

Real estate prices



REPORT by Christian Westermeier and Markus M. Grabka

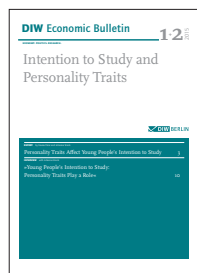
Real estate price polarization projected to increase
until 2030 in Germany 245

INTERVIEW with Markus M. Grabka

»Depopulation to affect regional real estate prices« 254

REPORT by Konstantin Kholodilin and Claus Michelsen

No Germany-wide housing bubble but overvaluation
in regional markets and segments 255



The DIW Economic Bulletin contains selected articles and interviews from the DIW Wochenbericht in English. As the institute's flagship publication, the DIW Wochenbericht provides an independent view on the economic development in Germany and the world, addressing the media as well as leaders in politics, business, and society.

The DIW Economic Bulletin is published weekly and available as a free download from DIW Berlin's website.

THE NEWSLETTER FROM THE INSTITUTE



DIW Berlin's biweekly English newsletter publishes the latest news from the Institute as well as information on new publications and upcoming events. DIW also offers 'New Issue Alerts' for the DIW Economic Bulletin and the DIW Roundup.

>> Subscribe to DIW Newsletter in English at: www.diw.de/newsletter_en

NEXT ISSUE OF DIW ECONOMIC BULLETIN

Revenue distribution and forms of labor market participation

Publishers

Prof. Dr. Tomaso Duso
Dr. Ferdinand Fichtner
Prof. Marcel Fratzscher, Ph.D.
Prof. Dr. Peter Haan
Prof. Dr. Claudia Kemfert
Prof. Dr. Lukas Menkhoff
Prof. Johanna Mollerstrom, Ph.D.
Prof. Karsten Neuhoff, Ph.D.
Prof. Dr. Jürgen Schupp
Prof. Dr. C. Katharina Spieß
Prof. Dr. Gert G. Wagner

Reviewer

Dr. Claus Michelsen
Prof. Dr. Christian Dreger

Editors in chief

Dr. Gritje Hartmann
Dr. WolfPeter Schill

Editorial staff

Renate Bogdanovic
Dr. Franziska Bremus
Prof. Dr. Christian Dreger
Sebastian Kollmann
Markus Reiniger
Mathilde Richter
Miranda Siegel
Dr. Alexander Zerrahn

Layout and Composition

eScriptum GmbH & Co KG, Berlin

Sale and distribution

DIW Berlin
ISSN 2192-7219

Reprint and further distribution—including excerpts—with complete reference and consignment of a specimen copy to DIW Berlin's Communications Department (kundenservice@diw.berlin) only.
Printed on 100% recycled paper.

Real estate price polarization projected to increase until 2030 in Germany

By Christian Westermeier and Markus M. Grabka

Demographic projections for Germany indicate a drop in the population of many regions by 2030. This is likely to have an impact on the real estate market. Our report presents the result of a model calculation of asking prices for residential real estate in Germany up to 2030 based on market data from empirica-systeme GmbH and a population projection from the Bertelsmann Foundation. Depending on the model specifications, it appears that real estate price polarization will increase by 2030. As with all model calculations, the results are subject to uncertainty. In the scenario presented here, we strictly focus on the demographic effect on real estate prices. According to our projections, in one-third of all rural districts (Landkreise) and urban districts (kreisfreie Städte), the market value of condominiums will fall by over 25 percent. This will also be the case for single- and two-family homes in one-quarter of all districts. Some regions in eastern Germany will be hit particularly hard by this development. In and around urban centers, however, the trend of rising prices is expected to continue. Our findings also show that the polarization of real estate prices might cause the inequality of wealth in Germany to rise slightly.

The demographic trend in Germany is predominantly determined by three main factors: fertility, mortality, and the sum of cross-border migration. At present, Germany's birth rate is below the sustainable level and at the same time, life expectancy is on the rise. As a result, the size and age structure of the population is changing significantly. According to the 13th coordinated population forecasts of the German Federal Statistical Office,¹ the population level is predicted to fall by 7.7 million to 13.2 million persons² by 2060 in comparison to base year 2013—depending on the assumed scope of migration.³

Changing population demographics and the associated regional variations in age structure will also have an effect on the real estate market. We presume that in regions with population shrinkage, the demand for real estate will fall and with it, prices. In expanding regions, prices will rise. This effect will be reinforced by a change in the population's composition: demand for living space is lower among older people than it is among younger people.

And population movement within Germany plays a role alongside migration. The continuing trend toward urban center growth and migration away from rural areas—especially by the young—reinforces the aging process in structurally weak regions. Since the supply of real estate is long-lasting yet inflexible in the short term, the housing stock will most likely react sluggishly to changes in demand.⁴ This should heighten the phenomenon of diverging price trends. Despite great uncertainty with regard to migration, we can presume that regional dis-

¹ Olga Pöttsch and Felix Rößger, "Bevölkerung Deutschlands bis 2060. 13. koordinierte Bevölkerungsvorausberechnung," (PDF, German Federal Statistical Office, Wiesbaden, 2015). (available online; retrieved May 31, 2017. This applies to all other online sources cited in this report unless otherwise noted).

² The composition of the age groups will also radically change, in particular with regard to the proportion of very old persons. For example, the dependency quotient—the proportion of persons ages 65 and older in relationship to 20 to 65-year-olds—is predicted to substantially increase between 2013 and 2060 (34 percent in 2013, 56 percent in 2030 and 65 percent in 2060).

³ This information refers to the scenario with constant birth frequency (L1) and a moderate rise in life expectancy (G1).

⁴ See Edward L. Glaeser and Joseph Gyourko, "Urban decline and durable housing," *Journal of Political Economy* 113.2 (2005): 345–375.

parities in population structure will continue to increase by 2030.⁵

The goal of this study supported by the Hans Böckler Foundation⁶ is to generate a model-based projection of real estate prices dependent upon the demographic trend up to 2030. Real estate prices are the focus since private real estate ownership represents the most important component of private household wealth in Germany by far.⁷ For this reason, changes in the assessment and structure of this component of wealth would definitely have an effect on the overall distribution of wealth.

Real estate prices react strongly to changes in demand

Real estate prices are influenced by both demand- and supply-side determinants. Demographic developments such as changes in age structure and total population are the primary demand-side factors that influence price structures.⁸ The demand-side also encompasses changes in household composition (e.g., an increasing number of one-person households) and changes in preference with regard to acquiring real estate. General economic growth—as manifested by level of disposable income, the interest rate, and the unemployment rate, for example—is another key determinant on the demand side.⁹

Supply-side determinants of real estate prices include construction activity, availability of land for both residential and commercial usage, prices in the surrounding regions, urban development and infrastructure-related trends (such as transport connections) or the availability of public infrastructure (e.g., daycare, schools, retailers or leisure time programs), housing policy (e.g., subsidy of owner-occupied housing), and the condition and quality of the buildings themselves.¹⁰

A special feature of real estate market is the “virtually impossibility” of adjusting the real estate inventory to changing demand-side real estate market determinants in the short term, due to the longevity of real estate and the relatively long periods required for planning and completing construction. For this reason, prices react strongly to unanticipated changes in demand in the short term.¹¹

Regional differences in real estate prices are already significant

A relationship between population growth and real estate prices can be shown for the five districts with the largest percentage population growth and largest population decline (see Table 1). For example, in the city of Leipzig, the total population has grown by 6.8 percent and at the same time, median asking prices have increased by 20 percent. On the contrary, in the Elbe-Elster rural district in Brandenburg, the population fell by 3.7 percent and asking prices by over 25 percent.¹²

There is already evidence of marked polarization in real estate prices. The information on asking prices from the empirica-systeme market data shows high regional variation for single- and two-family houses in 2015 (see Figure 1). For example, the majority of median

⁵ See Frank Swiaczny, “Auswirkungen des demographischen Wandels auf die regionale Bevölkerungsdynamik in Deutschland,” *Raumforschung und Raumordnung* 73(6) (2015): 407–421.

