FDZ Data Description: Regional Real Estate Price Indices for Germany (RWI-GEO-REDX) – Version 16: 2008-05/2025

Felix Heuer and Patrick Thiel

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Impressum

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Abstract

The FDZ Ruhr at RWI provides regional price indices for apartments and houses (rentals and sales) in Germany since 2008 through the RWI-GEO-REDX dataset, based on property listings from ImmoScout24 (RWI-GEO-RED).

RWI-GEO-REDX stands out for its high spatial resolution: the exact location of each listing allows price indices to be calculated at the level of 1×1 km grid cells. Results are aggregated at regional levels including grid cells, municipalities, counties, and labor market regions. The indices are reported as quality-adjusted absolute prices, including annual and regional changes. A key feature is the location-adjusted national index, which accounts for shifts in the regional composition of listings over time.

The data are publicly available via the FDZ Ruhr website. A weakly anonymized version is also available for research purposes upon request. This report refers to RWI-GEO-REDX V16, covering data through May 2025.

1. Introduction

An important topic in the current public and political discourse in Germany is the development of housing prices. Rising rents, housing shortages in urban areas, and rural-urban migration are some of the problems being discussed. Despite its topicality, little data is available on the recent development of house prices in Germany. To fill this gap, the RWI-GEO-REDX dataset quantifies regional differences in house sales, apartment rents, and apartment sales on the level of districts (Kreise, NUTS 3 level) and municipalities (Gemeindeverband, LAU 1 level) as well as labor market areas defined by RWI (2018).

Several methods are used to derive real estate indices. First, median sales prices are the easiest to construct and are used by the U.S. Census Bureau. However, they do not adjust for the quality of the properties on the market (Ghysels et al., 2013). Second, Case and Shiller (1989) propose a repeated-sales price index, which is a constant-quality index that uses only information on houses that have been sold at least twice during the sample period. This method is used by the U.S. Federal Housing Finance Agency for the HPI index. This index requires very little data. However, these properties may not be representative of the market (Clapp & Giaccotto, 1992), and the index relies on the crucial assumption that quality does not change due to renovation or modernization.

Third, hedonic price indices are based on hedonic price regressions, where the price is expressed as a function of the characteristics of the dwelling or house. The characteristics thus describe the quality of the property. For all three types of indices, it is important that the sale of a property can be correlated with local economic conditions, as more expensive homes tend to be put on the market during expansions. Gatzlaff and Haurin (1998) take into account the selectivity of using only sold houses. Englund et al. (1998) combine the hedonic index with the repeated sales index. Finally, there are stock market-based indices that are obtained by trading real estate investment trust shares.

While a simple study of regional average rents and prices is not sufficient to make reliable statements on housing prices, the RWI-GEO-REDX is based on hedonic price regressions. The hedonic price regressions take into account qualitative differences in housing supply, such as different amenities. Hedonic price regressions are a commonly used method for real estate pricing in Germany, e.g., in the hedonic EPX of Eurospace AG (2019), a commercial online distributor of real estate financing, and the real estate price index of the Verband Deutscher Pfandbriefbanken e V. (vdp) (2019), which processes transaction data from certain financial institutions. The real estate price index by bulwiengesa AG (2018) focuses on cities and larger towns, but does not include consistent information on data structure and methodology and is available for commercial use only. The AK-OGA, a cooperation of all German federal advisory committees on real estate issues, publishes housing price indices for different house types on an annual basis and at the federal and sub-district level. These price indices are partly derived by median sales observation and hedonic price regressions. In addition, the IMX Offer Index is a hedonic price index that is derived from the offers placed by the online real estate agency ImmobilienScout24 for the sale and rental of houses or apartments.

