How should we measure residential property prices to inform policy makers?\textsuperscript{1}

Jens Mehrhoff, Deutsche Bundesbank

\textsuperscript{1} This presentation was prepared for the meeting. The views expressed are those of the author and do not necessarily reflect the views of the BIS or the central banks and other institutions represented at the meeting.
How should we measure residential property prices to inform policy makers?

Dr Jens Mehrhoff*, Head of Section Business Cycle, Price and Property Market Statistics

* This presentation represents the author’s personal opinions and does not necessarily reflect the views of the Deutsche Bundesbank or its staff.
Structure of the presentation

1. Motivation and introduction

2. Conceptual and methodological framework

3. The Bundesbank’s dashboard

4. Spatial dependencies

“Real estate prices (residential and commercial)” (Recommendation 19 of the G20 Data Gaps Initiative)
1. Motivation and introduction

- Four stylised facts about the **German residential property market**:

  - About **every third euro spent** in Germany for private consumption purposes is spent **on housing**, including imputed rentals for homeowners.

  - Owner-occupied properties constitute the most significant asset of German households; the **rate of home ownership in Germany equates to just 44 %**.

  - Hence, more than half of the German households are renters. **Among the homeowners, two out of five have a mortgage**.

  - The value of the property stock is an important part of the wealth of the German economy: **gross fixed assets in housing stand at 267 % of GDP**.
1. Motivation and introduction

– The **various motivations for the analysis of house prices** call for **alternative measures** to be applied.

• **Macroeconomic**: identification of price signals, evaluation of monetary policy channels, volume measurement in National Accounts.

• **Macroprudential**: assessment of asset price bubbles, build-up of risks in banks‘ credit exposures, financial soundness of private households.

• However, these **indicators** can give **different results**, which could **undermine their credibility for many users**.

• Yet, there should be **no unique indicator**. In order to determine whether threats to the economy or financial stability emanate from the housing market, the **analyses should be based on a broad set of indicators**.
1. Motivation and introduction

- The diverse uses and associated methods of residential property price indices, the statistical framework for the compilation of such indices, as well as a dashboard comprising the three dimensions price, financial and real sector variables will be discussed.

1. Price and valuation indicators: E.g. price-to-rent, price-to-income and annuity-to-income ratios.

2. Loans to and debt of households: E.g. banks’ loans and interest payments.

3. Construction and activity indicators: E.g. completed housing units and transactions.

- Empirical results for the German residential property market will exemplify the usefulness of a multi-indicator approach in times of strong upward movements of price indicators.
2. Conceptual and methodological framework
2.0 Composite indicators

- **Composite indicators**, on the other hand, aim to combine numerous, diverse indicators in a single number.

- They claim to reduce complex relationships to a supposedly simple measure.

- For aggregating base variables to a composite indicators one has to select suitable data first and, then, to derive the respective weights.

- It is not straightforward at all how the selection and weighting of the base variables should be performed:
  - **Factor analysis** maximises the explained variance of all base variables, the thus derived weights do not, however, represent relative importance.
  - **Regression analysis** minimises squared error to a given target indicator, whose existence makes the whole exercise somewhat obsolete.
2. Conceptual and methodological framework
2.0 Composite indicators

Hence, generally accepted and obvious selection procedures as well as weighting schemes cannot possibly exist.

One composite indicator could use different base variables than another one; a third one could use the same base variables but apply a different weighting scheme.

What is more, a composite indicator suggests substitutability between different base variables such that one would be indifferent between certain combinations.

When the composite indicator is not constructed adequately or is not used so, the conclusions derived on that basis might be misleading and costly.

Particularly with many base variables, their interpretation will be in conflict.
2. Conceptual and methodological framework

2.0 Composite indicators

- The high dimensionality of a complex and diffuse phenomenon such as „the residential property market“ cannot adequately be reproduced by a composite indicator.

- Quite the contrary, the joint distribution of price, financial and real economic indicators seems to be at the centre of the current discussion.

- There is no simple answer to a complicated question; it might, thus, be better to look at a dashboard of indicators rather than to dissolve existing conflicts between base variables.

- Last but not least, statistics has a consulting function for policy makers – this makes it even more important to produce unbiased, easily interpretable and manageable measures.
2. Conceptual and methodological framework
2.1 Setting the stage

− Despite the quest for swiftly disseminated indicators, it is of utmost importance to set up a valid and reliable statistical framework first. The various data users make substantially different demands on the index concepts. These, in turn, need to be tailored for the distinctive purposes.

