year. In the 5th quarter, the regression is implemented from the 2nd to the 5th quarter. In the 6th quarter, the regression is implemented from the 3rd to the 6th quarter, and so on. Thus, the regression is run in a four-quarter rolling window.

At the stratum level, the indices from the new and the previous four-quarter windows are chained using the last overlap period between the two windows.[17]

[15] In this context, the time dummy variable indicates the specific quarter in which the housing loan was granted.

[16] A positively skewed nature of property prices can be a basis for using a log-linear regression model due to several reasons: a) **Normalization of Data**: Property prices often exhibit a right-skewed distribution, meaning there are a few very high values that can distort the analysis. By applying a logarithmic transformation, the data becomes closer to a normal distribution, which is a key assumption for many statistical models, including regression. b) **Reducing Heteroscedasticity**: In a positively skewed distribution, the variance of property prices tends to increase with the mean. This violates the assumption of homoscedasticity (constant variance) in linear regression models. A log transformation can stabilize the variance, making the data more suitable for regression analysis. c) **Linearizing Relationships**: The relationship between the dependent variable (property prices) and independent variables (e.g., property characteristics) may be multiplicative rather than additive. A log-linear model can linearize these relationships, making it easier to interpret the effects of the independent variables on the dependent variable. d) **Interpretability**: In a log-linear model, the coefficients of the independent variables may be interpreted as the percentage change in the dependent variable for a one-unit change in the independent variable. This can provide more meaningful and interpretable insights, especially in the context of property prices.

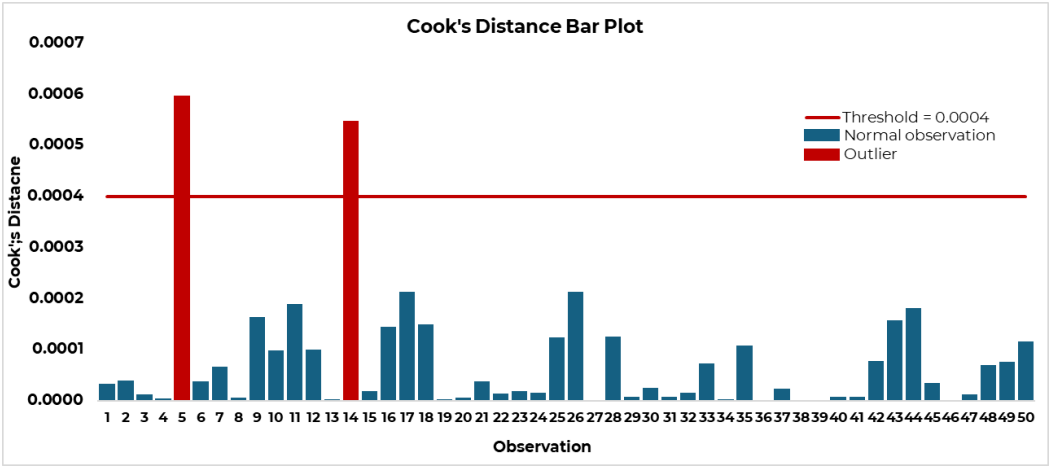
[17] An illustration of this can be found in the *Numerical Example* section on pages 11-14.

Cook's Distance for Outlier Detection:

Cook's distance is a statistical technique for identifying influential observations, i.e., outliers and observations of high leverage. It measures the impact of an observation on the predicted values by calculating the change in the predicted values with and without the said observation.[18] It is commonly used in other countries in the compilation of property price indices.

In principle, a higher Cook's distance generally indicates that an observation may be a potential outlier. The RPPI adopts a commonly used threshold of 4 divided by the total number of observations. Any observation exceeding this threshold is identified as an outlier and removed before rerunning the regression model. To illustrate, below is an example of a Cook's Distance bar plot for Metro Mindanao Condominium in the Q4 2024 window.

Figure 4
Cook's Distance Bar Plot of Selected Transactions for NCR Condominiums in the Q4 2024 window



The Cook's Distance bar plot is a diagnostic tool used to identify influential data points in a regression model. The x-axis represents individual observations, while the y-axis shows the Cook's Distance values. A red threshold line is drawn at 0.004, serving as a reference for identifying influential observations. Any observation above this threshold is considered a potential outlier, meaning it may exert a disproportionate influence on the model.