⁶ We would like to express our gratitude to the Hans Böckler Foundation for financing the research project “Vermögen in Deutschland—Status-quo-Analysen und Perspektiven” (Project number: S-2012-610-4, conducted by DIW Berlin and the Hertie School of Governance under the project direction of Markus M. Grabka). We would also like to thank empirica-systeme for allowing us to use microdata from the empirica regional database.

⁷ See Markus M. Grabka and Christian Westermeier, “Anhaltend hohe Vermögensungleichheit in Deutschland,” *DIW Wochenbericht* no. 9 (2014): 151–164. (available online).

⁸ In addition to primary demographic effect on real estate prices, birth cohort effects on demand for living space also affect overall demand and therefore, real estate prices. See Philipp Deschermeier and Ralph Henger, “Die Bedeutung des zukünftigen Kohorteneffekts auf den Wohnflächenkonsum” *IW Trends* 3 (2015): 23–39. Available online (Accessed May 31, 2017). The authors argue that the cohort effect prevails over the pure age effect, since per capita living space consumption increases only slightly with age.

⁹ Deutsche Bundesbank, the German central bank, assumes that due to the drop in overall population and the aging of wage earners, economic growth will trend sharply downward in the medium term. See Deutsche Bundesbank, “Demografischer Wandel, Zuwanderung und das Produktionspotenzial der deutschen Wirtschaft,” (PDF, Deutsche Bundesbank, Frankfurt am Main, 2017). (available online). As a key demand-side determinant of real estate prices, this can accordingly have a dampening effect on real estate prices in the future. The quantitatively key determinants of real estate prices are real disposable per capita income, population growth, level of urbanization, and the long-term real interest rate. See Konstantin A. Kholodilin, Jan-Oliver Menz, and Boriss Siliverstovs, “Immobilienkrise? Warum in Deutschland die Preise seit Jahrzehnten stagnieren” *DIW Wochenbericht* no. 17 (2008): 214–220. (available online).

¹⁰ See Denise DiPasquale, “Why don't we know more about housing supply?” *The Journal of Real Estate Finance and Economics*, 18(1) (1999): 9–23 and Stephen Malpezzi, “Hedonic pricing models: a selective and applied review,” *Housing Economics and Public Policy* (2003): 67–89.

¹¹ The starting point for most empirical studies on the development of real estate supply, demand, and prices is the Stock-Flow Model that DiPasquale and Wheaton developed in 1992 and 1994. It explicitly models the rigid offer and adjustment processes after demand shocks. See Denise DiPasquale and William C. Wheaton, “Housing market dynamics and the future of housing prices,” *Journal of Urban Economics* 35(1) (1994): 1–27 and Denise DiPasquale and William C. Wheaton, “The markets for real estate assets and space: a conceptual framework,” *Real Estate Economics* 20(2) (1992): 181–198.

¹² In the medium term, the negative price effect in shrinking regions can be stronger than the positive one in growing regions. In line with the ratchet effect, in regions with population growth there will be a price increase in the short term, but in the medium term an increase in supply will cause prices to fall again. However, there is hardly any adjustment on the supply side in regions with a shrinking population. Instead, real estate remains on the market and can therefore continue to affect prices negatively (see Tobias Just, *Demografie und Immobilien* (Munich: Oldenburg Verlag, 2013).

Table 1

Changes of asking prices of condominiums and population in selected districts (2012–2015)

District	Changes of asking prices of condominiums per m ² (median), in percent	Population change, in percent
Population growth (Top 5)		
Leipzig (City)	20.5	6.8
Frankfurt am Main	25.4	6.1
Offenbach am Main	31.7	5.3
Landshut (City)	35.8	5.0
München (City)	35.4	4.7
Population loss (Top 5)		
Elbe-Elster	–27.8	–3.7
Salzlandkreis	–9.4	–3.5
Oberspreewald-Lausitz	–41.1	–3.4
Anhalt-Bitterfeld	–5.8	–3.4
Altenburger Land	–11.9	–3.3

Source: Real estate asking prices of condominiums (empirica-systeme market data); Current population statistics published by German Federal Statistical Office and Federal State Statistical Offices (Regionaldatenbank)

© DIW Berlin 2017

In cities with significant population growth the asking prices of real estate appear to increase sharply.

prices¹³ in eastern German rural and urban districts were below 850 euros per square meter of living area. In urban centers such as Berlin, Hamburg, Frankfurt am Main, and Munich, asking prices were generally higher than in rural areas. At over 4,290 euros per square meter, asking prices were the highest in the Munich greater metropolitan area.

The asking prices of condominiums in 2015 deviated from those of single- and two-family homes in many regions (see Figure 2). We saw the largest differences in coastal regions. While asking prices for single- and two-family homes in the Rostock and Western Pomerania-Rügen rural districts were between 850 and 1,250 euros per square meter for example, they were between 1,950 and 2,420 euros per square meter for condominiums. With comparable price levels for houses and condominiums in rural districts in Saxony, Saxony-Anhalt, and parts of Thuringia, where both types of real estate have the lowest asking prices, or in and around Munich, which has the highest prices, the situation was different.

¹³ In the following report, we provide median prices only since unlike arithmetic means, they have the advantage of being robust against outliers at the upper end of the distribution.

Demographic shift already showing an effect

In particular, low asking prices in large parts of eastern Germany indicate already present demand-side effects (e.g., of the demographic shift) on real estate prices. For example, the median asking price for single- and two-family homes in the Harz rural district (Saxony-Anhalt) was 624 euros per square meter of living space in 2015, less than half of the overall German median of 1,580 euros per square meter.¹⁴ According to the information in the Bertelsmann Foundation's *Wegweiser Kommune*, a website with population statistics and forecasts for municipalities, in 2014 the average age in that rural district was 48.4 and the dependency quotient 44.2 percent. Since 2011, the population has fallen by 2.5 percent.

On the other hand, the population of the Biberach rural district (Baden-Württemberg) in 2014 was 1.6 percent higher than it was in 2011.¹⁵ There, the average age was 42.3 and the dependency quotient, 29.8 percent. At the same time, the median asking price for single- and two-family homes was 1,633 euros per square meter of living space in 2015, and therefore above the overall German median.

Many rural districts will have to face falling real estate prices

Due to the overall decrease in population forecast for Germany and the current trend toward urbanization,¹⁶ we can expect that real estate prices will continue to polarize. For example, the Federal Institute for Research on Building, Urban Affairs and Spatial Development (*Bundesinstitut für Bau-, Stadt- und Raumforschung*, BBSR) presumes that due to the demographic shift, the number of vacant apartments will continue to increase in the future: "Above all, in shrinking rural areas—and particularly for multi-story apartment buildings. According to calculations for the BBSR residential market forecast for 2030, 15 percent of rural districts can count on a very high risk of vacancies for rental apartments by 2030 and an addi-

¹⁴ The state of Saxony-Anhalt has experienced the highest decline in population since German reunification. According to information from the German Federal Statistical Office, the population plunged by almost 22 percent between 1991 and 2015. The Harz rural district's population declined by just under 23 percent.