The first two indices report house price changes at the national level and do not provide further information for smaller regions. This study fills this gap by combining a comprehensive, up-to-date dataset and a hedonic price regression; it provides regional price indices relative to the German mean, capturing regional differences, the region-specific time trend as well as the national development over time. The analysis is based on a dataset of online real estate advertisements, the RWI-GEO-RED. This comprehensive dataset is obtained from ImmobilienScout24. The data is regularly updated, which makes it possible to analyze the latest developments. It is therefore possible to update the price indices on a regular basis.

We use a hedonic price regression for the price indices in order to capture various characteristics of sales and rental prices beyond the median. The repeat sales approach may not be representative for the German real estate market, as Voigtländer (2012) mentions. Here, too, it is not possible to link two sales of the same property due to data limitations.

While other published price indices are constructed using financial data, the following analysis deals with seller-listed listings. This means that only apartments and houses that are for rent or sale and listed on the listing website are available in the dataset. Consequently, the analysis is based on advertised prices and not transaction prices.

In addition, indices for home sales are also included in the dataset, complementing the regional price information for home sales and rentals. In addition to the municipality and district level, all three supply categories are also reported at the level of labor market regions according to the delineation of RWI (2018).

2. Data

We use the RWI-GEO-RED data (RWI - Leibniz Institute for Economic Research, 2025a, 2025b, 2025c) of the FDZ Ruhr at the RWI to generate the price indices. They are based on real estate listings published on Germany's largest real estate listing website, ImmobilienScout24. Here, property owners and estate agents can advertise their houses and apartments for a fee. All information is provided by the owner or agent selling or renting the property. While some information is required to place an ad online, most information is provided voluntarily. More information about the property helps to present it appropriately and is likely to increase the chances of it being sold or rented. A detailed description of the data source can be found in Heuer and Thiel (2025).

The dataset includes information on the prices of property listings as well as various characteristics that determine the value of a property. Monthly data are used. The present dataset covers the period from January 2007 to May 2025. Since there are few observations in 2007, we restrict the data in the following to the years 2008 to May 2025. The restriction to May 2025 is to avoid a look-ahead bias in the time trend.

The RWI-GEO-RED provides information on the building at the level of the housing unit, municipality, district and federal state. Furthermore, the data includes information on the size of the house or apartment (e.g., living space, plot area, number of rooms), on its facilities (e.g., balcony, garden, bathrooms, level of facilities), on financial aspects (e.g., price and additional costs), as well as information on energy consumption. Unfortunately, some variables are characterized by many missing values, which has to be taken into account for the following analysis.

The selection of variables for the analysis is based on two considerations. First, we aim for coherence in the data set to ensure comparability between properties. Second, the set of characteristics used in the analysis must be comprehensive enough to capture the different characteristics of apartments and houses. In order to get as close as possible to the real market price of the property, we only include advertisements in their most recent month of publication, i.e., when they leave the listing website. Previously updated versions of the listed apartment or house are not included. This strategy aims to best approximate the actual sale price with the published, self-reported listing price. Further information on excluded homes from the original dataset is described in the Section 6.

We calculate price indices for districts and municipalities based on the regional definitions of 2019 (Federal Agency for Cartography and Geodesy, 2019). In 2019, there are 401 counties in Germany, varying in area and population size. In addition, there are around 11,000 municipalities. As a supplement, we included labor market regions according to the delineation in RWI (2018) as a third type of region, defining 182 areas. This delineation is advantageous for modeling real estate price indices, as it follows the idea of labor market accessibility for commuters. The labor market boundaries are drawn from existing commuting relationships. The advantage of this delineation is that these interrelationships are a stronger determinant of residence decisions and real estate market developments than pure administrative boundaries.

3.   Methodology

Estimated Equation

A meaningful regional price index should capture both temporal and spatial price differences while controlling for variations in dwelling quality through property characteristics. To achieve this, we first estimate a hedonic price regression based on the attributes reported in property advertisements. The specification follows common approaches in the literature (e.g., Sirmans et al., 2005) and is similar to applications for Germany, such as in Bauer et al. (2011).

