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Residential Property Price Index: Sources and Methods

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Preface

Statistics South Africa (Stats SA) has developed the Residential Property Price Index (RPPI) in partnership with the South African Reserve Bank (SARB) and with the support of the International Monetary Fund (IMF). The data are published as the RPPI Statistical Release (P0160).

The release contains information on the national RPPI (aggregate of 22 metropolitan and large municipalities), RPPI for provinces and RPPI for metropolitan municipalities. Additionally, for metropolitan municipalities, the release includes RPPIs for:

- properties sold for the first time;
- resold properties;
- sectional title properties; and
- freehold properties.

This sources and methods document provides an overview of the methodology used to compile the South African RPPI.

Risenga Maluleke
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1. Introduction to the South African residential property price index (RPPI)

1.1 Defining the RPPI

An RPPI aims to measure "the rate at which the prices of residential properties purchased by households are changing over time. Both new and existing dwellings are covered if available, independently of their final use and their previous owners. Only market prices are considered. They include the price of the land on which residential buildings are located" (OECD 2022).

1.2 Uses of the South African RPPI

RPPIs' importance increased worldwide following the global financial crisis, and they are typically used:

- as a macroeconomic indicator of economic growth;
- in monetary policy and inflation targeting;
- as an input into estimating the value of housing as a component of wealth;
- as a financial stability or soundness indicator to measure risk exposure;
- as a deflator in the national accounts;
- as an input into an individual's decision-making on whether to buy (or sell) a residential property; and
- to make inter-area and international comparisons (IMF, 2020).

1.3 Development of the South African RPPI

In 2018, an International Monetary Fund (IMF) team assessed the feasibility of compiling an RPPI for South Africa and concluded that the most suitable source of data would be the property transaction records maintained by the Office of the Chief Registrar of Deeds (Deeds Office). However, conflicting legislation and the high cost of obtaining the complete dataset prevented direct access to this information. In 2020, the South African Reserve Bank (SARB) entered into a contract with a third-party provider to secure access to the Deeds Office data for Statistics South Africa (Stats SA) to develop the RPPI.

From 2021, Stats SA, with the support of the IMF and the SARB, worked through the development stages of the RPPI and compiled a discussion document (D0160) in March 2023 which was then published monthly. Following feedback from stakeholders, the RPPI model was adjusted, and additional indices were compiled. Since the January 2024 release (P0160), published in June 2024, the indices have been published as official statistics.

1.4 Alignment with international best practice

In compiling the South African RPPI, Stats SA largely follows the methodology guidelines in the *Residential Property Price Index: Practical Compilation Guide* (2020) − the RPPI guide − published by the IMF and the *Eurostat Handbook on Residential Property Prices* (2013) − the RPPI handbook. These are the main references for RPPI concepts and definitions, providing the theory, conceptual framework and practical methodological guidelines for the compilation of RPPIs. The sources and methods documents of other statistical agencies are also used as reference material.

Stats SA also benefited from the training and technical assistance provided by the IMF during the development of the RPPI.

2. Data sources and cleaning process

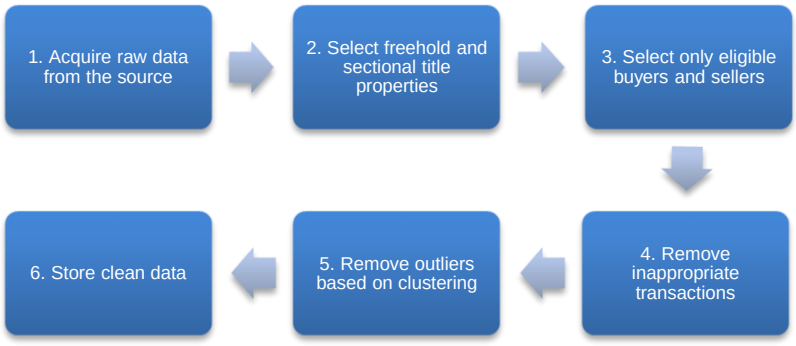
The RPPI handbook lists several potential data sources for the RPPI, available at different points in the process of selling a property:

- advertised or asking prices from newspapers, real estate agents or online property portals;
- mortgage applications from mortgage lenders;
- mortgage approvals from mortgage lenders;
- signed contracts from lawyers or notaries; and
- registered transactions from land registries or tax authorities.