By identifying and addressing influential points, this plot ensures that the regression model is not overly biased by extreme values, leading to more reliable estimates.

Using the outlined outlier detection method, Table 3 presents the percentage of outliers detected in each quarter of 2024 for each stratum.

[18] For more information, see http://www.stat.ucla.edu/~nchristo/statistics100C/1268249.pdf.

Table 3
Outlier Frequency (in percent) by Stratum in 2024

	2024			
Stratum	**Q1**	**Q2**	**Q3**	**Q4**
NCR Condominium	4.47	4.93	5.26	6.09
NCR Houses	5.79	6.32	6.61	6.48
Balance GMA Condominium	6.45	7.21	8.39	8.84
Balance GMA Houses	5.57	5.64	5.92	5.87
Metro Cebu Condominium	4.80	5.34	5.04	5.28
Metro Cebu Houses	4.82	4.72	5.30	4.80
Metro Mindanao Condominium	7.44	6.86	6.21	6.35
Metro Mindanao Houses	4.22	4.78	4.82	5.35
Other Areas in the PH Condominium	7.06	6.46	6.08	5.70
Other Areas in the PH Houses	5.29	5.54	5.57	6.04

After the identified outliers are removed from the model, the regression is run again.

To demonstrate the model performance of each model in each stratum, see the adjusted R-square of the window for Q4 2024 below.

Table 4
Adjusted R-square (in percent) by Stratum in Q4 2024

Stratum	**Adjusted R-square (before outlier removal)**	**Adjusted R-square (after outlier removal)**
NCR Condominium	64.90	67.88
NCR Houses	71.31	81.12
Balance GMA Condominium	47.51	57.43
Balance GMA Houses	66.12	78.57
Metro Cebu Condominium	70.71	75.40
Metro Cebu Houses	61.08	69.70
Metro Mindanao Condominium	61.47	67.33
Metro Mindanao Houses	69.75	79.76
Other Areas in the PH Condominium	62.50	74.00
Other Areas in the PH Houses	50.72	64.77

Generation of stratum indices:

Time dummy variables are used in regression models to capture the effects of different time periods. In the context of the RPPI, the time dummy refers to the specific quarter in which the housing loan is granted. Typically, the earliest period typically serves as the base period. The base period itself does not have a dummy variable; instead, its effect is absorbed into the model's intercept. The coefficients of the time dummy variables represent the difference in property prices between each respective period and the base period.

Since these coefficients are estimated in logarithmic form, taking the anti-logs and multiplying by 100 converts them into a meaningful sub-index, I_s^t.

$$I_s^t = exp(\delta_s^t) * 100$$

Eq. 3: Sub-indices

where:

t = period y, q (year, quarter)
s = stratum classification from 1 to 10 (see Figure 1)
I_s^t = sub-index of stratum s in period t
δ_s^t = time dummy coefficient of stratum s in period t

The resulting sub-index I_s^t represents the relative price level compared with the base period.

The quarterly sub-index links, Q_s^t, are derived by computing the ratio of the sub-index for the current quarter and the sub-index of the previous quarter in the same window. Given that both sub-indices for the current and previous quarters are referenced to the base period, their ratio effectively cancels out the effect of the base time dummy variable. Consequently, the resulting quarterly sub-index link captures the price relative, i.e., measure of how prices moved from one quarter to the next.

For the first year, this is calculated as the ratio of the sub-index for the quarter and the average of the sub-indices in the first year.

$$Q_s^t = \begin{cases} \dfrac{I_s^t}{\frac{1}{4}\sum_{t=1}^{4} I_s^t} & for\ the\ first\ year \\ \dfrac{I_s^t}{I_s^{t-1}} & otherwise \end{cases}$$

Eq. 4: Quarterly sub-index links

where:

t = period y, q (year, quarter)
s = stratum classification from 1 to 10 (see Figure 1)
Q_s^t = elementary index link or price relative
I_s^t = sub-index of stratum s in period t

Since the sub-index link, Q_s^t, represents the price relative between two consecutive quarters, the stratum index, S_s^t, is obtained by multiplying Q_s^t by the previous quarter's stratum index. This ensures that the index is properly chained and referenced to the base year.