For properties for sale, the dependent variable is the listing price per square meter; for rentals, it is the exclusive rent per square meter (*Kaltmiete*). This normalization of the dependent variable facilitates meaningful interpretation of results across both space and time. Exogenous variables in the regression include a range of property characteristics that influence the rent or sale price.

The aim of the index is to produce quality-adjusted price or rent values for each region and year that are straightforward to interpret. Whereas earlier versions of the index relied on three separate equations to capture temporal trends, cross-sectional regional differences, and regional trends, the current version is rather based on a single, unified estimation to facilitate interpretation. The estimation is performed separately for housing types (apartment for rent, apartment for sale and houses for sale)

$$ln(y_{igt}) = \theta X_{igt} + \eta_{gt} + \epsilon_{igt} \qquad (1)$$

Here, the dependent variable y_{igt} is the sale or rental price per square meter of dwelling unit i in region g (grid-level) in year or year-quarter t. The vector X_{igt} contains property characteristics, which differ between the three housing types; the full list of variables is provided in Table A1 in Section 6. All elements of X_{igt} are demeaned. Since all regions and years are estimated jointly, we assume that the characteristics are valued identical for all years and all regions. The error term ϵ_{igt} is assumed to follow a standard normal distribution.

The primary index measure is η_{gt}, the grid-time fixed effect for grid g in year or year-quarter t. Because X_{igt} is demeaned, η_{gt} can be interpreted as the logarithmic price for a property with average characteristics. By exponentiating the estimated η_{gt} for grid g in period t[1], we obtain nominal Euro-per-square-meter values.[2]

These grid-level values can be aggregated to any larger spatial unit using observation-weighted averages. We provide results for municipalities 'MUNIC' (*Gemeinden*), districts 'DISTR' (*Kreise*), and labor market regions 'LMR' (*Arbeitsmarktregionen*). The highest possible aggregation level is the national index, which provides a pure time series for each year from $t = \{2008, \ldots, 2024\}$ and for each quarter from $t = \{2008\text{-}Q1, 2008\text{-}Q2, \ldots, 2025\text{-}Q2\}$.

3.0.1.   Presentation of the Result Tables

The price index comprises a complex set of results for several reasons. First, we report results separately for the three market segments: apartment rents, apartment sales, and house sales. Within each segment, results are provided for three regional levels: municipalities ('Munic'), districts ('Distr'), and labor market regions ('LMR'). The core results, the quality-adjusted values per square meter by region and period, as obtained from the equation described above, are published

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[1]The exact formula for this procedure is as follows: $p_{gt} = e^{\eta_{gt}} \times e^{\frac{1}{2}\sigma^2}$ following the Smearing retransformation where *p* reflects the nominal Euro-per-square-meter price.

[2]The same procedure is also applied at the quarterly level instead of the yearly level.

in the sheets *_RegionEff_abs_*. The last row in each sheet contains the weighted mean across all observations in the respective period.

Based on these core results, we calculate each region's deviation from the weighted national mean for each period. These deviations are contained in the dataset *_DEV_CROSS. Results are provided in absolute terms (*_RegionEff_dev_*, in Euro per square meter) and as percentage deviations (*_RegionEff_devpc_*).

A third set of results, stored in *_DEV_REGION, focuses on price (rent) developments within regions over time. Here, the values represent each region's deviation from its own value in the first observation period (2008 for years and 2008-Q1 for quarters). Again, results are reported in both absolute terms (*_RegionEff_dev_*) and as percentage deviations (*_RegionEff_devpc_*).

Please refer to section 4 to more information on the exported file naming.

