

Report on the methodology of residential property price indices

The Bundesbank regularly publishes an annual residential property price index for seven major cities, 127 cities and Germany as a whole based on regional price information on apartments and houses provided by bulwiengesa AG.¹ The residential property price data are quality adjusted using the method of typical cases², i.e. only prices of similar properties are included in the index calculation.³ bulwiengesa AG uses information taken, among other sources, from its own consulting activities, from building and loan associations, research institutions, local committees of valuation experts (*Gutachterausschüsse*), associations of German real estate agents, chambers of industry and commerce as well as from independent experts. The regional figures thus also incorporate expert judgement, meaning that the data are not purely transaction prices.

Indices based on regional price data from bulwiengesa AG

This report explains the two weighting schemes as used by the Bundesbank since 2015, taking into account different analytical objectives.⁴ Since one single indicator is not equally suitable for addressing all questions, it is appropriate to use different approaches depending on the objective of the analysis. The data presented here should therefore be viewed as complementary indicators. The main data sources are the 2011 Census of buildings and housing and data on the number of transactions provided by vdpResearch GmbH. Our resulting time series go back until 2004.⁵

Indicators for different analytical purposes

¹ Price information is available for five different types of property: apartments (new/existing), detached single-family houses (existing) as well as terraced houses (new/existing, only for cities).

² See Deutsche Bundesbank, Price indicators for the housing market, Monthly Report, September 2003, pp 45-58.

³ The standardised properties are apartments with living space of around 80 square metres and terraced houses with living space of around 110 square metres, each providing comfortable living conditions and in average to good locations, as well as existing single-family houses with living space of around 175 square metres, standard fittings and a standard sized plot of land.

⁴ See Deutsche Bundesbank, Housing prices in 2014 in Germany, Monthly Report, February 2015, pp 55-57.

⁵ For the period prior to this, no information on the weights is available.

1 Conceptual framework

The market value of a specific building depends on a variety of factors, such as the location, materials used as well as the age and size of the property. The breakdown of this value⁶ into its three main components – price, quality and quantity – can be written as follows:

Property value determined by price, quality and quantity

$$\text{Value} = \underbrace{\text{Price} \times \text{Quality}}_{\text{Unit value}} \times \overbrace{\text{Quantity}}^{\text{Volume}}. \quad (1)$$

In formula (1), quantity is measured in units such as square metres. The unit value is calculated as the value divided by quantity, i.e., as the value in euro per square metre. It is thus dependent on the quality of the building concerned and captures not just pure price movements but also changes in quality over time. The ratio of value and price is the volume and describes the change in real value, adjusted for pure price movements. It can also express, for example, an increase in effective expenditure if this is the result of energy-saving renovation or modernisation (i.e. improved quality).

Value depends on quality of the building

The price in euro per square metre shown in (1) has to be interpreted with all quality factors eliminated, so that quality appears as a constant mark-up (or mark-down). The intertemporal comparison of prices therefore shows how much more or less would have to be spent today than in the past under the assumption that the same property would have identical price-relevant characteristics.

Determining the quality-adjusted price change is necessary

In order to make a statement about the residential real estate market as a whole, aggregation of regional data is necessary. This can be done by calculating the average using weights covering two different populations. On the one hand, the building stock – that is, all residential buildings existing in an economy – can be used as a basis; this results in a wealth perspective. On the other hand, the calculation can be based on transactions, reflecting market activity.

Weighting by stocks or transactions

⁶ The derivation of this breakdown is based to a lesser extent on theoretical model considerations, e.g. portfolio theory, on the value of a reproducible, durable consumer good such as a residential building, but more on the breakdown of the value into a price and quantity component while taking into account changes in quality, as is customary in index theory (and hence for consumer prices as well).

2 Data sources

Previously in Germany, there were no granular data nor any statistical register available on the existing stock of properties. The results of the 2011 Census on buildings and apartments⁷ were used for the first time as a source of data on the entire housing stock in Germany at the granular level. The housing census will be repeated every ten years.⁸ The results thus form a new data set on the stock of buildings and apartments, which also contains information on the number of apartments as well as single and two-family houses.

2011 Census provides detailed information on the stock of buildings

The Bundesbank uses data on the number of transactions for apartments as well as for single and two-family houses at the administrative district level provided by a subsidiary of the Association of German Pfandbrief Banks (Verband deutscher Pfandbriefbanken) called vdpResearch GmbH. In methodological terms, the data are derived from market reports issued by local committees of valuation experts, which are supplemented with estimates.