− The observation of values and prices generally yields different results. The change in market values between two consecutive periods does not necessarily reflect the pure, i.e. quality-adjusted, change in prices. It is rather a mixtum compositum of quality changes due to depreciation and renovation as well as the quality-adjusted change in prices; if quantities remain the same.

− Let, for example, the population be equal in the two periods under consideration. Due to depreciation the quality of all buildings will be lower on average. Ceteris paribus, it follows that in such a situation values decrease although quality-adjusted prices have remained constant.
2. Conceptual and methodological framework
2.1 Setting the stage

− The market value provides a nominal measure for residential property. If quantities (floor space or lot size in square metres, say) are available, dividing the value in euro by that quantity yields a so-called unit value in euro per square metre. Thus, the value can be split up as follows:

\[(1) \quad \text{Value} = \text{Unit Value} \times \text{Quantity}.\]

− However, the unit value in Equation (1) depends on the quality of the building and not just on floor space, or the location of the lot and not only its size.
2. Conceptual and methodological framework

2.1 Setting the stage

− Since price indices aim for a quality-adjusted indicator prices here denote a constant quality *numéraire*.

− With a hedonic quality adjustment, say, it is possible to decompose the value into a *constant-quality price* and a volume measure that inherits quality changes (e.g. through modernisation):

\[
\text{Value} = \text{Price} \times \text{Volume}. \tag{2}
\]

− Therefore, an index for property prices in its pure form will reflect *movements in prices that are stripped of quality changes*. The latter are included in the volume as shown in Equation (2).
2. Conceptual and methodological framework
2.1 Setting the stage

Eventually, the ultimate statistical goal is splitting up the value into a quality-adjusted price, the quality component itself and a quantity measure independent of quality:

\[ \text{Volume} = \frac{\text{Value}}{\text{Unit Value}} = \frac{\text{Price} \times \text{Quality} \times \text{Quantity}}{\text{Unit Value}} \]

Following Equation (3), the value is obtained via multiplying the constant-quality price of a unit by a dimensionless mark-up (or mark-down) for the desired level of quality and the nominal quantity of the structure or the land. This mark-up can reflect characteristics such as the age of the building or its year of construction.
2. Conceptual and methodological framework
2.2.1 Macroeconomic identification of price signals

− In a market economy, **prices give signals about relative scarcities** through equilibria between supply and demand.

− In this way, both enterprises and consumers gain important insights into their production and consumption decisions, respectively, so that **scarce resources are allocated to where they are most efficiently used**.

− Real estate prices are a significant economic indicator and **rising house prices are often associated with economic growth**.

− They **stimulate construction activity and promote house sales**. Not least, price increases **support private consumption via the wealth effect** (more on the measurement of “The Wealth of Nations” shortly).
2. Conceptual and methodological framework
2.2.1 Macroeconomic identification of price signals

− For monetary policy making, house price indices are an integral part of inflation measurement.

− In the near future, owner-occupied housing should become part of the European Harmonised Indices of Consumer Prices – as with other durable consumer goods, the net acquisitions approach will be applied.

− For the identification of pure price signals, a price index at constant quality is a condition sine qua non.

− Since for short-term business cycle analysis, the most recent developments are at the centre of attention, aggregation should be performed using transactions only (albeit not necessarily in terms of chain-linked indices).
2. Conceptual and methodological framework
2.2.2 Uses in National Accounts

In addition, figures on residential property are needed in National Accounts:

- **Converting nominal to real figures (deflationing):** The calculation of the volume as shown in Equation (2) requires a pure price index for this asset class (of course, nominal values have a right in their own as an indicator).

- Neglecting the issue of land-structure spilt, the measurement of the value of the entire housing stock calls for stock-weighted indices, which would also be appropriate for the assessment of households' wealth effects.

- Furthermore, deflators are needed to estimate the real output of the services of the real estate industry as well as gross (fixed) capital formation in new dwellings – in both cases, a transaction-based price index would be needed, which must cover new dwellings only in the latter case.
2. Conceptual and methodological framework

2.3 Financial stability

− Apart from the potential build-up of asset price bubbles, the risks of banks‘ credit exposures associated to the financial soundness of private households are most relevant.

− Here, the change in values of financed objects needs to be tracked over time.