4.   Data Access and Additional Information

The data can be obtained as Public Use File (PUF) or Scientific Use File (SUF) from the FDZ Ruhr at RWI. The FDZ Ruhr is the research data center of the RWI - Leibniz Institute for Economic Research. In order to ensure that the indices are not driven by small sample sizes, the PUF dataset includes only those indices that are based on at least 50 observations per year and region. The indices based on less than 50 observations per year and region are also available on request as an SUF for scientific research purposes only. It is the responsibility of the researcher to assess whether this lower threshold is appropriate for the intended research design. Since the RWI-GEO-REDX subsumes aggregated information, it does not contain any information that is restricted for data security reasons. The indices presented here are available as Excel (.xlsx) files and as CSV / parquet files for the grid indices. The naming convention of the files follows the logic below:

 DATASET_HOUSINGTYPE_VERSION_ANONYMISATION_TIME_VALUETYPE

Notice, the combined indices are only available for percentage changes and does not exist for absolute differerences (e.g., *RWIGEOREDX_COMBIND_V15_PUF_YEAR_ABS* does not exist.
Each component can take on the following values:

Table 1
Details Naming Convention Data Files

Component	Description	Possible Values
DATASET	Name of the dataset to which the file belongs.	RWIGEOREDX
HOUSINGTYPE	The housing type for which the values are calculated.	- APPURC - Apartment sales - APRENT - Apartment rents - COMBIND - Combined index - GRIDS - Grid-level values - HOUPURC - House sales
VERSION	The version of the dataset.	E.g. V16
ANONYMISATION	The degree of anonymisation.	- PUF - Public Use File - SUF - Scientific Use File
TIME	The temporal resolution of the data.	- YEAR - Yearly values - QUARTERLY - Quarterly values

VALUETYPE	The acutal representation of the data points.	
		• ABS - Absolute values
		• DEV_CROSS - Deviations across regions
		• DEV_REGION - Deviations within region

Data access does not require a data use agreement, but users must register to access the data. Interested users should visit our website https://www.rwi-essen.de/en/research-advice/further/research-data-center-ruhr-fdz/data-access.

Users are requested to cite the source correctly and to inform the FDZ Ruhr about publications using the data. When using the dataset RWI-GEO-REDX, please cite the data as RWI (2025): RWI-GEO-REDX: Regional Real Estate Price Index for Germany, 2008-05/2025. Version: 16. RWI – Leibniz Institute for Economic Research. Dataset. http://doi.org/10.7807/immo:redx:puf:v16. Further, we recommend citing this data description.

For more details on the index coding, please refer to our GitHub repository (https://github.com/PThie/RWI-GEO-REDX), which should be cited as: Felix Heuer, Patrick Thiel (2025). PThie/RWI-GEO-REDX: RWI-GEO-REDX V16 (V16.0). Zenodo. https://doi: 10.5281/zenodo.17735337

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6. Appendix

6.1. Information on data restriction in the RWI-GEO-REDX Price Indices

From the original RWI-GEO-RED dataset, we exclude luxury apartments for the estimation of the RWI-GEO-REDX price indices. So that, rental apartments with rents exclusive utilities above 5,000 Euro per month are omitted. The living area is restricted from 15 to 400 sqm and up to 7 rooms per rental apartment. These restrictions still cover a very large range of rent prices and living space, but it discards the extremely small or very exclusive apartments from the portfolio. It is likely that the luxury apartment market is not fully integrated into the aver-age rental market, which makes comparisons over regions across these markets difficult. We further set a bottom limit of 15 sqm living space to include only self-efficient apartments and to exclude typing errors.

House sales are restricted in a similar fashion; the living area ranges from 50 to 600 sqm and the house price varies up to 5 Million Euro. The number of rooms is restricted to 15. The aim, here, is to ensure self-efficiency but rule out possibly faulted on the one hand and extremely luxurious houses on the other hand, too. The focus of the analysis of house sales lies on single-family homes, thus, apartment buildings are excluded. Furthermore, holiday homes are excluded if declared explicitly by the seller as well as houses with more than five floors. The constraints are imposed on the offers for apartment sales likewise. Offered apartments with a price higher than 2 Million Euro, more than eight rooms and an adverted living area below the 1st percentile and above the 99th percentile are not accounted for in the following estimation.

