

The protracted rise in residential property prices in Germany from a macroeconomic perspective: transmission channels and fundamental determinants

The German economic upswing from 2010 until the slump caused by the coronavirus pandemic was accompanied by a continuous rise in residential property prices. Given the remarkable price levels reached in many regions, the economic slowdown last year already led to questions about the spillover effects on the residential property market. The historic slump in economic output this year caused by the pandemic has made these questions even more relevant. Going forward, developments in the residential property market in the short and longer term are currently subject to heightened uncertainty. This article uses econometric models of the residential property market to analyse the economic interrelationships between residential property price developments in Germany and macroeconomic developments. This also enables an assessment of the potential for a correction of residential property prices stemming from the previous price boom.

From a macroeconomic perspective, rising prices in the residential property market over the past few years have reflected developments in housing supply and demand. The price effects of the sharp surge in demand have stimulated additional residential construction, which has also driven the price of construction work up sharply. Land prices, whose contribution to residential property price inflation has risen significantly in recent years, have appreciated even more sharply. As land prices, in particular, tend to reflect a property's asset value, the risk of residential property price exaggerations has also increased. Overvaluations have emerged, especially in urban areas, and valuation measures have recently indicated some upward price deviations at the macroeconomic level as well. However, these results depend on the calculation method and are also very heavily influenced by the underlying assumptions regarding the natural level of lending rates. Further analyses provide scant evidence in support of the hypothesis that destabilising speculative demand motives are the main driver of these overvaluations.

Overall, the price structure in the German residential property market last year can therefore be regarded as robust to pronounced changes in the macroeconomic environment. This finding is supported by the fact that the pandemic has so far left little mark on the residential property market. However, the macroeconomic environment is now much more fragile than before. That said, there are no signs of an abrupt correction in residential property prices, provided that there is no serious disruption to the ongoing macroeconomic recovery.

Upward pressure on residential property prices broadly based across regions

Protracted economic upswing with strong impact on prices in residential property market

The protracted German economic upswing, which began in 2010 and came to an abrupt end with the outbreak of the coronavirus pandemic, also affected the residential property market. However, this occurred gradually and with regional differences. In the first half of this upswing, the sharp rise in residential property prices was largely concentrated in urban areas, with prices initially barely rising at all in rural areas. The boom in real estate prices only took off gradually in non-urban regions. As of roughly 2015, steep upward pressure on residential property prices became broadly based across regions. According to Bundesbank calculations based on data from bulwiengesa AG, residential property prices in Germany as a whole have since risen by an average of 7¾% per year, whereas they rose by just 4¼% per year in the first half of the boom period. In 2019, there were hardly any remaining differences in the price dynamics between urban and rural areas (see the box on pp. 69 ff.).¹ In the rental segment, too, there were hardly any regional deviations in inflation last year. However, house price inflation significantly outpaced inflation in terms of new rental contracts.

After years of consolidation in the construction sector, new construction activity picked up again in line with the positive price impulses of the most recent economic upswing. While there was a time lag before construction activity gained momentum, in 2019 the number of completed projects exceeded those in 2010 by just over 80%. The additional housing supply increased at an above-average rate in the seven largest cities. But in rural areas, too, the expansion of supply did not fall behind the average development. Only in smaller and medium-sized towns and cities was growth in the number of new dwellings comparatively low. As from around 2017, construction activity in most regions stabilised at its elevated level, while residential investment, which includes modernisation, conversion and expansion measures in existing residential buildings, continued to see strong growth.

Expansion in construction activity

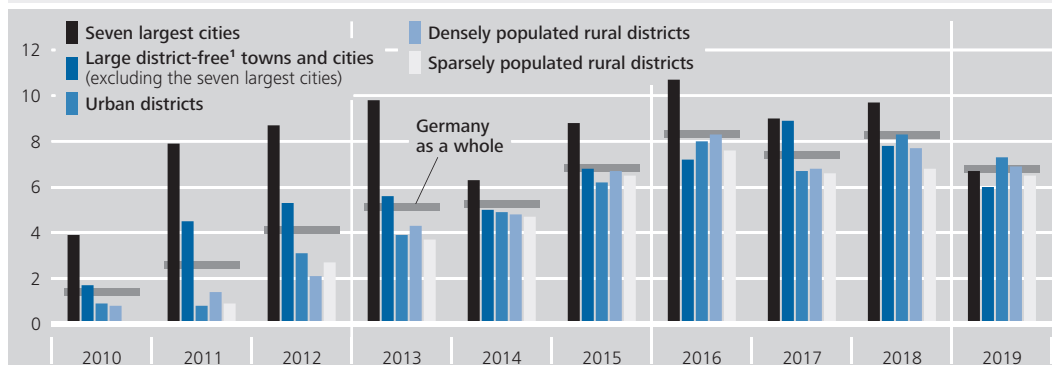
Already last year, in view of the remarkable level of residential property prices in many regions, the question also arose as to what impact the visible slowdown in the economy would have on the real estate market. This year's pandemic and the associated historic

Model analyses for assessing the structural condition of the residential property market

¹ The convergence of price dynamics took place both in densely populated and sparsely populated rural districts, thus spreading beyond areas close to towns and cities.

Residential property prices by district type, as classified according to their settlement structure*

Year-on-year percentage change



* Transaction-weighted. Bundesbank calculations based on price data provided by bulwiengesa AG. Spatial segmentation based on the Federal Institute for Research on Building, Urban Affairs and Spatial Development's classification of district types according to their settlement structure. ¹ I.e. not forming part of a larger administrative district.

Regional house price indices – what data the official statistics provide

Residential property markets are characterised by a high degree of regional heterogeneity. Appropriate data sources are required to investigate regional trends. For instance, while very granular regional data on the housing stock and construction activity have been published in the official statistics for many years, corresponding price indices have only been provided since mid-2019 and in a comparatively rough geographical breakdown. In addition to the house price index for Germany as a whole, the Federal Statistical Office reports on price developments of apartments and houses, starting from the fourth quarter of 2015, for five types of area based on the Federal Institute for Research on Building, Urban Affairs and Spatial Development's (BBSR) classification of district types by settlement structure.¹

According to this classification, districts and independently administered cities, which are referred to as district-free towns and cities, are broken down into four groups using criteria such as population density and share of the population living in towns and cities: large district-free towns and cities, urban districts, densely populated rural districts and sparsely populated rural districts.² Among the big cities, the seven largest cities in Germany³ are grouped separately. This takes account, amongst other things, of the fact that this city aggregate plays a particularly important role in the analysis of

the real estate market. The Bundesbank and vdpResearch GmbH have also been publishing price indices for the group of the seven largest cities for some time now.

bulwiengesa AG has been providing the Bundesbank with district-level price data for many years.⁴ These data enable fairly flexible regional aggregates to be formed for analytical purposes. For instance, it is also possible to calculate regional price indicators on the basis of the classification of district types by settlement structure. These data start in 2004 and thus capture a considerably longer period than the regionalised house price index compiled by the Federal Statistical Office, even though this means that they mainly cover the period of the recent upswing only. Furthermore, the data on houses and apartments can be condensed to form an overall aggregate,

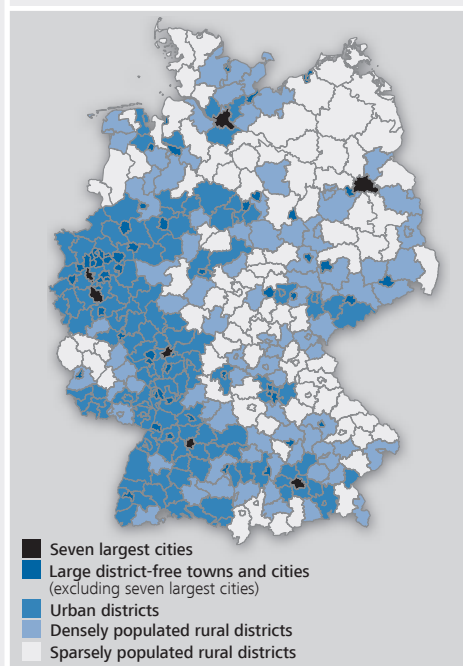
1 <https://www.bbsr.bund.de/BBSR/DE/forschung/raumbewachung/Raumabgrenzungen/deutschland/kreise/siedlungsstrukturelle-kreistypen/kreistypen.html?nn=2544954>

2 The predominantly demographic criteria underlying the definition of district types by settlement structure allow a stable categorisation, at least in the short to medium term. This is likely to be largely independent of events in the real estate markets and, in particular, to avoid interaction between price developments in a district and the category to which it is assigned.