− This has two dimensions:

  1. Hazards emerging from newly granted loans, and

  2. value changes of properties in the credit stock.
2. Conceptual and methodological framework
2.3.1 Evaluation of build-up of housing bubbles at the current end

− The **build-up of asset price bubbles** frequently comes with **misallocations**, a strong surge in housing investment, say. In case of an adjustment, this bears the **risk of higher probabilities of default** in the non-financial corporations sector.

− Focussing on the homebuying of **private households**, the **initial ratio of the loan to the value of the property** is of special interest for **macroprudential authorities**.

− Price dynamics have to be seen here in conjunction with further indicators on the financing; **particularly risky** is the **typical coincidence of housing booms and a credit expansion with lower lending standards**.
2. Conceptual and methodological framework
2.3.1 Evaluation of build-up of housing bubbles at the current end

− Much like in short-term business cycle analyses, transactions can be used as a proxy for financings in order to provide valuable clues on the build-up of risks in banks‘ new business.

− On the other hand, through aggregation important information on the regional heterogeneity is lost.

− Empirical evidence in other countries with overheated housing markets has shown that regional developments can develop systemic relevance.

− This means that, at first, isolated undesired developments eventually gain breadth; a deeper investigation of spatial transmission channels necessitates a geographical breakdown.
2. Conceptual and methodological framework
2.3.2 Valuation of financed objects in the course of time

− Another important indicator is the change in values – price changes including quality changes – of financed objects over time.

− This is because, from the banks‘ perspective, the residual value of a home is of interest only should the debtor default, since then the bank would have to sell the home on the market (possibly in a forced sale).

− Since the quantity, i.e. floor space or number of bedrooms, is constant in general, the change in the property‘s value between the time of purchase and a potential foreclosure is:

\[
\text{(4)} \quad \text{Value change} = \text{Price change} + \text{Quality change.}
\]
2. Conceptual and methodological framework
2.3.2 Valuation of financed objects in the course of time

- The quality of the house, however, is not fixed but it is assumed to be subject to a constant annual depreciation rate.

- The sole exogenous variable in the model then would be the quality-adjusted price.

- Still, it is not the absolute residual value of the house that matters but its ratio to the residual mortgage in the event of credit default.

- In the first years of the life of the loan, though, the amortisation rate of the annuity is rather low, so that the loan-to-value ratio worsens initially.
2. Conceptual and methodological framework
2.3.2 Valuation of financed objects in the course of time

− From a macroprudential view, only prices of financed objects would be relevant.

− A bank’s credit portfolio would, furthermore, have a changing composition; newly financed objects enter, others exit due to repayments of the loans.

− For financial stability purposes, additionally, institution-specific figures are indispensable for the identification of risk potentials.

− The tails of the distribution need close examination as do credit vintages which reflect then-effective lending standards.
3. The Bundesbank’s dashboard

- The year 2010 saw a trend reversal in the German housing market, which was reflected in a sharp rise in prices.

- This situation needs to be addressed in light of the ongoing low-interest-rate environment.

- In order to determine whether threats to the economy or financial stability emanate from the housing market, the Bundesbank based its analyses on a broad set of indicators.

- This clearly shows that no statistical one-size-fits-all approach exists but that each subject matter has to be considered separately.
3. The Bundesbank’s dashboard

<table>
<thead>
<tr>
<th>System of indicators for the German residential property market</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Price indicators</strong></td>
</tr>
<tr>
<td>- Residential property prices in Germany</td>
</tr>
<tr>
<td>- Price indices for rental housing in Germany</td>
</tr>
<tr>
<td>- Standard indicators to evaluate residential property prices in Germany</td>
</tr>
<tr>
<td>- Price-to-rent ratio for apartments in Germany</td>
</tr>
<tr>
<td>- Rents for apartments in Germany</td>
</tr>
<tr>
<td><strong>Financial indicators</strong></td>
</tr>
<tr>
<td>- Dynamics in domestic banks’ loans for house purchase</td>
</tr>
<tr>
<td>- Stock of domestic banks’ loans for house purchase</td>
</tr>
<tr>
<td>- Debt of households in Germany</td>
</tr>
<tr>
<td>- Changes in credit standards and margins on loans to households in Germany for house purchase</td>
</tr>
<tr>
<td>- Interest payments on loans to households in Germany for house purchase</td>
</tr>
<tr>
<td>- Interest rates on loans to households in Germany for house purchase</td>
</tr>
<tr>
<td>- Fixed interest periods for loans to households in Germany for house purchase</td>
</tr>
<tr>
<td><strong>Real economic indicators</strong></td>
</tr>
<tr>
<td>- Building permits and completed housing units in Germany</td>
</tr>
<tr>
<td>- Housing investment in Germany</td>
</tr>
<tr>
<td>- New orders for housing construction in the main construction sector in Germany</td>
</tr>
<tr>
<td>- Number of transactions for apartments in Germany</td>
</tr>
</tbody>
</table>

Deutsche Bundesbank
3. The Bundesbank’s dashboard
Prices have been rising since 2010, albeit with no acceleration recently.