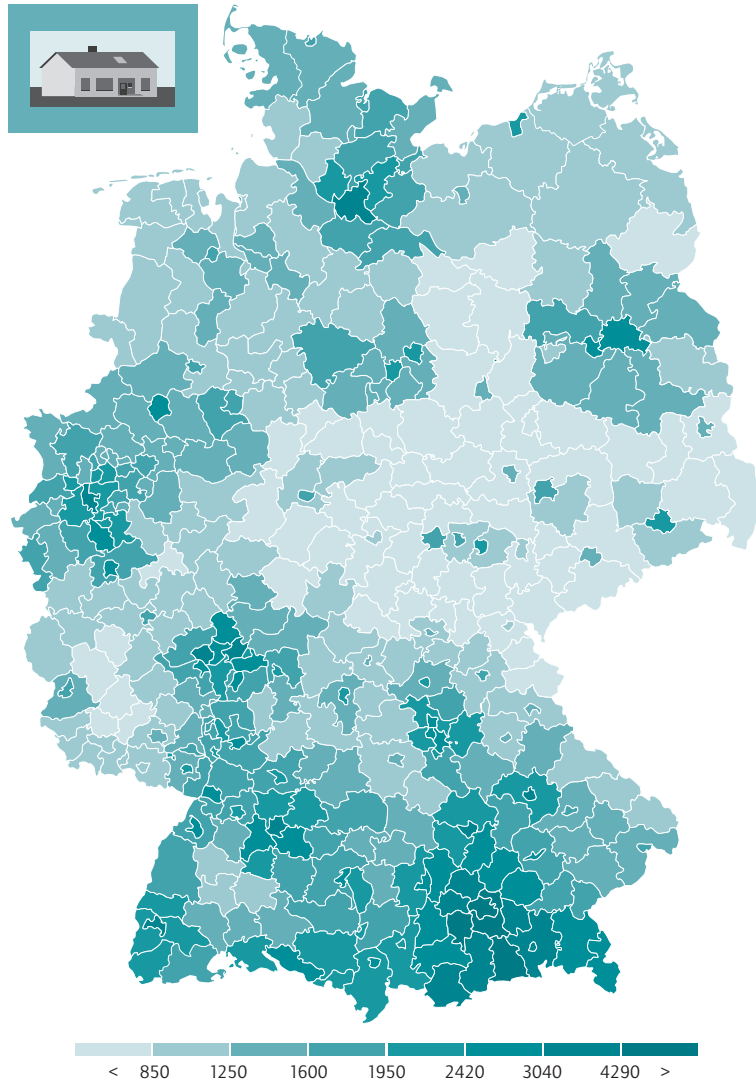
¹⁵ Alongside Bavaria, at just under nine percent the resident population of Baden-Württemberg has climbed most sharply since German reunification. In the Biberach rural district alone, growth between the end of 1990 and 2015 was almost 20 percent.

¹⁶ In the period 2004–2013, the domestic migration balance (inward movement minus outward movement across municipal borders within Germany) was consistently positive for the seven largest cities in Germany. This means that in those cities, the population grew as a result of migration. However, in 2014 this established trend not only came to a stop, but the corresponding migration balance was actually negative. See Konstantin A. Kholodilin, "Wanderungen in die Metropolen Deutschlands," *Der Landkreis* 87 1/2 (2017): 44–47.

Figure 1

Real Estate Prices in German rural and urban districts (2015)– Single- and Two-Family Homes

Median price per m² in Euro



Source: empirica-systeme market data.

© DIW Berlin 2017

tional 18 percent on a high risk of vacancies.”¹⁷ On the municipal level, this could lead to a drop in price of up to eight percent for single-family houses.¹⁸

¹⁷ Federal Institute for Research on Building, Urban Affairs and Spatial Development, “Wohnungsleerstände,” (Expert contribution, BBSR, Bonn, 2016). Available online.

¹⁸ See Oliver Lerbs and Markus Teske, “The House Price-Vacancy Curve,” ZEW Discussion Paper no. 16-082, 2016. (available online).

Population forecasts assume that in large parts of eastern Germany, the overall population will decline by 2030—in some regions at a rate in the two-digit range.¹⁹ In western Germany on the contrary, the population of most rural districts is expected to remain virtually constant. Using the information from the Bertelsmann Foundation projections on the population change in rural and urban districts up to 2030 and estimates of the change in real estate prices between 2012 and 2015 from the empirica-systeme market data, it is possible to estimate the development of real estate prices by district until 2030. As with all model calculations, our estimate is subject to uncertainty. However, according to our core specification, we find that real estate price polarization among regions in Germany will increase. The individual results presented vary depending on the model assumptions with regard to future growth of the job market or interest rate level, for example (see Box).

The results of the underlying regression model show the expected effect for all age groups considered, namely, that a change in population is positively correlated to the asking prices of real estate. The effect is strongest for the 45–64 age group. The additional explanatory variables, such as interest rate and regional unemployment rate, also show significant effects. As the regional unemployment rate increases, regional real estate prices fall.

The polarization of real estate prices across rural and urban districts can be described using an aggregate measure. In this report, we use a polarization index based on the work of Duclos, Esteban, and Ray.²⁰ The index increases when the tails of the real estate price distribution gain in importance and at the same time, the mean that dominates the distribution’s center decreases in importance. A significant increase in polarization is already apparent in the period used for the model calculation (see Table 2). Up to 2030, we can assume a significant rise in the polarization of real estate prices for both condominiums and single- and two-family homes.

In eastern Germany, projected real estate prices will develop more weakly than those in the western part of the country (see Figures 3 and 4). In some rural districts of Brandenburg, Saxony, Saxony-Anhalt, and Mecklenburg-Western Pomerania, prices for single- and two-family homes are likely to fall by over 25 percent. This will probably be the case in 100 of the 402 rural and urban

¹⁹ The BBSR also forecasts an overall decline in demand for living space in eastern Germany. See Federal Institute for Research on Building, Urban Affairs and Spatial Development, “Entwicklung der Bevölkerung und Haushalte 2015 bis 2030,” (Map, BBSR, Bonn, 2015). Available online. Of course a positive immigration balance could disrupt this trend.

²⁰ See Jean-Yves Duclos, Joan Esteban, and Debraj Ray, “Polarization: Concepts, Measurement, Estimation,” *Econometrica* 72(6) (2004): 1737–1772.

Table 2

Polarization indices of residential properties

	I	Condominiums	u	I	Single- and two-family homes	u
2012	0.155	0.163	0.170	0.166	0.174	0.181
2015	0.170	0.178	0.186	0.180	0.188	0.196
2030	0.224	0.234	0.244	0.216	0.227	0.238

Values for 2030 derived using forecasting model by Duclos, Esteban, and Ray (2003). I/u: lower and upper bound of a 95 % confidence interval.

Source: empirica-systeme market data and own projections of values of owner-occupied property until 2030, private households.

© DIW Berlin 2017

Polarization of asking prices of residential properties is expected to increase.

districts of Germany. In and around urban centers, however, the projection indicates that the rise in prices will continue. This is the result of rising living space demand on the one hand,²¹ and domestic migration to urban centers, which should lead to a population increase in these districts, on the other hand. We also project an increase in real estate prices of over 25 percent for single- and two-family homes in 32 rural and urban districts.

In the short and medium terms, the prices of condominiums react more strongly to changes in demand than the prices of single- and two-family homes.²² In 133 districts (33 percent), owners will face a price decline of over 25 percent. At the same time, a significant price increase will be more strongly concentrated in urban centers and less so in the suburbs, unlike the case of single- and two-family homes. For over 50 rural districts (14 percent) the price increase in this case is projected to be over 25 percent on average.

To illustrate this, we present the Harz and Biberach rural districts as examples again. For the Harz rural district, *Wegweiser Kommune* presumes a decline in population by 2030 of around 15 percent (34,000 persons) compared to 2012. According to the model calculation used here, the price per square meter of living space for single- and two-family homes in Harz should fall by around 275 euros per square meter (40 percent).