3 Berlin, Cologne, Düsseldorf, Frankfurt am Main, Hamburg, Munich and Stuttgart.

4 See Deutsche Bundesbank (2020).

District types by settlement structure*

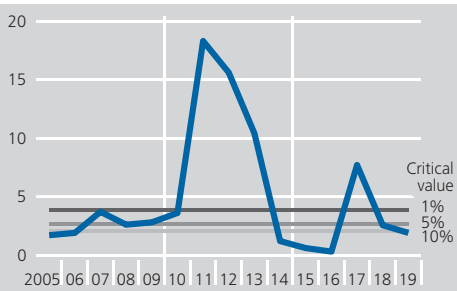


* Based on the Federal Institute for Research on Building, Urban Affairs and Spatial Development's classification, as of 2016.

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Test for equality of the mean annual price change between the district types by settlement structure

ANOVA F-statistic¹



¹ Test of the null hypothesis that the mean annual price changes do not differ between the district types by settlement structure. Results of the test statistic above the critical values indicate rejection of the null hypothesis.

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which is currently not done in the official data. However, the Bundesbank's regional indices based on price data from bulwiengesa AG are published only once a year, whereas the regionalised house price index appears quarterly. The nature of the underlying data also differs between providers. The Federal Statistical Office uses transaction data from committees of surveyors for property values. bulwiengesa AG's price data are primarily based on well-founded expert assessments.

Transaction data are the preferred data source for calculating real estate price indices. However, they involve substantial requirements with regard to statistical treatment. For example, a quality adjustment based on hedonic methods usually only produces satisfactory results if a large number of observations is available in the case of pronounced heterogeneity. Limiting the geographical breakdown to merely five sub-groups is likely to reflect the attempt to produce results for the data currently available that are analytically meaningful and of sufficiently good statistical quality.

House prices in the district types by settlement structure can show different tendencies. Drawing on the price series based on data from bulwiengesa AG that has been available since 2004, statistical tests can be

used to demonstrate that the annual rates of change between the five categories have differed systematically over much of the period under review. The gap between urban and rural areas was particularly pronounced in the early phase of the upswing in Germany's real estate markets in the first half of the last decade, for example.

The fact that raw data for the official house price index are currently provided in an incomplete form and with a time delay in some cases appears to make calculating robust results for rural areas in particular more difficult. This is indicated by the high susceptibility to revision of the data for this district type.⁵ By contrast, the corrections to the official results for the other district types are not conspicuous.

The house price index is published approximately 85 days after the end of a reporting quarter. This publication date is largely dependent on the provision of data by the committees of surveyors. They provide information on notarised purchase agreements to the official statistical offices no later than 60 days after the end of the reporting quarter.⁶ The revisions illustrate that information is lagged on a relevant scale.⁷ However, the usefulness of many data for house price statistics are currently limited, not only by when they are available but also by what data are provided. According to the Federal Statistical Office, 45% of the datasets provided cannot be used for index calculation as central price-determining attributes required for quality adjustment are not available.⁸ One key factor here is that the committees of surveyors often only ob-

⁵ The revision practice for the house price index stipulates that the results for the previous quarter be revised with the publication of the result for the current quarter. Furthermore, the previous year's result is revised with the publication of the first quarter of a year. See Federal Statistical Office (2018) p. 8. The revisions to the regionalised index are discussed, amongst other things, in Federal Statistical Office (2020a).

⁶ See Federal Statistical Office (2018), p. 3.

⁷ See Schöneich and Teske (2020), p. 41.

⁸ See Schöneich and Teske (2020), p. 38.

tain important information on real estate transactions through downstream postal buyer surveys.

Potential ways of improving the official real estate price statistics mainly involve creating the conditions for data on price-determining attributes to be transmitted in a timely and complete manner, starting with the data source.⁹ This objective could be considered as part of the implementation of the “eNoVA” (*Elektronischer Notariat-Verwaltungs-Austausch*) project – an electronic exchange between notary’s offices and the administrative bodies involved.¹⁰ The concept of this project is for the administrative procedures for conducting real estate transactions to be digitalised by establishing an IT portal. This would also improve the statistical usefulness of the information from real estate purchase contracts if a corresponding regulatory framework were established in this context that ensured that statistically relevant features were recorded and made available nationwide.

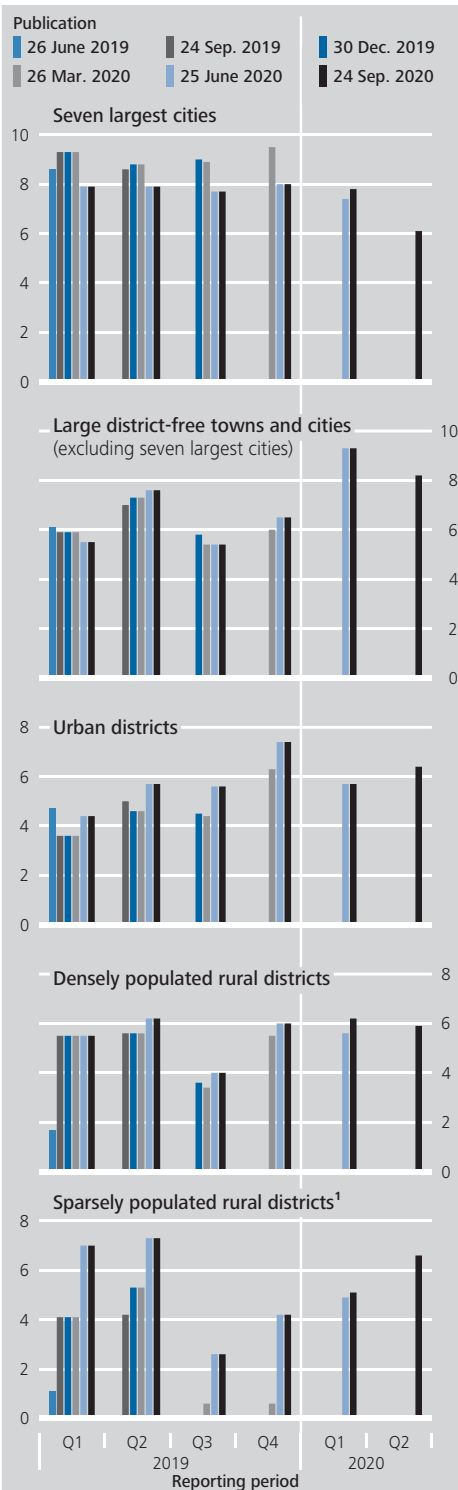
The regionalisation of the official house price index has extended the range of data available for monitoring developments in the residential property markets. However, the fact that data are, in some cases considerably, susceptible to revision has so far reduced the usefulness of the indices for analysis purposes. Considering the available price indicators from different sources and with different data coverage together still remains the best way to arrive at reliable empirical findings. Increased statistical uncertainty in this area means that general caution must be applied when interpreting the results.