The primary source of data used in the compilation of the South African RPPI is the records of property transactions registered with the Deeds Office. All transactions that result in a change of ownership of land are regulated by the Deeds Registries Act (1937), which requires the registration of title deeds with the Deeds Office. The data are purchased by the SARB from a third party that conducts quality assurance and adds a limited set of variables. The continued production of the RPPI currently depends on this sponsorship by the SARB.

The RPPI handbook points out that although registration records have the advantage of covering all transactions and reflecting the final price, the data are primarily recorded as a step in the administrative process and not as an input into a statistical system, and this needs to be taken into account when using the data. Stats SA takes the data through a six-step process to ensure that this administrative data set is suited for statistical processing. Figure 1 illustrates the process adopted.

Figure 1 – Data cleaning process



1. Acquire raw data from the source

Stats SA typically receives the updated dataset in the third week of each month. Among other variables, the data includes information about the price of the property, the type of property, the type of buyer and seller, and a unique property identifier code. On average, there is a four-month lag between the time a transaction is completed and the time it is recorded by the Deeds Office. While both dates are included in the data, the transaction date is the one relevant to the RPPI.

2. Select freehold and sectional title properties

To exclude non-residential properties, only freehold properties (erf) or sectional title properties are selected. These are assigned property type codes E and U, respectively, in the Deeds Office data.

3. Select only eligible buyers and sellers

To ensure that only properties intended for residential use are included, only transactions between eligible parties are included. Purchases by private individuals are included, while the following eight seller types are within scope:

- body corporate;
- company;
- close corporation;
- estate;
- financial institution;
- foundation;
- partnership; and
- private individual.

4. Remove inappropriate transactions

Three broad categories of records are removed from the data set: where necessary data is missing, where there are duplicate transactions and where the sales value or property size is so small or large that their inclusion will distort the results. These thresholds are based on the data distribution. Properties in areas labelled 'industrial' are also removed. Specifically, transactions are removed when:

- the selling price is null or missing;
- there are multiple buyers;
- the sale or transfer involves a share of the property;
- the transaction is a duplicate;
- the detail(s) of the buyer or seller are missing;
- the buyer and seller are the same person;
- the selling price is less than R80 000;
- the selling price is greater than R15 million;
- the size of the property is greater than 2 500m^2;
- the size of the property is smaller than 40m^2; and
- the suburb has fewer than five records on average since 2010.

5. Remove outliers based on clustering

Stats SA has developed a clustering approach based on the k-means methodology. This approach generates clusters annually based on the selling price for each suburb, allowing for a more accurate comparison of price data for similar geographic areas. Clusters that include fewer than 10 records are removed from the dataset. Clusters are calculated once a year, using data from the most recent five years.

6. Store clean data

The final dataset is now ready for generating the results.

3. Weights and index reference period

3.1 Weights basis and reference period

The RPPI handbook advises that the basis of the weights will depend on whether the aim of the index is to track the change in the value of the housing stock or the price to acquire housing. If it is the former, then stock value shares are more appropriate. The South African RPPI, however, aims to track changes in the sales values of properties and, therefore, uses aggregate sales values as weights.

The weights of the RPPI represent the proportion of sales value per area in a specific calendar year based on the final dataset used to calculate the RPPI. Each metropolitan municipality and each large municipality selected in the RPPI has a weight attached to it, which reflects its relative importance in the overall index. The municipal areas form the elementary indices, which are weighted in aggregating the provincial, metropolitan, and national indices.

Separate sets of weights are derived for the tables indicating the RPPIs for properties sold for the first time, resold properties, sectional title properties, and freehold properties. In these tables, the weight attached to each metropolitan municipality is specific to the relevant type of property.

The weights reference period should reflect economic conditions that are reasonably normal or stable. Weights are calculated each year using the total sales value of the two years prior. The reference period for the 2025 RPPI is 2023. The weights for each area are shown in Appendix A.

3.2 Index reference period

All indices are referenced to 100 in December 2020.

4. Index compilation method

4.1 Introduction

The challenge in compiling any price index is to capture only pure price changes – that is, to separate changes in price due to market dynamics from changes in price caused by shifts in the characteristics of the products being transacted over time. Typically, in measures of inflation such as the consumer price index (CPI) and producer price index (PPI), this is achieved by comparing the prices of similar products using a matched model method.