Private data provider supplies information on transactions

To determine the weights for new and existing properties, information from the house price index (HPI) published by the Federal Statistical Office (Destatis) can be taken. A large number of data sources are used to derive the HPI weights.⁹ This involves a breakdown of transaction values which are attributable to new buildings and existing properties; a regional breakdown of transactions is not possible. Since the HPI is calculated as a chain-linked index on the basis of European requirements, these weights are updated annually.¹⁰ The breakdown of new buildings and existing properties for the Bundesbank's index is the arithmetic average of the data from 2010 to 2012, similar to the selected period for the number of transactions.¹¹

Weights for new and existing buildings taken from the HPI by Destatis

⁷ All of the approximately 17.5 million owners and administrators of real estate were surveyed, by post, on the kind of building, the number of apartments in the building, the building type, the proprietorship, the year of construction and various fittings and fixtures of the apartments.

⁸ Regulation (EC) No 763/2008 of the European Parliament and of the Council of 9 July 2008 on population and housing censuses.

⁹ For a detailed description of the derivation of weights, see J. Dechent, Preisindizes für Wohnimmobilien, Wirtschaft und Statistik, November 2011, pp 1126-1134.

¹⁰ Commission Regulation (EU) No 93/2013 of 1 February 2013 laying down detailed rules for the implementation of Council Regulation (EC) No 2494/95 concerning harmonised indices of consumer prices, as regards establishing owner-occupied housing price indices.

¹¹ See section 3.2 for the calculation of the mean value for transaction-based figures.

3 Deriving the weights

The following section briefly describes the method for calculating aggregation matrices for residential properties in Germany. The limited availability of data is also discussed.

Limited availability of data

In principle, the available information permits two options for aggregating the properties – apartments and houses – within an administrative district or city as well as for Germany as a whole, for example. Specifically, one averaging is based on stocks and another is based on transactions.

Data sources allow different weighting schemes

Weighting is based on space data (stocks or turnover) since the price data provided by bulwiengesa AG are absolute figures in euro per square metre or are converted into such using the classification of building types.¹²

Calculations made for typical living spaces

3.1 Stock-weighting

Data from the 2011 Census, broken down by municipality, are available on apartments in residential buildings containing one apartment, broken down by construction type (detached house, semi-detached house and terraced house), and on apartments in residential buildings divided up according to the Act on Cooperative Apartments and Proprietary Leases (*Wohnungseigentumsgesetz*). This allows apartments in single-family houses to be clearly distinguished from freehold apartments. For each property type, the amount of the space available can directly be determined as follows:¹³

Census 2011 results permit breakdown by property type

$$\text{Space}_{i,k} = \text{Stock}_{i,k} \times \text{Living space}_i, \quad (2)$$

where i refers to the two property types (apartments and houses), and k denotes the respective municipality.

Additionally, the above-mentioned transaction-based HPI weights are used for the breakdown into new or existing housing consistently for all administrative districts and cities.

Breakdown into new and existing housing

¹² To do this, the price data are divided by 110 square metres in the case of terraced houses and by 175 square metres in the case of detached single-family houses. These values are also used for multiplying the stock figures and the transactions; 80 square metres are used for apartments. See also footnote 3.

¹³ For the rural districts, the entire stock of houses is attributed to detached single-family houses. For the cities, the joint stock of semi-detached houses and terraced houses is attributed to the "terraced houses" category, for which price information is available.

Although this weighting scheme results in a simple and complete solution, the next census on buildings and apartments will not be conducted until 2021, meaning that a new basis can only be introduced with a time lag.

Stock-weighting involves practical constraints

3.2 Transaction-weighting

Transactions (TA) for apartments as well as for single and two-family houses are available at the administrative level (rural and urban districts) only. Thus, for those cities which do not constitute an individual urban district but are part of a rural district, only a portion of the rural district’s transactions may be considered; for this purpose, the 2011 Census results by municipality are used. A factor specific to the property type is determined from the ratio of the stocks in a city to the district. Using the notation above, the equation can be expressed as follows:

Transaction-weighting requires additional adjustment for breakdown by municipality

$$TA_{i,m} = TA_{i,k(m)} \times \frac{Stock_{i,m}}{Stock_{i,k(m)}}, \tag{3}$$

where *m* refers to the cities and *k(m)* to the rural districts to which the cities belong.¹⁴

Again, the breakdown into new and existing properties uses the HPI weights, and the previously mentioned property spaces are used to provide the relevant turnover of space.