⁹ Furthermore, data could in principle also be obtained for commercial real estate – for which there are currently no official price indices – and the creation of a price index could be promoted. Recommendations from the European Systemic Risk Board (2016) and the G20 Data Gaps Initiative also suggest that metrics for the commercial real estate market are needed.

¹⁰ See Federal Statistical Office (2019a).

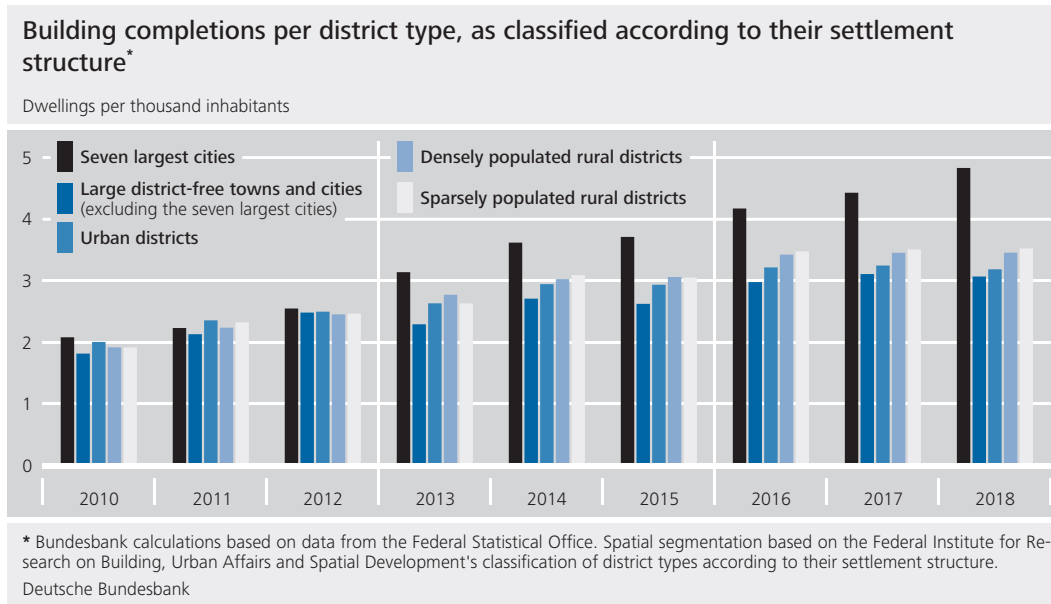
Regionalised house price index according to publication date*

Year-on-year percentage change



Source: Federal Statistical Office. * Apartments. Regional breakdown based on the Federal Institute for Research on Building, Urban Affairs and Spatial Development’s classification of district types by settlement structure. ¹ Publication on 30 December 2019 did not contain any data for the third quarter of 2019.

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slump in economic output in the first half of the year have made this issue even more pressing. There is no doubt that uncertainty about further developments in the residential property market in the short and longer term has increased this year. Assessments of the structural condition of the residential property market have therefore gained greatly in importance. On the one hand, this is about the factors that link the residential property market to macroeconomic developments. These provide information on the extent to which residential property price developments are consistent with economic interrelationships. On the other hand, this is also about assessing the size of the potential for correction stemming from the previous residential property price boom. From an analytical perspective, econometric models are available for both of these aspects (see the box on pp. 73 f.).

Factors influencing residential property price inflation from the perspective of a macroeconomic model approach

The combination of marked price increases and the housing supply expansion suggests that

residential property price developments were chiefly a reflection of the sharp rise in housing demand during the exceptionally long economic upturn. The situation of a demand-driven rise in residential property prices can be modelled in a class of models in which residential property prices are determined by the stock-flow equilibrium of supply and demand. A core component of the error correction approach is a long-run relationship between residential property prices, current and expected household income, and interest rate developments for mortgage loans. By also taking into account short-term influences on price dynamics, the model can be used to identify the way in which residential property prices and residential investment – the latter of which increases the housing supply in this model framework by expanding the housing stock – typically respond to changes in the macroeconomic environment.

Data on the macroeconomic variables included in the model specification for Germany are available for the period from 1991 onwards. The residential property price index in Germany covering the longest available period of time is based on the price index for owner-occupied residential property of the Association of German Pfandbrief Banks (*Verband deutscher Pfandbriefbanken, vdp*); however, it does not

Econometric model of residential property price developments

Dataset reaching as far back as possible

Two models for estimating residential property prices in Germany

Error correction models consisting of a specification of the long-run price trend and one or several equations describing the short-term price dynamics form part of the toolkit for analysing the residential property market.¹ One of the elements that theoretically underpin this approach is the model of stock-flow equilibrium in the residential property market.² The main conceptual relationships can be illustrated in a simplified error correction model.

The long-run equilibrium relationship links residential property prices (p_t) with households' disposable income (y_t) and interest rate developments for mortgage loans (r_t) as well as other demand-side factors such as longer-run GDP growth expectations (g_t^{exp}).³ To these are added supply-side factors such as productivity in the construction sector (y_t^{constr}). The error term (ε_t) captures temporary price deviations from the long-run relationship.

$$p_t = \beta_0 + \beta_1 y_t + \beta_2 r_t + \beta_3 g_t^{exp} + \beta_4 y_t^{constr} + \varepsilon_t$$

The housing stock is derived from the cumulative changes in supply resulting from residential construction activity and the number of housing units that are no longer available on the market.⁴ In the first short-run equation, it is assumed that price increases (Δp_t) tend to be followed by higher residential investment (i_t), enlarging the housing supply.⁵

$$i_t = \beta_5 \Delta p_{t-1} + \beta_6 \Delta cc_{t-1} + \zeta_t$$

For instance, higher demand thanks to income growth would cause prices to go up, which would stimulate residential investment and increase the stock of dwellings until housing demand and supply balance each other out. Higher costs for construction services (Δcc_t), meanwhile, would ceteris paribus curb construction activity and produce additional price pressure; moreover, random disturbances (ζ_t) can occur. According to the theoretical approach, increased residential investment – triggered by productivity growth or deregulation – will ceteris paribus dampen price dynamics, though disturbances (η_t) can

1 See Kajuth (2020), Leung (2014), Malpezzi (1999) and Steiner (2010). For an application for extrapolating residential property prices, see Deutsche Bundesbank (2017).

2 See DiPasquale and Wheaton (1994) and McCarthy and Peach (2004).

3 Variables in levels are transformed into logarithms in the specification. Residential property prices and the measure of income were adjusted for the general price level as measured by the deflator of private consumption. The productivity measure refers to real hourly productivity in the construction sector. Interest rates on housing loans were adjusted for longer-term inflation expectations using Consensus Economics survey-based data. The survey-based data on longer-run real GDP growth are obtained from Consensus Economics. Moreover, in the calculations volumes were placed in relation to the number of households.

4 Vacancies are not taken into account in the model framework.

5 Real residential investment is placed in relation to the real value of the housing stock; the ratio is entered into the estimation in logarithms. Moreover, the full specifications of the short-run equations in the estimation of the error correction model contain rates of change of the determinants in the long-run relationship, lagged values of the dependent and the explanatory variables and, in some cases, constants or dummy variables.