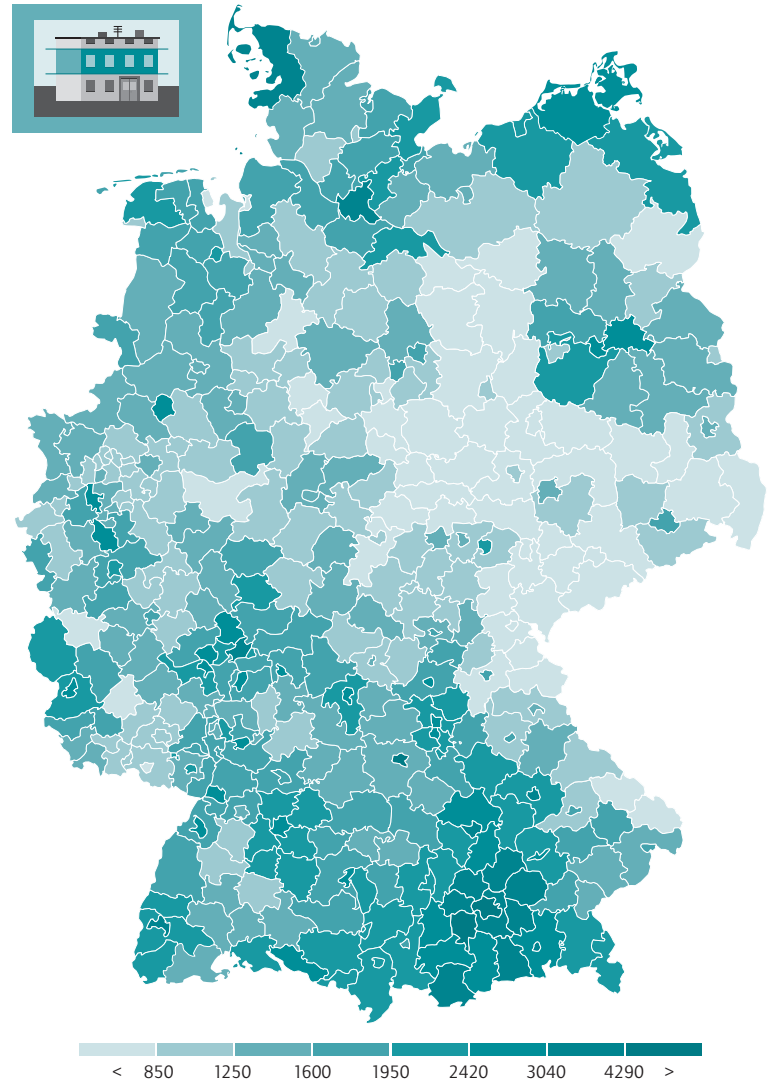
²¹ Federal Institute for Research on Building, Urban Affairs and Spatial Development, "Entwicklung der Wohnflächennachfrage insgesamt bis 2030," (Map, BBSR, Bonn, 2015). (available online).

²² This finding is confirmed by other studies, which also indicate that different segments of the real estate market could react differently to changes in demographics. See Norbert Hiller and Oliver W. Lerbs, "Aging and Urban House Prices," *ZEW Discussion Paper* no. 15-024 (2015). (available online).

Figure 2

Real Estate Prices in German rural and urban districts (2015)–Condominiums

Median price per m² in Euro



Source: empirica-systeme market data.

© DIW Berlin 2017

The situation is different in the Biberach rural district. There, the population is expected to grow by about two percent by 2030. The prices of single- and two-family homes are projected to rise by just under 150 euros per square meter of living space (almost ten percent).

Box

Data and methods

Our projection of real estate prices by rural districts and urban districts in Germany up to 2030 is primarily based on three data sources. They are: the Socio-Economic Panel (SOEP) data, representative of the population and current to 2015, real estate price information for 2012–2015 from the *empirica-systeme* market data,¹ which is divided into single- and two-family homes and condominiums, and information on future population growth from the Bertelsmann Foundation's *Wegweiser Kommune*.

Our information on population growth up to 2030 (differentiated among six age groups) in 295 rural districts and 105 urban districts is based on a population projection by Bertelsmann Foundation, which in turn bases its assumptions on the birth rates and life expectancies in the 12th population projection, coordinated by the German Federal Statistical Office (*Statistisches Bundesamt*) and the Federal State Statistical Offices (*Statistische Landesämter*).² Variant L1—a continued moderate rise in life expectancy and constant birth rate—underlies the data in our report. We assume a net migration rate to Germany of 400,000 persons in 2013 that will decline to 200,000 persons per year by 2020. The population extrapolation is based on the overall population as of December 12, 2012, which takes the results of the 2011 census into account.

We use a two-stage regression model for our estimates. First, a regression model describes the median price per square meter of living space for real estate—for single- and two-family homes and condominiums separately—depending on the existing population in six different age groups, the regional unemployment rate, the regional GDP, the average interest rate on mortgages, information on the stock and scope of new buildings, and region-specific fixed effects.

In most earlier studies, the effect of population aging was estimated separately from the effect of population growth. Studies influenced by Mankiw and Weil (1989) first estimate living space usage specific to age cohort and, based on the results, calculate aggregate living space demand—the latter's impact on real estate prices is estimated next. DiPasquale and Wheaton's approach (1992) has influenced researchers to derive the model's regressors from a stock-flow model. Typically,

the model takes variables into consideration that separate the effect of agglomeration (population density) from scarcity ratios (living space per resident) and from the effects of population composition (proportion of young vs. old residents) and control for unemployment and income growth. These models allow for analytical dissection of the demographic shift's effects on real estate prices.

The regression model used in our study is specified much more simply. It is related to the ad hoc model formulated by Maenning and Dust (2008), who used the logarithmized prices of average residential real estate in different regions in order to estimate the direct effect of population changes on real estate prices.³ Unlike Maenning and Dust (2008), we use logarithmized median asking prices in rural districts and urban districts as dependent variables. Also unlike Maenning and Dust (2008),⁴ we do not employ interaction effects to identify population shrinkage or population growth. Instead, our study only takes the number of residents within a rural district (divided into different age groups) into consideration. All other effects that are usually controlled for, such as level of agglomeration or scarcity on the housing market, are captured as region-specific fixed effects. In this specification, the influence of age cannot be clearly separated from the effect of population change or changes in agglomeration. However, because we are using this model for forecasting and not for analytical purposes, we accept this imprecision.

¹ (available online).

² The results of the projection calculations can be retrieved by municipality, gender, and age. (available online).

³ The special significance of demographic trends for real estate prices has been documented in a variety of studies. See for example, N. Gregory Mankiw and David N. Weil, "The baby boom, the baby bust, and the housing market," *Regional Science and Urban Economics* 19(2) (1989): 235–258; Előd Takáts, "Aging and House Prices," *Journal of Housing Economics* 21(2) (2012): 131–141; or Yumi Saita, Chihiro Shimizu and Tsutomu Watanabe, "Aging and real estate prices: evidence from Japanese and US regional data," *International Journal of Housing Markets and Analysis* 9(1) (2016): 66–87.

⁴ Wolfgang Maenning and Lisa Dust, "Shrinking and growing metropolitan areas asymmetric real estate price reactions? The case of German single-family houses," *Regional Science and Urban Economics* 38(1) (2008): 63–69.

One shortcoming is that due to data restrictions, the first-stage regression is based on the rather brief period from 2012 to 2015. A strong real estate market upswing occurred in that period. A priori, it is not clear whether this under- or overestimates the effects of population changes.⁵ In order to determine the average long-term effect, an observation period of between nine and 12 years would be required for Germany in order to cover an entire market cycle.⁶ Similar to Dust and Maenning (2008), since we do not explicitly differentiate between price reactions in already depopulating and currently growing regions, the prices simulated here are not precisely in focus for each different market. For this reason and also due to the imponderable nature of population projections, our simulation results should be understood as qualitative—that is, less than precise—estimates of the effects.