For the first year, the sub-index link is multiplied by 100.

$$S_s^t = \begin{cases} 100 * Q_s^t & for\ the\ first\ year \\ S_s^{t-1} * Q_s^t & otherwise \end{cases}$$

Eq. 5: Stratum Index

where:

t = period y, q (year, quarter)
s = stratum classification from 1 to 10 (see Figure 1)
S_s^t = index of stratum s in period t
Q_s^t = sub-index link of stratum s in period t

Generation of higher-level indices:

To generate the higher-level indices, the index links, L_s^t, are computed as the ratio of the stratum index for a given quarter, S_s^t, to the stratum index of the fourth quarter of the previous year, $S_s^{y-1,4}$. Using the fourth quarter as a reference point offers a stable and comprehensive baseline for comparing quarterly data. This approach mitigates seasonal effects and provides a consistent bridge between the previous year's developments and the current year.

$$L_s^t = \frac{S_s^t}{S_s^{y-1,4}}$$ Eq. 6: Index link

where:

t = period y, q (year, quarter)
s = stratum classification from 1 to 10 (see Figure 1)
L_s^t = index link vis-à-vis $y-1,4$ of stratum s in period t
S_s^t = index of stratum s in period t

To compute for the higher-level index, R_a^t, multiply the weighted average of the index link vis-à-vis the fourth quarter of the previous year with the higher-level index of the fourth quarter of the previous year to re-reference the index to the base year.

For the first year, the quarterly sub-index link is used.

$$R_a^t = \begin{cases} 100 * \frac{\sum_{s=1}^{m} Q_s^t * w_s^y}{\sum_{s=1}^{m} w_s^y} & for\ the\ first\ year \\ R_a^{y-1,q4} * \frac{\sum_{s=1}^{m} L_s^t * w_s^y}{\sum_{s=1}^{m} w_s^y} & otherwise \end{cases}$$ Eq. 7: Higher-level Index

where:

t = period: y (year) for weights; y, q (year, quarter) for all others
s = stratum classification from 1 to 10 (see Figure 1)
m = total number of strata in a higher-level index
a = area or house type
R_a^t = higher-level index of area/house type a in period t
Q_s^t = sub-index link of stratum s in period t
L_s^t = index link vis-à-vis y-1,4 of stratum s in period t
w_s^y = weight of stratum s for aggregation in year y

Computation of growth rates:

The growth rates are calculated using the following formulas:

$$g_a^t = \begin{cases} \left(\frac{R_a^t}{R_a^{t-4}}\right) * 100 - 100 & for\ \ year - on - year \\ \left(\frac{R_a^t}{R_a^{t-1}}\right) * 100 - 100 & for\ quarter - on - quarter \end{cases}$$ Eq. 8: Growth rate

where:

t = period y, q (year, quarter)
a = area or house type
g_a^t = growth rate of index of area/house type a in period t
R_a^t = higher-level index of area/house type a in period t

Computation of contribution to year-on-year growth:

The contribution to year-on-year growth rate for each area/house type a is calculated as:[19]

Eq. 9: Contribution to growth

$$c_s^t = \begin{cases} 100 * \left\{ \left[\left(\frac{R_{ph}^{y-1,4}}{R_{ph}^{y-1,q}} \right) * w_s^y * \left(\frac{S_s^{y,q} - S_s^{y-1,4}}{S_s^{y-1,4}} \right) \right] + \left[\left(\frac{100}{R_{ph}^{y-1,q}} \right) * w_s^{y-1} * \left(\frac{S_s^{y-1,4} - S_s^{y-1,q}}{100} \right) \right] \right\} \\ \qquad otherwise \\ 100 * \left\{ \left[\left(\frac{R_{ph}^{y-1,4}}{R_{ph}^{y-1,q}} \right) * w_s^y * \left(\frac{S_s^{y,q} - S_s^{y-1,4}}{S_s^{y-1,4}} \right) \right] + \left[\left(\frac{R_{ph}^{y-2,4}}{R_{ph}^{y-1,q}} \right) * w_s^{y-1} * \left(\frac{S_s^{y-1,4} - S_s^{y-1,q}}{S_s^{y-2,4}} \right) \right] \right\} \end{cases}$$

where:

t	=	period: y (year) for weights; y, q (year, quarter) for all others
s	=	stratum classification from 1 to 10 (see Figure 1)
c_s^t	=	contribution to year-on-year growth of stratum s in period t
$R_{ph}^{y,q}$	=	overall RPPI in year y quarter q
w_s^y	=	weight of stratum s for aggregation in year y
S_s^t	=	index of stratum s in period t