Estimation results of the error correction model^o

Determinants of the long-run relationship ¹	(Semi-)elasticities
Households' disposable income	0.6 (0.2)
Expected GDP growth ²	5.2 (1.0)
Mortgage lending rate	-0.8 (0.4)
Adjustment coefficient of the error correction term	-0.2* (0.1)

^o Long-run estimation equation includes year dummies for the years from 2015 onwards. Estimation period: Q4 1993 to Q4 2019. * Significant at the 5% level. ¹ In logarithms, except GDP growth expectations and mortgage lending rates (both in %). Standard errors are shown in parentheses. ² Annual average real GDP growth over the next ten calendar years.

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Estimation results of the panel model^o

Explanatory variables ¹	(Semi-)elasticities
Dwellings per inhabitant	- 0.9** (0.1)
Per capita disposable income	1.0** (0.1)
Population density	2.1** (0.1)
Mortgage lending rate	- 3.5** (0.2)
Expected GDP growth ²	17.1** (1.1)

^o Estimation period: 2004 to 2019. ** Significant at the 1% level. ¹ In logarithms, except GDP growth expectations and mortgage lending rates (both in %). Standard errors are shown in parentheses. ² Annual average real GDP growth over the next ten calendar years.

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occur here, too. This is represented by the second short-run equation.

$$\Delta p_t = \beta_7 \hat{\varepsilon}_{t-1} + \beta_8 \dot{i}_{t-1} + \eta_t$$

The error correction mechanism is reflected in the short-run price adjustment that is triggered by previous deviations of residential property prices from their long-run trend ($\hat{\varepsilon}_{t-1}$). The coefficients of these specifications, in which the explanatory variables affect the dependent variables with a time lag, can be estimated by means of a conventional OLS estimation.

While the analysis of actual price dynamics is all about explaining changes in prices as well as possible with given determinants, questions relating to overvaluations centre on the extent to which prices deviate from a level justified by the fundamentals. This can be measured using the long-run relationship of the error correction model without the short-run relationships. In this case, the assessment of price developments is based on its deviation from a trend path determined by the sustainable values of macroeconomic variables.⁶ Another approach to estimating the fundamental price also looks at the relationship between residential property prices and their determinants in a cross-section of Germany's 401 administrative districts. In an econometric panel

model, the price of residential property in administrative district i is explained by district-specific variables, namely the per capita housing stock at the beginning of the year (s_{it}), per capita disposable income (y_{it}) and population density (d_{it}).⁷ The model also incorporates macroeconomic data on mortgage lending rates (r_t) and survey-based longer-run GDP growth expectations (g_t^{exp}).⁸

$$p_{it} = \alpha_0 + \alpha_1 s_{it} + \alpha_2 y_{it} + \alpha_3 d_{it} + \alpha_4 r_t + \alpha_5 g_t^{exp} + c_i + \tau_{it}$$

Furthermore, c_i denotes an unobserved district-specific time-invariant fixed effect, and τ_{it} represents an error term. The coefficients of variables that could be correlated with the unobserved effect are estimated in a panel model with random effects using the instrumental variables estimator.⁹ On the basis of this econometric approach, residential property prices can be compared with the estimated district-specific fundamental equilibrium levels. The measure of overvaluation is based on the district-specific estimation residuals, which are condensed using population shares to create different regional sub-aggregates and a figure for the economy as a whole.

⁶ The price deviation is not necessarily identical with the error correction term because, amongst other things, the determinants can persistently deviate from the level justified by the fundamentals.

⁷ See Kajuth et al. (2016).

⁸ In this case, nominal variables were adjusted for the general price level using the regional consumer price index; interest rates on housing loans were adjusted using survey-based data on longer-run inflation expectations obtained from Consensus Economics. The survey-based data on longer-run real GDP growth obtained from Consensus Economics were converted into per capita values using data on population trends based on the Federal Statistical Office's 14th coordinated population projection. Additional district-specific determinants were not found to have an impact.

⁹ This was done using the deviations of the district-specific determinants from the administrative district-specific mean. See Hausman and Taylor (1981). The usual length of the publication process means that data on some explanatory variables are currently only available up until 2018 or 2017. Where these district-specific variables were not yet available, they were extrapolated using the previous year's percentage change in their share in the aggregate figure.

start until 2003. The quality of the estimation of long-run relationships depends, amongst other things, on the data coverage of cyclical phases being as balanced as possible. Therefore, in order to achieve a sample that reaches as far back as possible, the vdp price index was back-calculated to 1993 by way of approximation using a newly constructed indicator for residential property prices in Germany based on official statistics (see the box on pp. 77 f.).

Empirically plausible long-run relationship between residential property prices and macroeconomic variables

According to the estimation results, residential property prices are fairly closely linked to longer-term income developments and interest rates on mortgage loans. Added to this is the impact of expected future GDP growth, which is seen as an indicator of expected increases in household income. Taken together, these variables affect the affordability of owner-occupied dwellings, which can be measured, for example, by the interest burden on disposable income in the case of credit-financed residential property purchases. It improved very strongly between 2010 and 2016 and was also significantly more favourable in 2019 than at the start of the upturn in the real estate market.² In this context, according to the results of the analysis, mortgage lending rates, which – mirroring the general interest rate environment in the euro area – fell exceptionally sharply in particular between 2010 and 2016, had a somewhat greater impact than current income growth on property price increases.³ On the supply side, however, the results show that productivity gains in the construction sector had no substantial impact on residential property price trends. Furthermore, there are no indications that looser bank lending standards for mortgage loans played a role in the rising residential property prices.⁴

Investment incentives based on price impulses intact

Higher housing demand, for example stemming from growth in household income, can result in rising prices and, indirectly, in increased construction activity. The estimation approach makes it possible to trace changes in prices and residential investment triggered by isolated changes in macroeconomic variables. The analyses show, for one thing, that stimulative price

signals had a significant impact on residential investment.⁵ According to OECD data, Germany is nevertheless one of the countries where the housing supply tends to be inelastic.⁶ Factors that could hinder a greater expansion of supply include a lack of availability of suitable residential building land and the tightness of rent regulation.⁷ The more pronounced these are, the more difficult or less attractive investment in new dwellings is in the event of significant price increases.

On the other hand, the assessment of the transmission channel in the opposite direction, i.e. after expansions in supply, shows that additional residential investment scarcely dampened residential property price inflation in the short run, provided it was not itself attributable to price impulses. Viewed in isolation, stock-increasing residential investment actually led to price increases to a certain extent, contrary to the expected effect. The gradually increasing capacity utilisation in the construction sector reached an extremely high level last year, causing price pressure on the cost side. Moreover, the availability of building land, especially in the attractive urban regions, became scarce quite quickly, which meant that additional dwellings were increasingly built without an expansion in the underlying residential building land.⁸

Residential property investment has scarcely any price-dampening effect in the short run

² See also the Bundesbank's system of indicators for the German residential property market at <https://www.bundesbank.de/en/statistics/sets-of-indicators/system-of-indicators-for-the-german-residential-property-market>. Repayments of principal are not taken into account in this calculation.

³ Income variables also reflect the demand effect of the high level of labour market-oriented immigration between 2011 and 2019.

⁴ See Geiger et al. (2016). Furthermore, owing to the lack of statistical data, it is not possible to determine the extent to which red tape, entrenched land use plans or resistance by interest groups prevented the expansion of residential building land.

⁵ This can be seen in the impulse responses of residential investment to exogenous increases in residential property prices.