We use the estimated regression coefficients to project the price per square meter of real estate up to 2030. In the process, our main source of information is the development of the population structure for rural districts and urban districts based on information from the Bertelsmann Foundation's population projections.⁷ We hold the region-specific unemployment rate constant and after 2016, the growth of region-specific GDP is also assumed to be constant at two percent. We also presume that the interest rate on mortgages will rise slightly and new construction activity would react with a bit of delay to the changes in population after 2016. The regression models do not explicitly include aspects such as changes in household size, home ownership rates, and changes in the investment of private wealth due to

sinking real estate prices. And with the variables at our disposal, we are not able to distinguish between a change in living space demand caused by aging and a purely demographic aging effect.

These estimates also contain further restrictions that must be considered when interpreting the results. Since real estate prices were only available for single- and two-family homes and condominiums, we are not able to make statements regarding the overall real estate market, which also encompasses rented multi-family buildings as investment properties and other buildings, such as undeveloped property or commercial real estate. And the information from the empirica-systeme market data reflects asking prices, not actual selling prices.⁸ This should have only a slight influence on the estimate results because the asking price trend in the period 2012–2015 probably paralleled that of market prices.

The projections are subject to uncertainty as they rest on normative assumptions. For example, higher or lower immigration would result in rising or falling demand, generating higher or lower market prices in turn. We did not make any explicit assumptions about changes in demand for living space. Instead, we included this aspect indirectly via the change in age structure. Here it is noteworthy that as the population ages, demand for rental property instead of ownership can rise. In this case, the model calculations in this report would be underestimates. The scenario we use assumes average new construction activity and an average interest rate of 2.5 percent.

⁵ In order to improve the validity of the estimate, a longer period would be helpful—in particular, for taking housing price cycles more fully into consideration. However, data for a longer period were not available. The period we selected does have advantages, including the fact that exogenous effects—such as the short-term effects of the financial crisis in 2008–2009 on real estate prices—were unable to influence the estimates. Earlier studies such as that of Maenning and Dust (2008) used only cross-sectional data, which would overestimate negative effects of a projection in the case of population shrinkage (see Just, *Demografie und Immobilien*).

⁶ Philippe Bracke, "How long do housing cycles last? A duration analysis for 19 OECD countries," *Journal of Housing Economics* 22(3) (2013): 213–230.

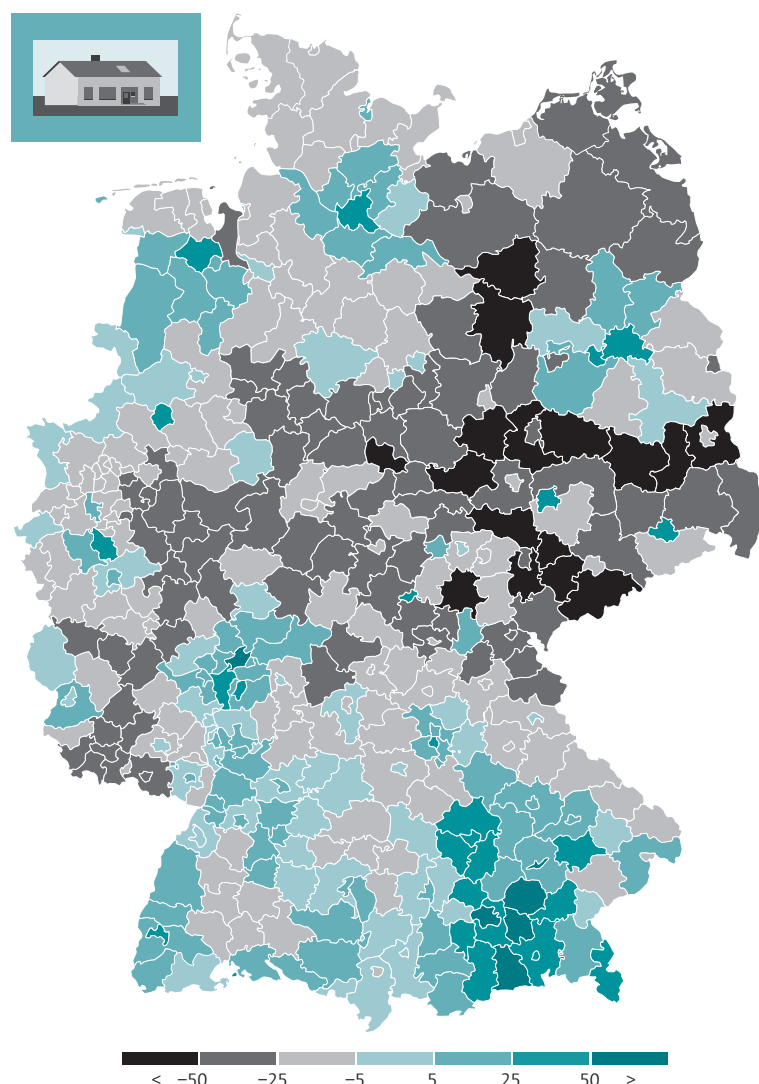
⁷ The model calculation for condominiums may provide an exaggerated picture here. Condominiums were somewhat overvalued during the observation period, while single-family homes did not deviate from their fundamental value with any statistical significance (see Florian Kajuth, Thomas A. Knetsch, and Nicolas Pinkwart, "Assessing house prices in Germany: evidence from an estimated stock-flow model using regional data," *Deutsche Bundesbank Discussion Paper* no. 46/2013 (2013). (available online).

⁸ A comparison of the asking and actual selling prices for selected German states indicates that asking prices were overestimated by around seven to eight percent on average. See Bernhard Faller, et al., "Möglichkeiten zur Bildung eines Regionalindex Wohnkosten unter Verwendung von Angebotsdaten," *RatSWD Research Note* 34 (2009). Available online. (Accessed: May 31, 2017) and Ralph Henger and Michael Voigtländer, "Transaktions- und Angebotsdaten von Wohnimmobilien—eine Analyse für Hamburg," *IW Trends* 4 (2014): 85–100. (available online).

Figure 3

Real estate development in Germany—Single- and Two-Family Homes

Price changes in percent, 2015–2030



Source: empirica-systeme market data and own projections of values of owner-occupied property until 2030, private households.

© DIW Berlin 2017

Impact on the distribution of wealth

We combined the price developments projected until 2030 with housing data from the SOEP²³ in order to

²³ SOEP is a recurring annual representative survey of private households. It began in West Germany in 1984 and expanded its scope to include the new federal states in 1990, see Gert G. Wagner et al., "Das Sozio-oekonomische Panel (SOEP): Multidisziplinäres Haushaltspanel und Kohortenstudie für Deutschland—Eine Einführung (für neue Datennutzer) mit einem Ausblick (für erfahrene Anwender)," *ASTA Wirtschafts- und Sozialstatistisches Archiv* 2 no. 4 (2008): 301–328.

Table 3

Mean value and distribution of owner-occupied properties

	Owner-occupied property		For informational purposes: household net worth
	Mean in Euro	Gini coefficient	Gini coefficient
2012	214,076	0.36	0.74
2015	244,706	0.37	0.74
2020	246,186	0.39	0.74
2025	247,899	0.42	0.75
2030	243,968	0.44	0.76

Source: SOEPv32 and own projections of the values of owner-occupied properties until 2030, private households.

© DIW Berlin 2017

Inequality of the distribution of owner-occupied property will increase until 2030.

gauge the expected average value of owner-occupied real estate and make meaningful statements about the distribution of wealth. The average gross value of owner-occupied real estate—without deducting any liabilities—was around 215,000 euros in 2012, according to the SOEP data (see Table 3). We were able to track the rise in real estate prices currently observable in Germany for the period 2012–2015. According to the SOEP data and considering the price trend from the empirica-systeme market data, there was an increase in gross value of 14 percent to an average value of 245,000 euros. Based on the model calculation, all things being equal the average value of owner-occupied real estate will not change by 2030.²⁴ This is an aggregate result of different regional trends: the weak price development in shrinking regions will balance out price increases in urban centers. This is also reflected in the inequality of the value of owner-occupied real estate. Whereas the Gini index²⁵ for this type of wealth was 0.36 in 2012, based on the model calculation and again all other things being equal, it will rise to 0.44 by 2030.