Residential property prices in Germany

2010 = 100, log scale

- Annual data
  - Deutsche Bundesbank
  - 127 towns and cities
  - Total

- Quarterly data
  - vdp price index for owner-occupied housing

- Hypoport AG (total index)

- House price index (Destatis)

Source: Bundesbank calculations based on data provided by the Association of German Pfandbrief Banks (vdp). 1 Annuity of a mortgage loan with a fixed interest rate (between five and ten years) and a hypothetical term of 30 years in relation to household income. 2 Disposable income per household in Germany, nominal. An increase represents a rise in the purchase price in relation to disposable income. 3 Prices and rents of apartments.

Deutsche Bundesbank

2 Nov 2015, 09:23:57, S3PR01100.Chart

Standard indicators to evaluate residential property prices in Germany

2010 = 100, log scale

- Annuity-to-income ratio
- Price-to-income ratio
- Price-to-rent ratio

Source: Bundesbank calculations based on data provided by the Association of German Pfandbrief Banks (vdp). 1 Annuity of a mortgage loan with a fixed interest rate (between five and ten years) and a hypothetical term of 30 years in relation to household income. 2 Disposable income per household in Germany, nominal. An increase represents a rise in the purchase price in relation to disposable income. 3 Prices and rents of apartments.

Deutsche Bundesbank

2 Nov 2015, 09:45:52, S3PR0182.Chart
3. The Bundesbank’s dashboard

− The observed price movements do not, on their own, make it possible to derive any potential overvaluation or undervaluation. A benchmark would be required, but it cannot be specified unambiguously from a conceptual point of view, nor can it be observed directly.

− Price data going far back into the past contain statistical breaks. Averages of the standard indicators do not take account of medium and long-term trends.

− If prices as well as rents rise substantially, the price-to-rent ratio may remain largely unchanged. Conversely, the price-to-income ratio would shoot upwards.

− If the interest rate conditions for new mortgage loans are taken into account, a substantial improvement of affordability can be observed since the outbreak of the financial crisis.
3. The Bundesbank’s dashboard
Price movements reflect the lagged expansion of the housing supply.

**Building permits and completed housing units in Germany**

<table>
<thead>
<tr>
<th>Year</th>
<th>Building permits</th>
<th>Completed housing units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>700</td>
<td>650</td>
</tr>
<tr>
<td>1995</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>2000</td>
<td>550</td>
<td>550</td>
</tr>
<tr>
<td>2005</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>2010</td>
<td>450</td>
<td>450</td>
</tr>
<tr>
<td>2014</td>
<td>400</td>
<td>400</td>
</tr>
</tbody>
</table>

* In residential and non-residential buildings. Including construction work on existing buildings.

Deutsche Bundesbank

**Number of transactions for apartments in Germany**

<table>
<thead>
<tr>
<th>Year</th>
<th>7 major cities</th>
<th>127 administrative districts</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>80</td>
<td>85</td>
<td>95</td>
</tr>
<tr>
<td>2008</td>
<td>85</td>
<td>90</td>
<td>95</td>
</tr>
<tr>
<td>2009</td>
<td>90</td>
<td>95</td>
<td>100</td>
</tr>
<tr>
<td>2010</td>
<td>95</td>
<td>100</td>
<td>105</td>
</tr>
<tr>
<td>2011</td>
<td>100</td>
<td>105</td>
<td>110</td>
</tr>
<tr>
<td>2012</td>
<td>105</td>
<td>110</td>
<td>115</td>
</tr>
<tr>
<td>2013</td>
<td>110</td>
<td>115</td>
<td>120</td>
</tr>
<tr>
<td>2014</td>
<td>115</td>
<td>120</td>
<td>125</td>
</tr>
</tbody>
</table>

Source: Extrapolation provided by vdpResearch GmbH on the basis of data from surveyor committees. Regional coverage not entirely comparable with residential property prices for 127 towns and cities from bulwiengesa AG.