Breakdown into new and existing housing

Figures from the years 2010 to 2012 are used for the transactions since the latter are subject to cyclical fluctuations.¹⁵ Finally, concerning the choice of index formula, a chain-linked index – given a (positive) correlation between prices and transactions – involves the risk of an index drift.¹⁶ Therefore, a fixed-base index is used instead of a chain-linked index.

Volatile transactions require averaging over years

¹⁴ In the rural districts, all transaction data on houses are attributed to detached single-family houses. In the cities, the transaction data on houses first need to be broken down into terraced houses and detached single-family houses. For this purpose, we also use the 2011 Census data.
¹⁵ Even when the weighting scheme is based only on transactions from a specific year, we did not detect any notable differences in the aggregates.
¹⁶ For a detailed description of this effect, see J. Hoffmann and A. Lorenz, Real estate price indices for Germany: past, present and future, paper presented at the OECD/IMF workshop on real estate price indices in Paris from 6 to 7 November 2006.

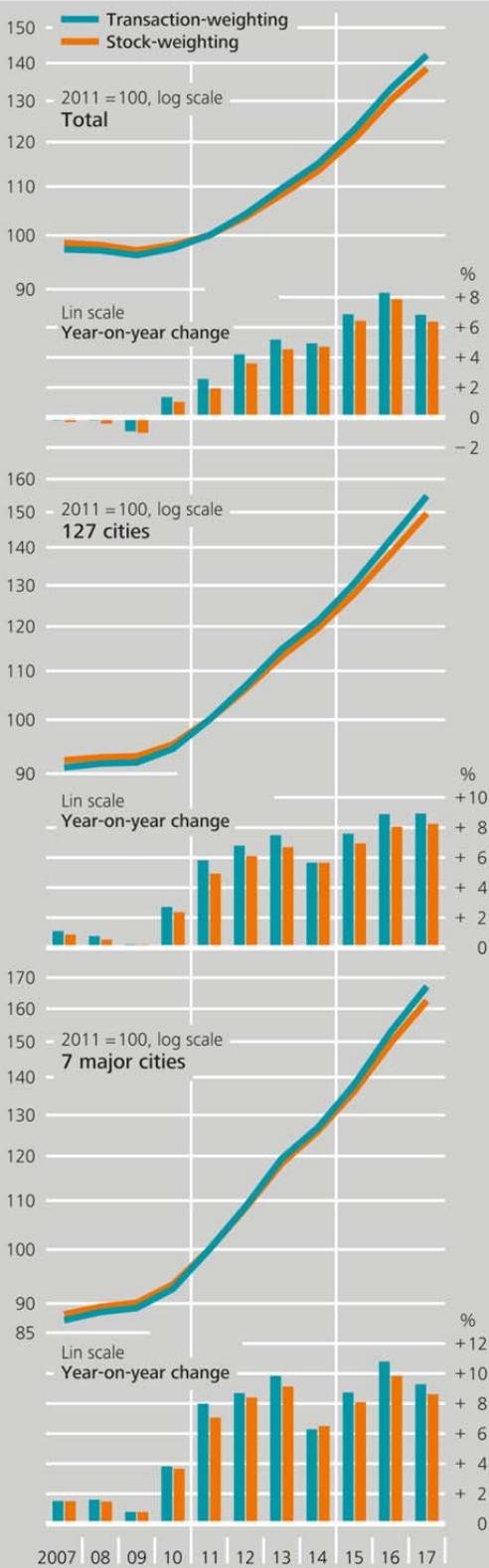
4 Differences in the weights

The differences in the weights can be explained by structural differences in the sales rates (the ratio of transactions to housing stock) both between regions and property types. For example, apartments are given a higher weight in a transaction-weighting scheme. Their sales rate is higher than that of houses. A breakdown by municipality also reveals that urban regions have a higher share when weights are transaction-based. The reason for this is, again, the higher sales rate compared with rural areas, not just for apartments but also for houses. Therefore, a broad statement can be made that the sales rate is higher in cities than in rural areas and is likewise higher for apartments than for houses.

Differences from structurally deviating sales rates



Comparison of residential property price indices in Germany according to different weighting schemes



Source: Bundesbank calculations based on price data provided by bulwiengesa AG.
Deutsche Bundesbank

5 Comparison of price indices

So far, no fundamentally different statements can be made about trend patterns or the timing of turning points when comparing the residential property price indices based on stock-weighting and transaction-weighting. Generally speaking, the same is true for the signs of the annual rates of change and the determination of an increase or decrease in price dynamics. In general, however, the stock-weighted price indices show a flatter pattern compared to the price indices calculated using transactions.

No fundamental differences in the pattern of price indices