Frequency and Schedule of Release

The RPPI is published quarterly.

The RPPI is computed by the BSP on a quarterly basis. It is posted on the BSP website following the schedule stated in the BSP Advance Release Calendar, which is usually the last Friday of the quarter following the reference quarter (or the preceding working day in case of a holiday).[20]

Period Coverage

The RPPI series starts in Q1 2019.

The hedonic methodology was applied beginning the Q1 2025 dataset. Due to the higher data requirements of the new methodology, the RPPI was backcasted from Q1 2019 to Q4 2024 only.

Revision Policy

Regular assessments on the methodology will be conducted.

A regular assessment on the models and methodology will be conducted which includes, but not limited to, an analysis on outlier frequency, model performance, and variable selection. Necessary updates and adjustments on the model specification will be implemented periodically.

The BSP shall inform the public should any revisions take place.

[19] The calculation primarily follows the method shown in the paper "Contributions to growth against the previous year of continuous chain-linked Laspeyres indices", by Jana Rentzsch. (https://bbkrd.github.io/documents/kixcc/Rentzsch2019.pdf).

[20] https://www.bsp.gov.ph/Statistics/Advance%20Release%20Schedule/AdvanceReleaseSchedule.aspx

Numerical Example[21]

For the first year:

Based on the 2019 RREL data, sample computations for the RPPIs are as follows:

Step 1: Run the regression model.

Suppose the time dummy hedonic regression model for the NCR Condominium stratum is run for periods Q1 2019 to Q4 2019. The resulting time dummy coefficients from the regression are shown below:

Time Dummy Variables	Coefficient
Q1 2019	0.0000
Q2 2019	0.0384
Q3 2019	0.0347
Q4 2019	0.0787

Step 2: Obtain sub-index, I_s^t , using Eq. 3.

After the extraction of the time dummy coefficients, obtain its anti-logs and multiply by 100, as shown in the table below:

Period	Coefficient	Sub-index of NCR Condominium, $I^t_{NCR\ Condominium}$	
Q1 2019	0.0000	$exp(0.0000) \times 100$	100.0
Q2 2019	0.0384	$exp(0.0384) \times 100$	103.9
Q3 2019	0.0347	$exp(0.0347) \times 100$	103.5
Q4 2019	0.0787	$exp(0.0787) \times 100$	108.2

Step 3: Obtain the quarterly sub-index link, Q_s^t, using Eq. 4.

To ensure that the first year (2019), which is also the reference year, has an index set to 100, the I_s^t values are re-referenced i.e., each is divided by the average of I_s^t across all quarters in the first year (2019), as illustrated in the table below:

Period	Sub-index of NCR Condominium, $I^t_{NCR\ Condominium}$	Sub-index links of NCR Condominium $Q^t_{NCR\ Condominium}$	
Q1 2019	100.0	$\frac{100.0}{103.9}$	0.9624
Q2 2019	103.9	$\frac{103.9}{103.9}$	1.0000
Q3 2019	103.5	$\frac{103.5}{103.9}$	0.9964
Q4 2019	108.2	$\frac{108.2}{103.9}$	1.0412
Average	103.9		

This re-referencing ensures that the reference year index is standardized to 100, allowing for consistent comparisons over time.

[21] Details may not add up to total due to rounding.

Step 4: Obtain the stratum index, S_s^t, using Eq. 5.