In the case of residential properties, however, price is determined by many different characteristics such as the location, the size of the property, the land it occupies and the type of building, with the result that no two properties are entirely identical. In addition, only a small proportion of the housing stock will be transacted in any given period. The combination of these factors makes the matched model approach difficult to apply to residential property.

Where possible, RPPIs are computed using a hedonic regression method, which estimates shadow prices based on the characteristics of properties (such as size and location) to ensure that quality is held fixed when measuring price changes from one period to the next. The result is an index that reflects pure price change for a consistent set of characteristics.

4.2 The South African model

The South African RPPI uses a form of the hedonic regression model – a rolling window time dummy hedonic regression – to compute the index. The model includes the data of 13 months (the window), with time dummies included for each month. The 13-month window has the advantage of keeping the coefficients relatively up-to-date and so takes account of changes in price determinants as market conditions change.

The model controls for location, type of property (freehold or sectional title) and the size of the property, which are all available in the data source. Suburbs within each municipality provide the location variable. In cases where there are multiple suburbs with the same name (e.g. Bryanston Ext 1, Ext 2, etc.), these are grouped together. The model includes an interaction term between size and type of dwelling.

Price indices are derived from the estimated coefficients on the time dummies. Equation 1 is the notation of the regression model. Each month the model is moved forward one period and re-estimated. The overall price index is constructed by chaining together the price indices from these rolling windows.

The Cook’s distance method identifies any transactions having an outsized impact on the regression results. These observations are flagged for investigation and possible removal from the dataset.

The resulting indices typically show a high level of volatility. In order to provide a more meaningful interpretation of changes in the index, a smoothing algorithm (a Henderson filter) is applied.

Elementary indices are calculated for each of the eight metropolitan and 14 large non-metropolitan municipal areas.

Equation 1 – Time dummy hedonic model

$$\ln p_n^t = \beta_0 + \sum_{t=1}^{T} \delta^t D_n^t + \sum_{k=1}^{K} \beta_k^t Z_{nk}^t + \gamma^t X_n^t + \varepsilon_n^t$$

where:
t – period;
n – number of dwellings in period t;
k – characteristics;
ln p_n^t – price logarithm;
β_0 – intercept;
δ^t – coefficient of the time dummy variable that will generate the index;
D_n^t – time dummy variables;
β_k^t – 'shadow' price of characteristic k in period t;
Z^t_{nk} – quantity of characteristic k in period t and dwelling n;
γ^t – coefficient of interaction term between property type and property size in period t;
X_n^t – interaction term between property type and property size in period t and dwelling n; and
ε_n^t – error term.

The index for the current period (t) is then derived as follows:

Equation 2 – Index derivation

$$I_t = \exp(\hat{\delta}_t) * 100$$

When data for a new period is added to the model, the parameters of the previous periods' dummy variables are affected. To ensure an adequate quantity of data for the model and to keep the coefficients current, a rolling 13-month window is used. This means that data from the last 13 months are pooled together every time the index is calculated for a new period. The indices from the new 13-month window and the previous 13-month window are chained using the last overlap period between the two windows.

4.3 Aggregation structure

The elementary indices calculated for the metropolitan and other selected municipalities are aggregated first to a provincial level and then to a national level. The metropolitan areas are aggregated in a separate table to 'All metropolitan areas'. The RPPIs for properties sold for the first time, resold properties, sectional title properties and freehold properties are also aggregated separately into tables for 'All metropolitan areas'. The indices are aggregated using weighted arithmetic means – the same method as used in the CPI and PPI. The weights are proportions of total sales from two years prior (see Section 3.1). Appendix A shows the detailed coverage and weights of the national and all metropolitan areas RPPIs.

4.4 Changes in weights – linking the old and new index series

RPPI weights are updated annually with effect from January. It is important to ensure that the change in weights does not distort the month-on-month movements of the indices between December and January. To maintain the continuous time series, the January index using the new weights is linked to the December index (using old weights) by means of a linking factor. The linking factor is the ratio of the December index calculated using the old and new weights. The linking factor is applied during the year, until a new linking factor is calculated to link the following January.

Linking results in non-additivity of the new, linked index. In other words, if components are multiplied by their weights and aggregated to higher levels, the results may not be the same as those published.

4.5 Revisions

The Deeds office data is continuously updated, and therefore Stats SA allows for revisions of the indices. The RPPIs for the latest 12 months will be subject to revision. The scope of the revisions is outlined in the following schedule. Any unscheduled revisions will be promptly indicated in the relevant tables to maintain transparency and accuracy.