Holding all other components of wealth constant and observing the stand-alone effect of real estate prices for owner-occupied real estate on the inequality of net household wealth, we find that inequality of wealth would

²⁴ However, it must be taken into consideration that we estimated the impact of the demographic shift alone on the prices of owner-occupied real estate here. We did not include other possible effects caused by a change in wealth portfolio.

²⁵ Also see the term *Gini-Koeffizient* in the DIW Berlin glossary (available online in German only).

increase by at least two percent by 2030 as compared to 2012 (0.74 to 0.76).

Conclusion

Owner-occupied real estate is the quantitatively most important component of wealth in Germany. The model calculation presented here indicates increasing polarization of the prices of owner-occupied real estate in Germany by 2030. However, this also means that in a significant number of rural districts, investing in real estate should be less appealing from the economic viewpoint due to falling prices. Moreover, with increasing polarization of real estate prices wealth inequality is bound to increase as well.

Christian Westermeier is Doctoral Student in the Research Infrastructure Socio-Economic Panel (SOEP) at DIW Berlin | cwestermeier@diw.de

Markus M. Grabka is a Research Associate in the Research Infrastructure Socio-Economic Panel (SOEP) at DIW Berlin | mgrabka@diw.de

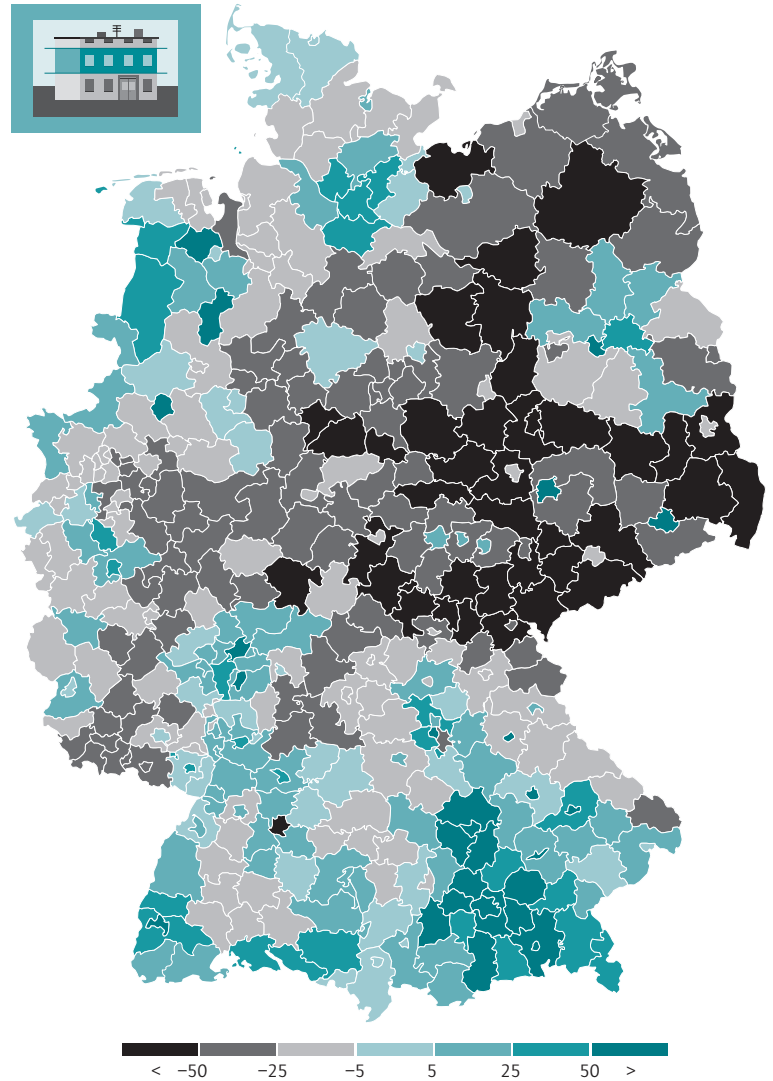
JEL: G12, J11, D31

Keywords: Demographic change, property prices, projection, SOEP, Empirica-Systeme Marktdaten

Figure 4

Real estate development in Germany—Condominiums

Price changes in percent, 2015–2030



Source: empirica-systeme market data and own projections of values of owner-occupied property until 2030, private households.



Dr. Markus M. Grabka, Research Associate
in the Socio-Economic Panel (SOEP)
research infrastructure at DIW Berlin

SEVEN QUESTIONS FOR MARKUS M. GRABKA

»Depopulation to affect regional real estate prices«

1. Mr. Grabka, you have studied the effects of the demographic shift on residential real estate prices in Germany. What does population growth in the coming decades look like? We based our work on the population forecast coordinated by the German Federal Statistical Office (Statistisches Bundesamt), which currently extends to 2060. According to that projection, the population of Germany will shrink by between eight and 13 million persons by then, depending on the level of migration to the country.
2. Your study's goal is to generate a model-based projection of residential real estate prices dependent upon the demographic trend until 2030. What exactly does this involve? Residential real estate prices are influenced by both supply- and demand-side determinants. In the case of demand-side determinants, changes in overall population as well as changes in population structure should have an effect on residential real estate prices. This means the level of depopulation we expect Germany to experience in the coming decades should have an effect on residential real estate prices by region.
3. Are you saying that supply will remain the same, demand will drop, and the price of residential real estate will fall as well? That is a simplified yet accurate explanation. The supply side of the residential real estate market changes very slowly. The real estate market is special because its "goods" cannot react quickly to market trends. The advance-planning phase for new buildings is rather long. Accordingly, the market reacts to strong demand-side determinants such as depopulation quickly and decisively in comparison.
4. So will residential real estate prices in Germany plummet in the future? According to our calculations, prices will develop very different regional patterns. We presume that in Germany's rural regions aging and depopulation will have a significant impact. In regions such as Saxony-Anhalt, for example, residential real estate prices will plummet in affected rural districts. At the same time, residential real estate prices in regions with population growth—in Germany, mainly large cities—will probably rise slightly.
5. Is there a general difference between eastern and western Germany in this regard or only between rural and urban regions? The relevant differences are no longer between eastern and western Germany. Instead, they are between regions that show population growth and those in which are trending toward depopulation, depending on the rural district in question and its population structure.
6. Which type of residential real estate will be most affected by a decline in price, single- and two-family homes or condominiums? Our simulation supports the findings described in the literature, which indicate that the price of condominiums reacts more strongly to demographic change than the price of single- and two-family homes. This is primarily because most condominiums are located in urban centers and the demographic shift exercises a stronger effect there than in rural areas.
7. What does a shift in residential real estate prices mean for the distribution of wealth in Germany? Owner-occupied real estate is still the most important component of wealth in Germany. Due to the increasing polarization of residential real estate prices, the inequality associated with this component of wealth will increase. Overall and for purely demographic reasons, this will probably lead to a slight increase in inequality in wealth in Germany until 2030.

Interview by Erich Wittenberg

No Germany-wide housing bubble but overvaluation in regional markets and segments

By Konstantin Kholodilin and Claus Michelsen

Although the housing prices in the 127 largest German cities have surged strongly in recent years, there is still no sign of a Germany-wide housing bubble. In comparison with 2009, the price of condominiums has risen by around 55 percent. Single-family houses cost between 38 and 45 percent more in 2016 than seven years prior, and building lot prices have risen by around 63 percent. The study at hand shows that concerns about a national housing bubble are largely unfounded. There may, however, be bubbles on the local level—primarily in the relatively small segment of new multi-story apartment buildings but also with regard to the valuation of undeveloped residential land. Given the situation, it seems appropriate that financial regulators have opened up more policy options in order to intervene when the market trend proves unsustainable. But because the measures were diluted in the federal legislative process, the need for policy-related action remains.