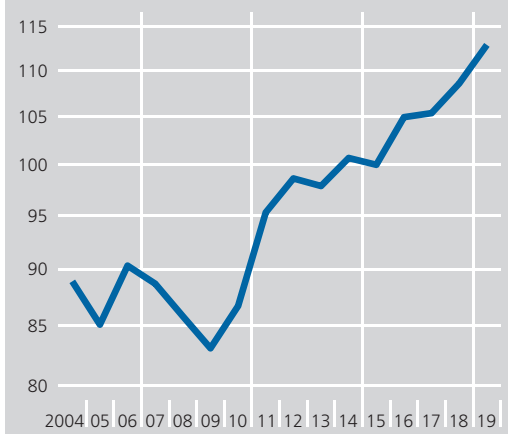
⁶ See Cavalleri et al. (2019).

⁷ The necessary societal debate about the purpose of land use can also play a role here. In the case of rent regulation, across-the-board rent controls, in particular, risk reducing investment incentives.

⁸ This was achieved, for example, by increasing building density or adding storeys to existing buildings.

Real housing investment

2015 = 100, log scale



Source: Federal Statistical Office.
 Deutsche Bundesbank

Price dynamics decomposed into the contributions of construction prices and land prices

Real estate prices comprise the cost of construction work and the cost of land. It is therefore interesting to see which of these factors can explain most of the increase in residential property prices in recent years. To this end, based on the value of the housing stock, price dynamics can be decomposed into the contributions of movements in the prices of construction work and building land. The results suggest that the main driver of the sharp rise in real estate prices over the past decade has been the increased growth in the prices of building land, which outpaced construction prices, particularly in the second half of the period.

Transmission channels via construction prices and land prices

The previous analysis of the macroeconomic determinants of residential property prices overall can also be carried out separately for each of the two price components – construction costs and land prices. In order to assign the effects of the price-determining variables to the two components, the estimations that were applied to residential property prices can be repeated for both construction prices and land prices. The separate analysis shows that the impact of both income and interest rate developments was chiefly transmitted through the land component. As the contribution of the land component has grown in the recent past, the impact of income growth and declining

interest rates has tended to increase. This disaggregated estimate also sheds light on the finding that higher residential investment did not have a dampening effect on residential property prices. This is attributable to the price pressure on construction work caused by the increase in construction activity. Increased residential investment has thus pushed up the price of construction work, thereby contributing to the price dynamics of residential real estate. This is plausible, given that capacity utilisation in the construction sector has been extremely high for some time now. According to the model results, price-dampening effects are more likely to be achieved through the designation of additional building land. Additional residential building land would thus counteract the price pressure attributable to growing construction activity.

Taken together, the findings show that price movements in recent years have, from a macroeconomic perspective, largely been an expression of economically plausible transmission mechanisms. Owing to the growing scarcity of residential building land, the rise in the demand for housing had a fairly strong price impact. In addition, the increases in construction prices triggered by higher construction activity counteracted the price-dampening effect of additional building land. Nevertheless, prices in the period under review diverged, in some cases markedly, from the dynamics suggested by the macroeconomic variables. This can be partly explained – from a statistical perspective – by a lack of data availability, for example for the costs of designating building land; moreover, the prices could also reflect temporary price exaggerations.

Transmission mechanisms plausible on the whole

Approaches to a macroeconomic assessment of residential property price developments

Price developments in residential property are usually assessed by comparing the actual price

An indicator for residential property prices in Germany as of 1993

Indicators that model developments in aggregate residential property prices in Germany and which demonstrate sufficient data quality are available from 2003 onwards.¹ The data therefore cover mainly the period of the protracted economic upswing. In order to look even further back at property price trends in Germany, an additional price indicator for residential property prices can be obtained using a procedure that has previously been applied to the United States.² This price indicator goes back to 1993, thus covering a considerably longer period than the one for which aggregate property price data for Germany are currently available.

The starting point for calculating this indicator is the definition of housing wealth ($p_t^h h_t$), defined as the capital stock of residential buildings (h_t) valued at current prices (p_t^h). Its time path reflects the combinations of pure changes in the price of

the housing stock and the value of stock changes.

$$p_{t+1}^h h_{t+1} = \frac{p_{t+1}^h}{p_t^h} p_t^h h_t + p_{t+1}^h \Delta h_{t+1}$$

In order to separate the price changes, the contribution made by the value of stock changes has to be deducted from the changes in housing wealth. Housing wealth here is defined as the sum of the building value ($p_t^s s_t$) and the land value component ($p_t^l l_t$).

$$p_t^h h_t = p_t^s s_t + p_t^l l_t$$

Data for these components are available in the sectoral and national wealth accounts.³ The value of the change in the housing stock is accordingly composed of net investment in dwellings and the value of growth in residential building land.⁴ This can be measured using district-specific data on changes in the area of residential build-

1 The quality-adjusted, transaction-based price index for owner-occupied housing of the Association of German Pfandbrief Banks (vdp) starts in 2003. The Bundesbank indicator for residential property prices in Germany based on bulwiengesa AG data goes back to 2004. Data on the Federal Statistical Office's house price index that lend themselves to time comparisons are available as of the year 2014. See Federal Statistical Office (2018).

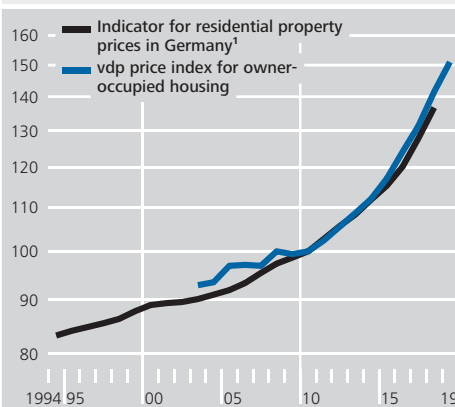
2 See Davis and Heathcote (2007) as well as Kajuth (2020).

3 See Federal Statistical Office (2012, 2019b). With the exception of the data on the value of growth in building land, the calculations are based on the total economy excluding general government. The data on the value of residential building area was derived from the ratio of the area of land used for residential purposes to the area used for residential, commercial or industrial purposes.

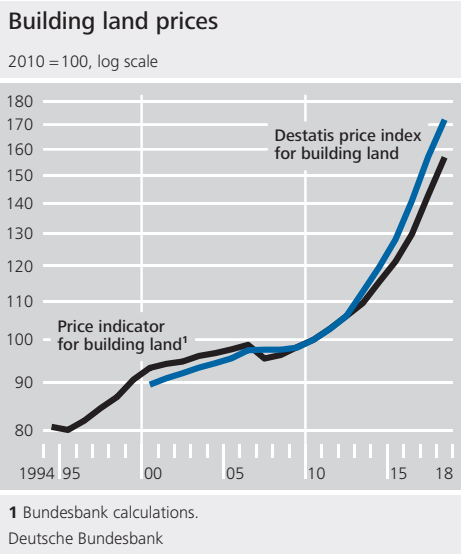
4 In order to calculate the share of depreciation on residential buildings accounted for by the private sector, it was assumed that it matches that of private sector housing investment. Ancillary construction costs have to be deducted from net housing investment, which also comprises non-deductible turnover tax. These costs include charges, commissions, fees, real estate acquisition tax and the value of utility and service connections and external facilities.

Residential property prices in Germany

2010 = 100, log scale



1 Bundesbank calculations.
 Deutsche Bundesbank



ing land combined with average prices of developed building land per square metre.⁵

Statistical data for nearly all of the necessary variables are available for the period from 1991 onwards. However, the district-specific data on the area of residential building land go back only as far as 1996. In the previous period, aggregate data for Germany are available only for 1992. The data for the years 1993 to 1995 have therefore been linearly interpolated. Looking at the growth in residential building land, 1993 is therefore taken as the starting point for the price indicator for residential property in Germany.