Table 1 – Scheduled revisions for 2025

Statistical release	Period subject to revision
Jan-25	Jan-24 - Dec-24
Feb-25	Feb-24 - Jan-25
Mar-25	Mar-24 - Feb-25
Apr-25	Apr-24 - Mar-25
May-25	May-24 - Apr-25
Jun-25	Jun-24 - May-25
Jul-25	Jul-24 - Jun-25
Aug-25	Aug-24 - Jul-25
Sep-25	Sep-24 - Aug-25
Oct-25	Oct-24 - Sep-25
Nov-25	Nov-24 - Oct-25
Dec-25	Dec-24 - Nov-25

Abbreviations

CPI	Consumer Price Index
IMF	International Monetary Fund
OECD	Organisation for Economic Co-operation and Development
PPI	Property Price Index
RPPI	Residential Property Price Index
SARB	South African Reserve Bank

Appendix A: RPPI coverage and weights (2025)

Province and municipality	National RPPI	All metropolitan areas RPPI	Properties sold for the first time RPPI	Resold properties RPPI	Sectional title properties RPPI	Freehold properties RPPI
	Weight					
Western Cape	**35,54**					
City of Cape Town	28,54	34,63	36,43	34,30	31,65	36,19
Drakenstein	1,21					
Overstrand	1,76					
Mossel Bay	1,51					
Saldanha Bay	1,16					
George	1,36					
Eastern Cape	**4,93**					
Buffalo City	1,47	1,78	2,02	1,74	0,70	2,35
Nelson Mandela Bay	3,46	4,20	3,30	4,37	3,50	4,57
Northern Cape	**0,80**					
Sol Plaatje	0,80					
Free State	**2,37**					
Mangaung	1,95	2,37	3,12	2,23	3,33	1,86
Matjhabeng	0,42					
KwaZulu-Natal	**10,61**					
eThekwini	7,91	9,60	8,11	9,87	12,61	8,02
KwaDukuza	1,79					
Msunduzi	0,92					
North West	**2,54**					
City of Matlosana	0,69					
Rustenburg	1,85					
Gauteng	**39,08**					
City of Johannesburg	17,96	21,80	21,84	21,79	23,22	21,06
City of Tshwane	11,78	14,30	13,06	14,52	17,99	12,36
Ekurhuleni	9,33	11,32	12,12	11,18	7,00	13,59
Mpumalanga	**2,82**					
City of Mbombela	1,54					
Emalahleni	1,28					
Limpopo	**1,31**					
Polokwane	1,31					

Glossary

Chain linking	The construction of a continuous price series by multiplying together price indices that have been calculated using different weights reference periods. The resulting index is referred to as a chained index. Linking is intended to ensure that the individual indices on all levels show the correct development through time but leads to non-additivity. The RPPI is chained annually as new weights are implemented.
Cook's distance	Cook's distance is a statistical measure used to identify influential observations in a data set when fitting a linear regression model.
Freehold property	A tenure status where the owner has title to both the dwelling and the land, for example, stand-alone houses.
Henderson filter	The Henderson filter is a smoothing method in time series analysis. It estimates trend-cycle components by applying weighted moving averages over a set number of periods, usually odd for symmetry. This technique aims to reduce noise while preserving underlying trends, aiding in forecasting and economic analysis.
Large municipality	Large municipalities refer to municipalities where a large number of property sales transactions occur.
Metropolitan municipality	Local authority that has a municipal executive and legislative authority in an area that includes more than one municipality, as described in section 155(1) of the Constitution as a category A municipality.
Properties sold the first time	Dwellings that appear for the first time in the deeds data, indicating their initial registration in the residential property market.
Residential Property Price Index	Residential property price indices measure the changes in the price of residential properties.
Resold properties	Dwellings that appear more than once in the deeds data, reflecting subsequent transactions following their initial registration.
Sectional title property	A tenure status where the owner has title to only the dwelling, for example, apartments and townhouses.
Time dummy hedonic approach	One of the main hedonic regression approaches to constructing a (residential property) price index. In the standard log-linear time dummy variable model, the characteristics coefficients are constrained to be fixed over time, and the price index numbers can be directly computed from the time dummy coefficients (through exponentiation).

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