The strong upsurge in the price of residential real estate in Germany shows no sign of stopping. Since 2010, the price of condominiums in large cities has risen by around 55 percent—an unparalleled development in recent German history. The prices of single- and terraced homes and of undeveloped residential land have also risen sharply (see Figure 1). The European Central Bank's low interest-rate policy is a key driver. On the one hand, it relaxes the conditions for financing real estate investment—right now interest rates on residential construction loans are at an historic low. On the other hand, it reduces the yield of alternative investments. And the trend of moving to Germany's cities that started at the beginning of the 2000s is ongoing. In many cities, construction activity is not able to satisfy the increase in demand.¹ This is reflected in sharply rising housing rents, whose momentum has not been significantly reduced by regulatory intervention, such as the rental price brake.²

Thus, there is abundant evidence that the development of housing prices is justified by the fundamental factors. From the mid-1990s until 2010, real estate prices in Germany stagnated, and as measured by the general inflation rate the price of living space actually fell. At least in part, today's price increases are catch-up effects. The expectation that in the future the population will fall even more dramatically in rural areas and rise in urban regions could also be an explanatory factor in the current price trend.³

¹ See Philipp Deschermeier, et al., "Zuwanderung, Wohnungsnachfrage und Baubedarfe. Aktualisierte Ergebnisse des IW Wohnungsbedarfsmodells," *IW Report* 18/2016 (PDF, Cologne Institute for Economic Research, Cologne, 2016). (available online; retrieved June 7, 2017. This applies to all other online sources cited in this report unless otherwise noted).

² See Konstantin Kholodilin, Andreas Mense, and Claus Michelsen, "Die Mietpreisbremse wirkt bisher nicht," *DIW Wochenbericht* no. 22 (2016): 491–499. (available online).

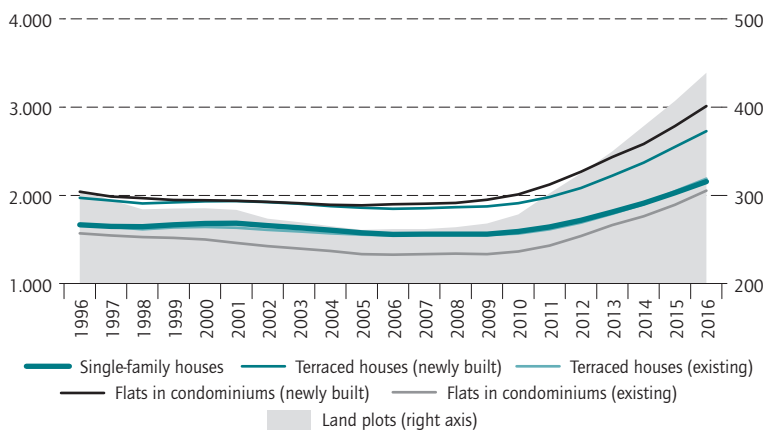
³ For example, rough estimates indicate that prices in rural regions will dramatically fall while they show significant potential to rise in urban centers. See Markus Grabka and Christian Westermeier, "Real estate price polarization projected to increase until 2030 in Germany," *DIW Economic Bulletin* no. 25–26 (2016).

Figure 1

Real estate prices and rents in Germany

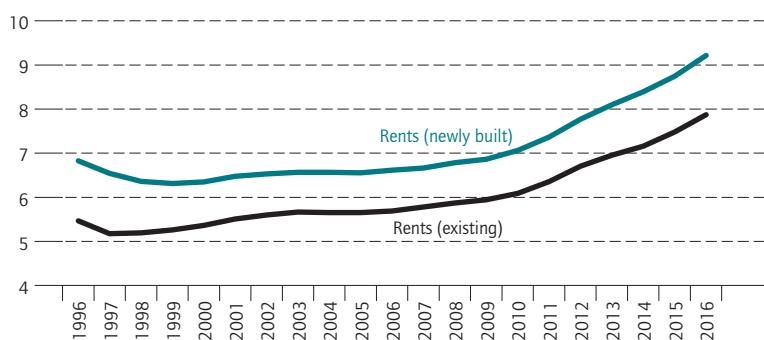
Prices by market segments in all 127 cities

Euros per square meter of living or ground space in current prices



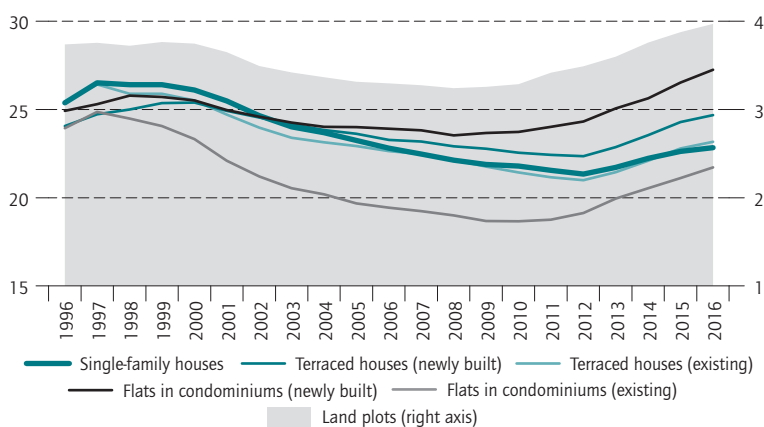
Rents by market segments in all 127 cities

Euros per square meter of living space in current prices



Price-to-rent ratios by market segments in all 127 cities

Purchasing price per square meter/Annual rent per square meter



Source: Bulwiengesa; own calculations.

In spite of this, there is some concern that a speculation-driven housing bubble could arise in Germany.⁴ As the USA, Spain, and Ireland have experienced, housing bubbles engender risks for the stability of the economic and financial system. Germany's central bank, whose analyses indicate massive overvaluation of residential real estate in many regions of the country, sends out warnings at regular intervals. The International Monetary Fund has also been demanding that Germany develop instruments to enable effective intervention by banking authorities in cases of aggregate risk due to housing bubbles. The German Bundestag adopted a law to this effect in March 2017, but the set of instruments was significantly diluted in the federal legislative process.⁵

It is difficult to identify cases of price overvaluation with accuracy. Descriptive analyses alone can lead to an incorrect impression. Examining national price indices is an ineffective means of early detection of housing bubbles.⁶ Since 2014, DIW Berlin has analyzed price trends in Germany's 127 largest cities and used an elaborate statistical procedure to determine the existence of price bubbles.⁷

The approach used by DIW Berlin is the only one based on regional price indices. It has the advantage of detecting speculative overvaluations in real time. Other procedures that attempt to explain price trends using fundamental factors can be applied on the regional level only with a significant delay due to the data availability. The present study updates the results of previous studies and supplements them with observations from additional market segments. The latter are based on a data set from Bulwiengesa AG containing housing

⁴ International Monetary Fund, Article IV consultation, Staff Report for the 2016 Article IV Consultation. 2016.

⁵ Isabel Schnabel, "Schutz vor Immobilienblasen: Genug der Zugeständnisse!" Guest article, *Handelsblatt*, March 20. 2017.