A caveat, however, is that the price indicator is neither based on transaction data nor quality-adjusted. Up-to-date results can only be calculated with a time lag. Moreover, only annual data are available – which, for the 1990s, are partly interpolated. This impairs the informative value of the indicator, especially for the 1990s. Nevertheless, according to the indicator, the residential property price trend is broadly consistent with that of the transaction-based, quality-adjusted vdp price index for owner-occupied housing over the overlapping

period. The indicator shows that residential property prices in Germany trended moderately upwards in the second half of the 1990s, whereas they more or less stagnated in some years during the first half of the 2000s. Only as from 2010 did they gain considerable momentum.

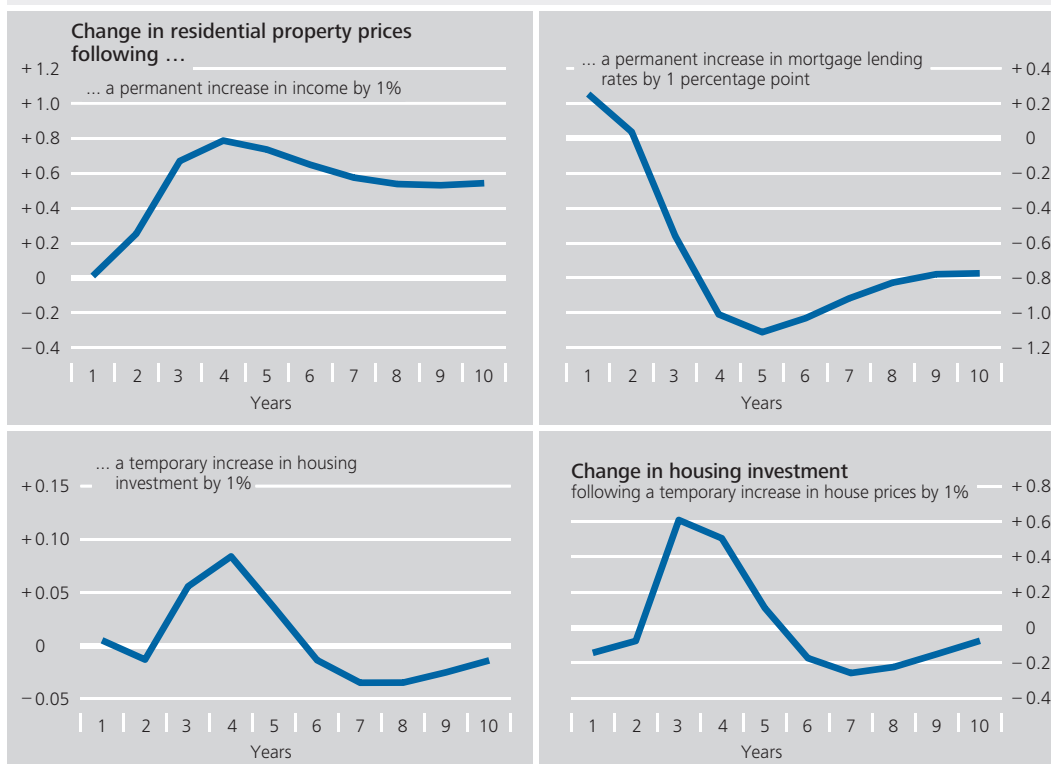
From this point of view, residential property price growth can be approximated as a weighted average of price increases for residential buildings and residential building land, with the weights referring to the value shares of the respective component in total housing wealth.⁶ This also enables a price indicator for residential building land going back to 1993 to be derived. According to this sub-indicator, building land prices rose moderately in the second half of the 1990s, whereas they barely rose at all in the subsequent period up until around 2010. Over the past decade, they have picked up sharply. The indicator for building land prices has a profile similar to that of the transaction-based, quality-adjusted building land price index of the Federal Statistical Office, which is available for the period from 2000 onwards. This lends plausibility to the new price indicator for residential property in Germany.

⁵ The advantage of performing the calculation using district-level data over aggregated data is that it minimises the impact on the total price of residential building land caused by time fluctuations in the regional shares of land transactions. Regional data on average purchase prices for residential building land missing for some years were added or statistically extrapolated using data provided by bulwiengesa AG or the state building and loan associations on purchase prices for residential building plots. This is also the case for the missing data on the residential building land area from the 1997 to 1999 and 2001 to 2003 periods, which have been linearly interpolated.

⁶ The approximation holds for sufficiently small changes in the housing stock and in the area of residential building land.

Estimated mechanisms in the residential property market

Deviation from the baseline (%)



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Valuation requires reference value

level with a benchmark that reflects the sustainable price path. Since this reference value is an unobserved variable and calculating it involves considerable uncertainty, it is preferable to use various approaches to assess developments in residential property prices.

Standard indicators suggest heightened valuation level

Standard indicators for assessing residential property include the price-to-rent and price-to-income ratios, where the reference value is the indicator's long-run mean. This measure assumes that, in the long run, there is a fixed relationship between house price developments and the trend in rents and incomes. While this measure is easy to construct and interpret, one drawback is that the reference value is time-invariant and that there is no scope to add factors. Moreover, the informative value of these indicators depends heavily on the period for which the mean is calculated. According to this approach, house price valuations in German towns and cities were exceedingly high last year. The price-to-rent ratio for apartments

there deviated by between 20% and 25% from the respective long-run average since 1990, while it deviated by around 30% in the seven big cities.⁹ Looking at Germany as a whole, apartment prices were around 20% above the reference value as measured by developments in rents for new lettings last year. Looking at residential properties as a whole, too, income-based indicators show aggregate house price deviations to be close to the 20% mark in 2019.

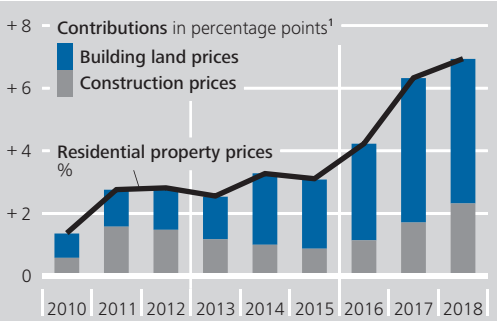
A time-varying reference value can be calculated, for example, from the long-run relationship of the error correction model. From an economic perspective, the specification of the long-run relationship can be interpreted as an equilibrium price-income ratio that is corrected for the interest rate effect. This approach is based on the notion that the sustainable financing of residential property purchases should

Time-varying reference value

⁹ The seven big cities are Berlin, Cologne, Düsseldorf, Frankfurt am Main, Hamburg, Munich and Stuttgart.

Components of residential property price dynamics

Year-on-year percentage change



Source: Bundesbank calculations based on data from the Federal Statistical Office. ¹ Rates of change for prices of construction work and residential building land, weighted by the value shares of residential buildings and residential building land in total housing wealth.

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real interest rate for housing loans is the level it stood at in 2009 – i.e. before interest rates embarked on their multi-year decline. Under this assumption, the marked decline in the real lending rate since then is a temporary phenomenon. While there is indeed some evidence to suggest that the natural interest rate in advanced economies has come down over time, there are also signs that the return on fixed capital did not decline as much as the risk-free interest rate.¹⁰ Moreover, the actual real interest rate in Germany is estimated to have been only slightly below the natural real interest rate in 2009.¹¹ From around this point onwards, the decline in interest rates on loans for house purchase in Germany was largely related to crisis management policies in the euro area. From this perspective, the interest rate level of 2009 represents an approximation of the sustainable mortgage lending rate in Germany. Second, it is hypothetically assumed that the natural interest rate has equalled the actual interest rate since 2009. That would lead to the assumption that the current level of mortgage lending rates is purely structural in nature. The two assumptions are extreme cases and form the edges of a range that encompasses possible trajectories

be consistent with income developments in the long run.