After computing the quarterly sub-index links, Q_s^t, the stratum indices, S_s^t, for the first year (2019) are obtained by simply multiplying the sub-index links by 100, as follows:

Period	Sub-index links of NCR Condominium $Q_{NCR\ Condominium}^t$	NCR Condominium Index $S_{NCR\ Condominium}^t$	
Q1 2019	0.9624	0.9624×100	96.2
Q2 2019	1.0000	1.0000×100	100.0
Q3 2019	0.9964	0.9964×100	99.6
Q4 2019	1.0412	1.0412×100	104.1

The next steps show the computation of the higher-level indices.

Step 5: Compute for the higher-level index, R_a^t, using Eq. 7.

Consider the sample computation of the overall RPPI in Q1 2019.

Suppose we have calculated the sub-index links and weights of each stratum in 2019.

The higher-level indices are simply the weighted average of the sub-index links of their composition. For example, to compute for the Overall NCR index, we compute for the weighted average of NCR Condominium and NCR Houses.

Hence, the overall RPPI is the weighted average of the sub-index links of all the stratum.

Sample computation is seen below:

Stratum	Sub-index link $Q_s^{Q1\ 2019}$	Weight w_s^{2019}	$\left(Q_s^{Q1\ 2019} \times w_s^{2019}\right) \times 100$
NCR Condominium	0.96	0.51	49.0
NCR Houses	0.97	0.08	7.5
Balance GMA Condominium	0.98	0.03	2.5
Balance GMA Houses	0.96	0.20	19.3
Metro Cebu Condominium	0.94	0.04	3.7
Metro Cebu Houses	0.98	0.03	2.6
Metro Mindanao Condominium	0.95	0.01	1.4
Metro Mindanao Houses	0.99	0.03	2.9
Other Areas in the PH Condominium	0.93	0.01	1.2
Other Areas in the PH Houses	0.98	0.06	6.2
Total Sum		1.00	
Overall RPPI			96.3

Note: The weights used in the first year (2019) correspond to the value share of each property within that year. In subsequent years, the relative weights—determined by the value share in the previous year—are applied.

The overall RPPI for Q1 2019 is **96.3.**

For the subsequent years:
Based on the 2024 RREL data, sample computations for the RPPIs are as follows:

Step 1: Run the regression model.

Suppose we are interested in getting the Q4 2024 NCR Condominium price index, run the time dummy hedonic regression model of the stratum for periods Q1 2024 to Q4 2024. The following table shows the results from the regression:

Time Dummy Variables	Coefficient
Q1 2024	0.0000
Q2 2024	0.1039
Q3 2024	0.0683
Q4 2024	0.0250

Step 2: Obtain sub-index, I_s^t , using Eq. 3.

For the subsequent 4-quarter rolling window, compute only for the sub-index of the current, and previous quarter within the current window by multiplying its anti-logs by 100, as shown in the table below:

Period	Coefficient	Sub-index of NCR Condominium, $I^t_{NCR\ Condominium}$	
Q1 2024	0.0000		
Q2 204	0.1039		
Q3 2024	0.0683	$exp(0.0683) \times 100$	107.1
Q4 2024	0.0250	$exp(0.0250) \times 100$	102.5

Step 3: Obtain the quarterly sub-index link, Q_s^t, using Eq. 4.

The sub-index link of the current period, $Q^{Q4\ 2024}_{NCR\ Condominium}$, is linked relative to the sub-index link of the previous period that were derived in the current regression:

Period	Sub-index of NCR Condo $I^t_{NCR\ Condominium}$	Sub-index link of NCR Condominium $Q^t_{NCR\ Condominium}$	
Q3 2024	107.1		
Q4 2024	102.5	$\frac{102.5}{107.1}$	0.9576

This figure represents the price movement of Q4 2024 NCR Condominium relative to the previous quarter, Q3 2024.

Step 4: Obtain the stratum index, S_s^t, using Eq. 5.

After computing the quarterly sub-index link for Q4 2024 of the NCR Condominium stratum, we re-reference it to 2019 by chaining it to the previous quarter's index, $S^{Q3\ 2024}_{NCR\ Condominium}$, to obtain the Q4 2024 NCR Condominium RPPI.