Deutsche Bundesbank
3. The Bundesbank’s dashboard

− Since 2010, only the price indicators for Germany demonstrated strong upward movements.

− The Bundesbank could not, on the basis of model-based analyses of the valuation situation in the housing market, detect any notable deviations from fundamentally justified housing prices throughout Germany.

− Hence, at present, no substantial macroeconomic risks are arising from the price structure on the housing market.

− In the 127 cities studied, current estimates put upward price deviations at between 10% and 20%, measured in terms of the longer-term demographic and economic variables; with freehold apartments in major cities showing the strongest overvaluations.
3. The Bundesbank’s dashboard

Despite the low interest rates, growth in mortgage loans is still sluggish.

**Dynamics in domestic banks' loans for house purchase**

Year-on-year rate of change as a percentage, end-of-quarter data, seasonally adjusted

<table>
<thead>
<tr>
<th>Year</th>
<th>To domestic households¹</th>
<th>To domestic companies²</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>-6</td>
<td>-6</td>
</tr>
<tr>
<td>2005</td>
<td>-5</td>
<td>-5</td>
</tr>
<tr>
<td>2006</td>
<td>-4</td>
<td>-4</td>
</tr>
<tr>
<td>2007</td>
<td>-3</td>
<td>-3</td>
</tr>
<tr>
<td>2008</td>
<td>-2</td>
<td>-2</td>
</tr>
<tr>
<td>2009</td>
<td>-1</td>
<td>-1</td>
</tr>
<tr>
<td>2010</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2011</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2012</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>2013</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2014</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2015</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

¹ Data for MFIs adjusted for statistical changes. ² Including self-employed persons and sole traders. ³ Excluding self-employed persons and sole traders.

**Interest rates on loans to households in Germany for house purchase**

With an initial rate fixation of...

- ... floating rate or up to 1 year
- ... over 1 year and up to 5 years
- ... over 5 years and up to 10 years
- ... over 10 years

Memo item, enlarged scale

* Data based on the monthly new business of the MFI interest rate statistics for secured and unsecured loans, excluding overdraft loans. ¹ Calculated as the difference between the interest rate with an initial rate fixation of over 5 years and up to 10 years and the interest rate with an initial rate fixation of over 1 year and up to 5 years.

Deutsche Bundesbank

2 Nov 2015, 09:33:56, SSPR0120.Chart

Deutsche Bundesbank

2 Nov 2015, 09:36:39, SSPR0123.Chart
3. The Bundesbank’s dashboard

− The **other indicators** mentioned above **did not reach critical levels**.

− However, **studies of averages throughout Germany** have **limited value**, as moderate rates of increase in housing loans for the whole of Germany could obscure a heterogeneous regional distribution of lending growth.

− The Bundesbank’s analyses show **very few signs of procyclical behaviour** by banks **or of a destabilising nexus between mortgage lending and property prices**. However, it is striking that, in the **towns and cities under consideration with sharply rising housing prices**, a large share of **mortgages** have a German sustainable **loan-to-value ratio** (**Beleihungsauslauf**) of over 100%.

− This points to **structural vulnerabilities in the German banking system** to urban real estate market risks.
3. The Bundesbank’s dashboard

4. Spatial dependencies

Price changes from 2013 to 2014, in %

Price-to-rent ratio in 2014

Bundesbank calculations based on price data provided by bulwiengesa AG.
4. Spatial dependencies

- Although the differences in price rises between the regions diminished again in 2014, waning price dynamics did not reduce existing gaps between Southern and Northern Germany as well as Western and Eastern Germany.

- Special effects in prices are attributable to tourism, particularly at the North Sea and Baltic coasts.

- The steep rise in prices has so far been largely confined to regions with an urban character.

- With regard to the future stability of the residential property market as a whole, it is therefore of key importance to investigate the spatial transmission channels of price impulses in greater depth.
Contact

Dr Jens Mehrhoff
Head of Section Business Cycle, Price and Property Market Statistics
Deutsche Bundesbank
Central Office
General Economic Statistics

Wilhelm-Epstein-Strasse 14
60431 Frankfurt am Main, Germany

Tel: +49 69 9566 3417
Mobile: +49 172 7950739
Fax: +49 69 9566 2941
E-mail: jens.mehrhoff@bundesbank.de
www.bundesbank.de