Scenario calculations to determine the sustainable level of mortgage lending rates

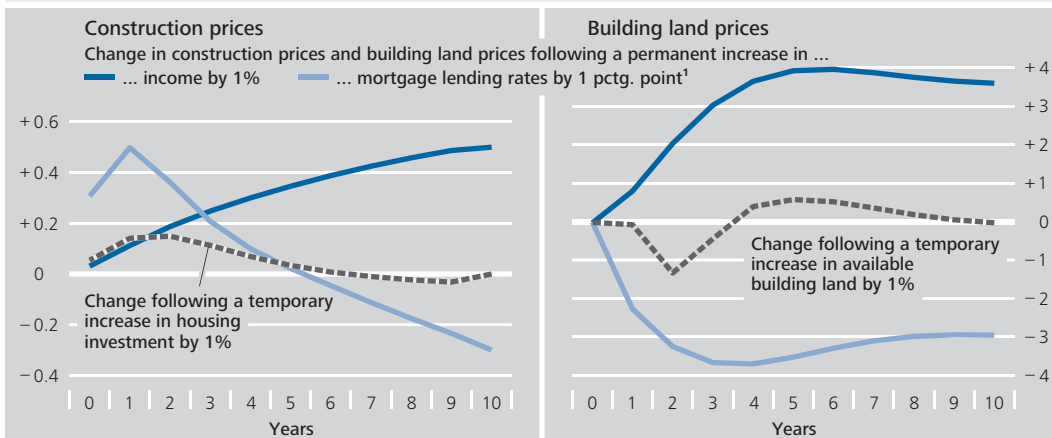
Particularly looking at mortgage lending rates for residential property, which have been extremely low for some time now, this approach raises the question of the extent to which they reflect a decline in their sustainable component and how much of the decline in interest rates is the result of cyclical factors. Given that estimating the long-run equilibrium interest rate in Germany involves considerable uncertainty, a range is defined with the aid of two hypothetical assumptions. First, it is assumed that the natural

¹⁰ For example, the risk premium may have trended upwards. See Brand et al. (2018).

¹¹ See Arena et al. (2020).

Estimated mechanisms of housing construction prices

Deviation from the baseline (%)



¹ Response of construction prices not significant at the 10% level.

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for the sustainable mortgage lending rate – and thus also, all other things being equal, for fundamental residential property prices.

According to the long-run equilibrium relationship, macroeconomic overvaluations are low

If the actual, low interest rate level is used to determine the fundamental price, there were no substantial overvaluations in 2019. Assuming the higher figure – measured in 2009 – for the fundamental component of the mortgage lending rate, macroeconomic prices deviated by less than 10% from their fundamentally justified level. They are thus clearly below the value according to the simple statistical indicators.

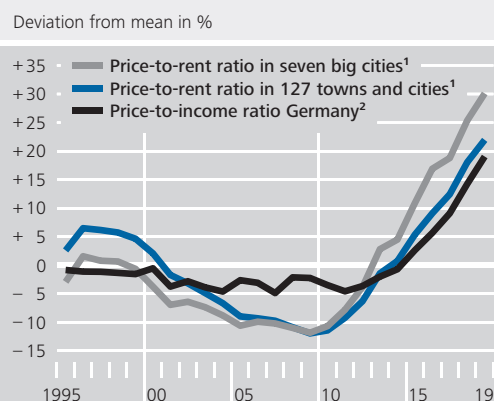
A regional panel model suggests overvaluations, especially in towns and cities

A third approach additionally considers that specific regional trends in the fundamental determinants may also play a role. A panel model is used to calculate a fundamental property price at the level of German administrative districts. In this case, too, scenario calculations are used to narrow down the contribution of mortgage lending rates to the fundamental price of real estate by establishing a range. Assuming that the sustainable component of the interest rate is at the comparatively high level it reached in 2009, the calculations show residential property prices in Germany as a whole to be just over 20% above the level that appears justified by longer-term economic and demographic factors. If the current, low level of interest rates is used as a basis, the price level in Germany in 2019 was, on the whole, just over 10% above its fundamentally justified level. Assuming a higher fundamental interest rate, residential property in the seven big cities was overvalued by around 30% in 2019; assuming a lower fundamental interest rate, it was almost 20% overvalued. According to this approach, housing in urban areas overall was overvalued by between 15% and 30%, depending on the underlying fundamental interest rate level. The results thus largely confirm the findings of the simple statistical indicators; they are, however, higher than the results based on the estimated aggregate long-run equation.

Valuation level high overall

Looking at the big picture in terms of the indicator results and taking into account the con-

Standard indicators for assessing house prices in Germany



1 Bundesbank calculations based on data provided by bulwiengesa AG. **2** Bundesbank calculations. Income and number of households: Federal Statistical Office.

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siderable uncertainty that the valuation approaches are subject to, residential property was overvalued by up to 20% on a nationwide average in 2019. In urban regions, overvaluation was greater. However, these results depend on the calculation method and are also strongly influenced by the underlying assumptions regarding the natural level of lending rates. If the decline in interest rates in the period since 2010 is interpreted as a largely persistent phenomenon – i.e. the prevailing interest rate level is seen as being close to the equilibrium interest rate – price deviations would be smaller in the aggregate.

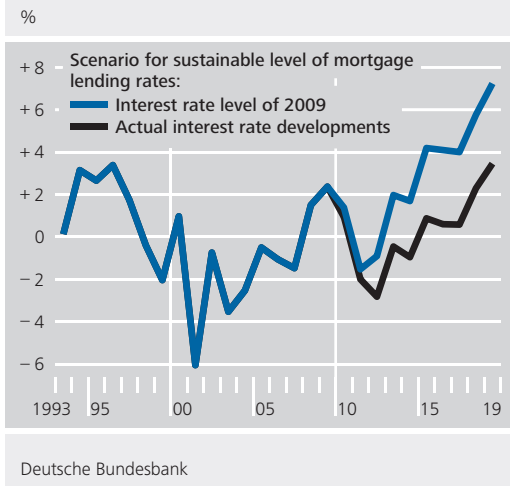
Survey-based assessment of price expectations in the housing market

The deviations in the prices of residential property from their fundamentally justified level as calculated above inherently also reflect contributions from factors that are not included in the estimation equation. From a stability perspective, speculative motives for buying property are of particular importance.¹² They can

Analysis of household expectations to assess speculative elements

¹² Other, less problematic contributions could stem, for example, from specific regional growth prospects or anticipated constraints in terms of available building land. See Nathanson and Zwick (2018).

Price deviation from the estimated long-run relationship with income and mortgage lending rates



have a destabilising effect if they lead to price movements that are based solely on expectations of further price increases – without reference to fundamentals. Data from the Bundesbank Online Pilot Survey on Consumer Expectations conducted in 2019 can be used to gauge the extent to which there are indications of destabilising speculative motives.¹³ By definition, this might be suspected if overvaluations are expected to increase in a region where prices already exceed their fundamentally justified levels.¹⁴ Households' expectations regarding the future valuation of residential property can be captured on the basis of the information that they provide on the expected price-to-rent ratio of residential property in their vicinity.¹⁵ These data can be combined with the results for regional overvaluations.