Period	Sub-index link of NCR Condominium $Q^t_{NCR\ Condominium}$	NCR Condominium Index $S^t_{NCR\ Condominium}$	
Q4 2023		120.8	
Q1 2024		133.6	
Q2 204		147.5	
Q3 2024		141.2	
Q4 2024	0.9576	141.2×0.9576	135.2

Hence, the RPPI of NCR Condominiums for Q4 2024 is **135.2**, indicating that condominium prices in NCR have increased by 35.2% since 2019.

Now, proceed to calculate for higher-level indices using the steps below.

Step 5: Obtain the index-links, L_s^t, using Eq. 6.

Using the stratum index of the current quarter and the stratum index of the fourth quarter of the previous year, we obtain the index links by getting its ratio.

Period	NCR Condominium Index $S^t_{NCR\ Condominium}$	Index-links of NCR Condominium $L^t_{NCR\ Condominium}$	
Q4 2023	120.8		
Q1 2024	133.6		
Q2 204	147.5		
Q3 2024	141.2		
Q4 2024	135.2	$\frac{135.2}{120.8}$	1.1185

This ratio represents the price relative to Q4 2023, as it measures how prices in the current quarter compare to those at the end of the previous year. As stated on page 9, this ensures a stable baseline for comparing quarterly data.

Step 6: Compute for the higher-level index, R_a^t, using Eq. 7.

Suppose we are interested in getting the overall RPPI in Q4 2024, consider the following example below:

Stratum	Index-links $L_s^{Q4\ 2024}$	Weight w_s^{2024}	$L_s^{Q4\ 2024} \times w_s^{2024}$
NCR Condominium	1.1185	0.2855	0.3193
NCR Houses	1.1331	0.1244	0.1409
Balance GMA Condominium	0.9897	0.0386	0.0382
Balance GMA Houses	1.1046	0.3112	0.3438
Metro Cebu Condominium	1.0451	0.0278	0.0291
Metro Cebu Houses	1.0791	0.0273	0.0295
Metro Mindanao Condominium	1.0681	0.0192	0.0206
Metro Mindanao Houses	1.0815	0.0321	0.0347
Other Areas in the PH Condominium	1.0573	0.0169	0.0179
Other Areas in the PH Houses	1.0581	0.1170	0.1238
Total Sum		1.00	
Weighted average of the index links			1.0977

Now that we have obtained the weighted average of the index links for the period Q4 2024, we multiply it with the overall RPPI in Q4 of the previous year as seen below:[22]

Period	Overall RPPI R^t_{PH}	
Q4 2023	133.1	
Q1 2024		
Q2 204		
Q3 2024		
Q4 2024	133.1×1.0977	146.1

Hence, the overall RPPI for Q4 2024 is **146.1.** This means that prices of residential properties increased by 46.1 percent since 2019.

[22] The index link is always re-referenced to the 4th quarter of the previous year (see Equation 7 on page 9).

Glossary of Terms	
Term	**Definition**
Acquisition Cost	This refers to the contract price or the actual selling price agreed upon between the purchaser and seller at the time the contract was signed or deposit made.
Apartment	Refers to a room, suite of rooms in a building, or row houses that is/are being rented out as housing units
Appraised Value of Housing Unit	Refers to the real estate appraiser's opinion of the current worth of a housing unit based on factors such as area, location, improvements, and amenities at a given point in time
Condominium Units	Refers to a structure, usually a high-rise building, consisting of multiple dwelling units which are owned individually but the land, and other areas and facilities are commonly owned
Duplex	Refers to a single structure divided into two separate dwelling units by a common wall extending from the floor to the ceiling
Foreclosed	Refers to housing units repossessed by bank due to owners' default payments on the housing loan. This covers all foreclosed properties which are sold to individuals
New	Refers to newly-built or never been occupied housing units excluding foreclosed properties
Pre-owned	Refers to previously owned and occupied housing units excluding foreclosed properties
Single-detached house	Refers to a dwelling unit with all four walls not attached to any other dwelling or structure (except its own garage or shed). It has open space on all sides, and has no dwellings either above it or below it
Single-attached house	Refers to a dwelling unit with at least one side attached to a wall (usually a firewall)
Townhouse/ Accesoria/Detached row house	Refers to a structure, usually of two to three storeys, made up of a row of dwelling units entirely separated by walls with independent entrance from the outside for each dwelling units or separated by open spaces