When placing the advertisement online, the user decides which information to publish on the advertised real estate. Working with these self-declared information leads to many missing values in many variables that need to be handled with care. For the binary variables a missing is accounted for as a zero, so the offer does not meet the feature in question. This seems reasonable to the extent that the owner or agent tends to publish benefits of the real estate to attract searchers with certain preferences. Furthermore, in some years many characteristics are collected using checkboxes which means that there is no difference between "no" and "no answer". Examples are especially positive characteristics of the property, such as a balcony or guest toilet. In the analysis, we deal with missing values as a separate category for categorical variables. In the considered metric variable, number of rooms, missing values are given as "zero rooms".

Table A1

Explanatory Variables in Analysis of House, Apartment and Rent Prices

Variable	Description	House sales (HS)	Apartment rents (AR)	Apartment sales (AS)	Restrictions
Numerical variable					
Number of rooms	Number of rooms in the unit	x	x	x	Restricted to: 15 rooms (HS), 7 rooms (AR), and 8 rooms (AS)
Categorical variable					
Number of total floors	1 := Missing 2 := 1-3 Floors 3 := 4-5 Floors 4 := 6-10 Floors 5 := More than 10 floors			x	
Floor number of housing unit	0 := Missing 1 := Ground floor (UG) 2 := First floor (EG) 3 := 2nd to 3rd floor 4 := 4th to 5th floor 5 := 6th to 10th floor 6 := Above 10th floor			x	
Endowment	0 := Missing 1 := Simple 2 := Normal 3 := Sophisticated 4 := Deluxe	x	x	x	
Year of construction	1 := Missing 2 := Before 1900 3 := 1900-1945 4 := 1946-1959 5 := 1960-1969 6 := 1970-1979 7 := 1980-1989 8 := 1990-1999 9 := 2000-2009 10 := After 2009	x	x	x	
Plot area (in sqm.)	0 := Missing 1 := (0-200] 2 := (200-400] 3 := (400-600] 4 := (600-800] 5 := (800-1,200] 6 := (1,200-2,500]	x			Restricted to 2,500 sqm. due to possible agricultural use
Binary variable					
First occupancy	1 if new owner or renter move in as first occupancy	x	x	x	
Detached house	1 if house is detached	x			
Semi-detached house	1 if house is semi-detached	x			
Terraced house	1 if house is a terrace house	x			

Continued on next page

Table A1 – *Continued from previous page*

Variable	Description	House sales (HS)	Apartment rents (AR)	Apartment sales (AS)	Restrictions
Exclusive house	1 if the property is declared as a mansion or castle	x			
Other house type	1 if house is categorized differently	x			
Balcony	1 if property has a balcony		x	x	
Garden	1 if apartment has access to a private garden		x	x	
Guest toilet	1 if housing unit includes a guest toilet	x	x	x	
Built-in kitchen	1 if housing unit comes with a built-in kitchen		x	x	
Granny flat	1 if the property contains a separate "granny flat" or secondary suite	x			
Cellar	1 if cellar room is available		x	x	
Common charge	1 if common charge is declared in offer			x	
Lift	1 if property contains a passenger lift			x	

Notes: In the report on the property market of the federal state of North Rhine-Westphalia (Der Obere Gutachterausschuss für Grundstückswerte im Land Nordrhein-Westfalen, 2017) the referees do not count sales of undeveloped rural plot area under 2,500 sqm. in their statistics of farmland sales. This is also the case in the report on the property market for the scarcely populated state of Saxony-Anhalt (Gutachterausschuss für Grundstückswerte in Sachsen-Anhalt, 2017). This gives a notion that plot areas above the margin of 2,500 sqm. can be of interest for agricultural and not only residential purposes. To focus on house sales for living purposes without further commercial use, only plot areas smaller than 2,500 sqm. are included in the following.
Source: Authors' table based on RWI-GEO-REDX (RWI - Leibniz Institute for Economic Research, 2025d).