No evidence of widespread speculative elements

According to the results of descriptive evaluations, the surveyed households expected a trend decline in price-to-rent ratios in areas with overvaluations, as well as in regions without overvaluations. In other words, they expected overvaluations to decline. This applies both to Germany as a whole and to the towns and cities category. Using the microdata in the survey information on expected developments in the price-to-rent ratio in additional regression analyses, it is possible to quantify the probability of excessively strong price develop-

ments in the event that house prices have already exceeded their benchmark.¹⁶ The results can be interpreted as the probability of destabilising price trends. According to the analysis, the estimated probabilities of price developments that are based purely on expectations are low on the whole and change only slightly as overvaluations increase. Overall, the analyses do not provide any evidence of destabilising price trends for residential property either for Germany as a whole or for the aggregate of towns and cities. The probability that price-to-rent ratios will continue to rise in the future as overvaluations grow approaches the 50% mark only in individual areas where valuations have so far been exceedingly high. If at all, the calculations show only for individual major cities a certain risk that speculative price components were a factor in the past year.

Marks left by the COVID-19 crisis on the housing market

House price developments have been robust so far during the coronavirus crisis. In particular, there have been no signs of a slowdown as yet. According to data provided by vdp, house prices rose by 6.8% on the year in the second quarter of 2020, no less than in the previous

House price developments have been robust in the year to date

¹³ Information on the Bundesbank's Online Pilot Survey on Consumer Expectations in Germany is available at www.bundesbank.de/en/bundesbank/research/pilot-survey-on-consumer-expectations

¹⁴ In the other case – the normal case without self-reinforcing price deviations – survey-based expectations would show the high valuation level coming down.

¹⁵ Further evaluations of the survey data show that respondents' valuation data are positively and statistically significantly correlated with expert estimates of the price-to-rent ratio in their region as well as with the regional price deviations as per the panel model.

¹⁶ The logit estimates are based on the regression of the survey-based data on the expected increase in the price-to-rent ratio over the next 12 months on the regional overvaluations estimated under the panel regression model. The dependent variable assumes the value of 0 (no increase in the price-to-rent ratio expected) or 1 (increase in the price-to-rent ratio expected). Furthermore, the influence of the explanatory variables is transformed by means of a logistic function, which means that the estimated values of the binary dependent variable lie in the range from 0 to 1. In addition, the influence of control variables is taken into account.

year in which, as expected, price dynamics in the housing market had eased somewhat. In the seven big cities, the rate of price increase rose somewhat in the second quarter, at 4.6% on the year, according to vdp data, but was – like the annual average for 2019 – already much lower than in the preceding years. According to the house price index compiled by the Federal Statistical Office, the rise in house prices in the second quarter, at 6.6%, was somewhat greater than in the previous year.

No disruption to expansion of supply so far

There have so far been no major supply-side disruptions. Although the number of building permits was more or less stagnant at the beginning of the pandemic in Germany, there was already a marked increase again in May, and in the period from March to the end of August the number of building permits was higher than in the same period of the previous year.¹⁷ In the period under review, new orders in housing construction returned to close to their pre-crisis levels following a slump in March and April caused by the pandemic.

Signs of weaker demand for residential property

Although financing conditions remain exceedingly favourable, the affordability of credit-financed purchases of residential property is likely to have deteriorated on average given the ongoing upward pressure on prices. Households' disposable income stagnated in the second quarter, and the general uncertainty is high. Demand for housing could consequently ease off – at least temporarily.¹⁸ However, if prospective buyers believe that their income prospects are only temporarily lower, demand for housing will probably be dampened only marginally. Moreover, residential real estate is likely to remain an attractive investment option in the low interest rate environment.

¹⁷ The restrictions introduced to combat the pandemic probably also caused disruptions to approval processes, with backlogs being cleared after restrictions were eased. See Federal Statistical Office (2020b).

¹⁸ The fact that price developments were robust, by comparison, in the second quarter might also be related to the fact that they are derived from actual transactions, which could currently include more purchases by households that have seen virtually no pandemic-induced income losses.

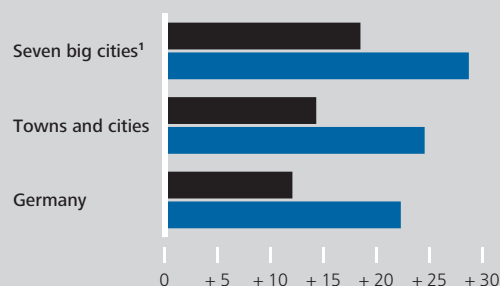
Residential property price deviations in 2019 according to regional panel model

Deviation from estimated fundamental price in %

Scenario for sustainable mortgage lending rate:

■ Actual interest rate developments

■ Interest rate level in 2009



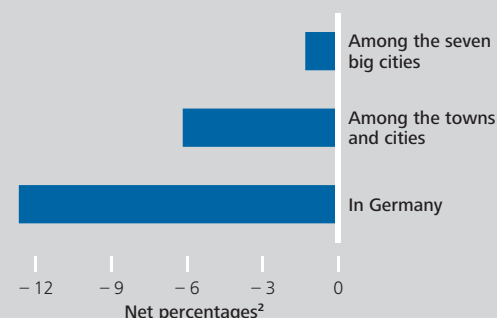
¹ Berlin, Cologne, Düsseldorf, Frankfurt am Main, Hamburg, Munich and Stuttgart.

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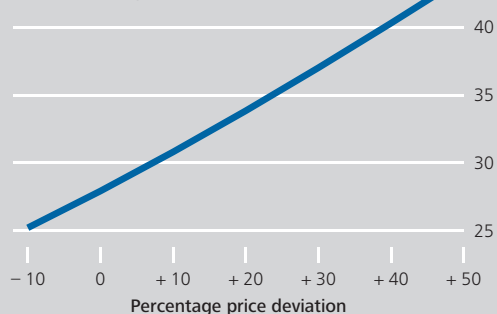
Valuation tendencies for residential property in Germany*

%

Expected change in the price-to-rent ratio in regions with overvaluation¹



Estimated probability of rising price-to-rent ratios (%) conditional on price deviations³



* Bundesbank calculations based on survey-based data provided as part of the Bundesbank Online Pilot Survey on Consumer Expectations in 2019. Overvaluations and/or price deviations according to the panel model. ¹ Expected development in the next 12 months. Residential property in a region was defined as being overvalued if its price was more than 10% above the estimated fundamental price in 2019. ² Difference between the number of respondents expecting the price-to-rent ratio to rise and those anticipating a drop in the price-to-rent ratio, as a percentage of all answers. ³ Estimated using a logit model.

Deutsche Bundesbank

■ Conclusion

Rising prices in Germany attributable to developments in supply and demand

Looking at the economy as a whole, rising prices in the residential property market over the past few years have probably largely reflected developments in housing supply and demand. Additional housing construction did little to dampen the demand-driven pressure on prices, partly because it caused a sharp rise in the price of construction work. Land prices, whose contribution to house price inflation has risen significantly in recent years, appreciated even more sharply. As this, in particular, tends to reflect a property's asset value, the risk of price exaggerations in residential property also increased. Considerable overvaluations emerged, especially in urban areas, while some price deviations to the upside were also observed at the aggregate level. However, further calculations provide little indication that house price developments – both in the aggregate

and in town and cities – were based to a significant extent on destabilising, purely speculative motives.

Overall, the price structure in the German housing market in 2019 can therefore be regarded as robust to pronounced changes in the macroeconomic environment. This is consistent with the fact that the pandemic has so far left little mark on the housing market. However, the macroeconomic environment is now much more fragile than before. In particular, the combination of an as yet unabated expansion of housing supply and weaker demand mean that price dynamics could, in the event of additional turbulence, moderate more rapidly, and to a greater extent, than previously suggested. That said, there are no signs of an abrupt correction in house prices, provided that there is no serious disruption to the ongoing macroeconomic recovery.

So far, the pandemic is having no impact on house prices

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