⁶ The number of studies concerning the possible speculative housing price bubble formation in Germany is still limited. The results of existing studies are controversial and do not provide a conclusive picture. Xi Chen and Michael Funke examined aggregated series a few years ago and concluded that there is no housing bubble in Germany; see Xi Chen and Michael Funke, "Renewed Momentum in the German Housing Market: Boom or Bubble?" *CESifo Working Paper* no. 4287 (2013). Two other researchers applied the same methodology to the seven largest cities in Germany; see Philipp an de Meulen and Martin Micheli, "Droht eine Immobilienpreisblase in Deutschland?" *Wirtschaftsdienst* 93(8) (2013): 539-544. They found that speculative motives contributed to the real estate price increases to a very limited extent. In Florian Kajuth, Thomas A. Knetsch, and Nicolas Pinkwart, "Assessing house prices in Germany: evidence from an estimated stock-flow model using regional data," *Deutsche Bundesbank Discussion Paper* no. 46/2013 (2013), the authors concluded that some prices were significantly higher than the fundamentally justified level by up to 25 percent.

⁷ See Konstantin Kholodilin and Claus Michelsen, "Weiter steigende Immobilienpreise, aber keine flächendeckenden Spekulationsblasen," *DIW Wochenbericht* no. 49 (2015): 1164-1173. (available online)

Since 2010, the housing prices and rents increased substantially.

rents and selling prices (see Box 1). Using the statistical tests that identify explosive price developments, it is possible to detect bubbles in regional real estate markets (see Box 2).⁸

High volume of loans for real estate

Price series are not the only variable where aberrations relevant to the economy as a whole (bubbles) can show up. Housing affordability as measured by the relationship between housing prices and disposable income is another indicator. In the long run, housing prices should develop in harmony with disposable income. Although real estate prices have recently risen much faster than income, the relationship between selling prices and income has historically been and continues to be harmonious in Germany. A comparison with other countries indicates that fluctuations are not unusual (see Figure 2).

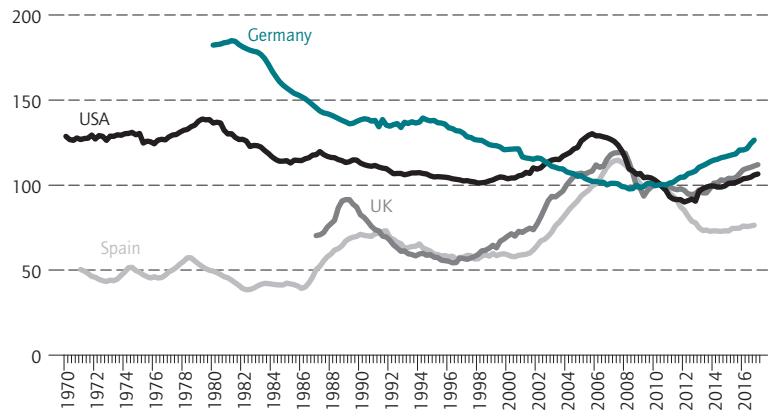
Another frequently mentioned indication of speculative bubbles is a jump in the volume of new housing loans. This does not apply to Germany at present: loan volume surged upward in Germany in 2015 but has recently stabilized at a constant level (see Figure 3). This is typically explained by the European Banking Authority's *Guidelines on Sound Remuneration Policies and Disclosures*, that reportedly led to limitation of lending for specific types of households. However, the recent *Bank Lending Survey* of commercial banks did not indicate any long-term tightening of lending standards. The ratio of new housing loans to GDP is stable. The volume of loans with interest rates fixed for over five years continues to expand—partially due to an increase in loans with long-term fixed interest rates of over ten years (see Figure 4).

In view of these indicators, the overall risk of a speculative bubble occurring in the national German housing market appears low. Long-term fixed interest rates and the relatively stable volume of new loans support the assumption that most residential construction projects rest on a solid financial foundation. The excessive credit-driven investment activity in other countries such as the USA led to financial market distortions and when the property bubble burst, to the massive debt overload of many households. Currently, a scenario like this is unrealistic for Germany.

Figure 2

Housing price-to-income ratio

Index: 2010 = 100



Source: OECD.

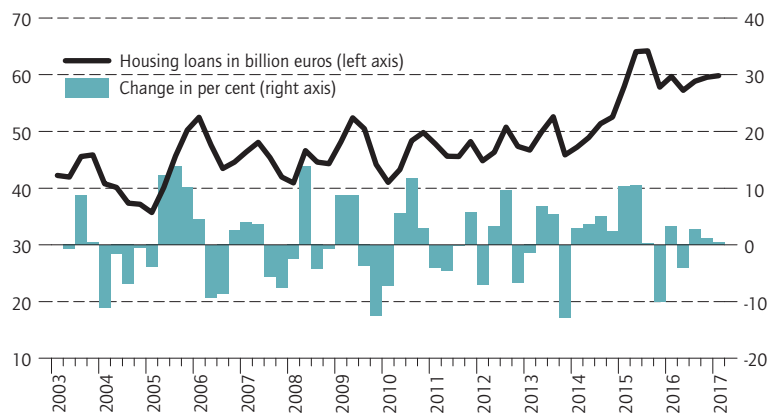
© DIW Berlin 2017

During many years, the house prices had been growing much more slowly than the income

Figure 3

Housing loans for private households

Billion euros; change in per cent



Source: Deutsche Bundesbank.

© DIW Berlin 2017

The provision of housing loans to private households remains stable.

Regional real estate market development is relevant

Studying individual indicators and the aggregated national market is only the first step in analyzing price developments in the market for residential real estate. Housing markets are first and foremost regional markets. Accordingly, speculative overvaluations arise in individ-

⁸ For detailed explanations see Konstantin Kholodilin, Claus Michelsen, and Dirk Ulbricht, "Speculative Price Bubbles in Urban Housing Markets in Germany," *DIW Discussion Papers* 1417 (2014) (available online) and Ulrich Homm and Jörg Breitung, "Testing for speculative bubbles in stock markets: a comparison 605 of alternative methods," *Journal of Financial Econometrics* 10(1) (2012): 198-231.

Box 1

Regional real estate prices

The data on price trends for real estate in Germany are meager in comparison to other countries. On the local level in particular, there are hardly any sources that allow for analysis over longer periods of time. German time series are typically very short, cover only a few locations, or only contain asking prices.

For the present study, we used rental and selling price data from Bulwiengesa AG, a consulting company that has generated data and indices on individual real estate market segments for over 30 years. The German central bank, for example, uses them to track trends in the real estate market. And the Organization for Economic Co-operation and Development (OECD) employs them as the basis for the Germany-wide housing price index embedded in its international database. The data encompass the average selling prices and rents for apartments in 127 large German cities between 1990 and 2016. It is a unique source of information with regard to geographical and temporal coverage of the market.¹

In the present study, we included eight variables:

- average selling price for lots for multiple-family homes in the mid-price range
- average selling price for condominiums upon initial occupancy (new buildings)
- average selling price for condominiums upon resale (existing buildings)
- average selling price for townhouses upon initial occupancy (new buildings)

- average selling price for townhouses upon resale (existing buildings)

- average selling price for single-family homes (existing buildings)

- average rent for apartments upon initial occupancy (new buildings)

- average rent for apartments upon re-rental (existing buildings)

We also used the above variables to calculate the ratio of selling prices to annual rents for new and existing buildings. To calculate the price-to-rent ratio for lots, we used the annual rent for apartments in new buildings. And to find the ratio for single-family homes, we used the annual rent for apartments in existing buildings.

Bulwiengesa AG also classified the cities into four groups based on their importance, population, and liquidity in the urban real estate market. The classification system has become an industry standard. A-cities are the most important markets. There are seven of them: Berlin, Hamburg, Munich, Cologne, Düsseldorf, Frankfurt am Main, and Stuttgart. A-cities are internationally and/or nationally important and overall, feature excellent real estate market conditions. The annual turnover in these cities is over 2.5 percent of the national market. Fourteen cities are classified as B-cities. They are nationally and/or regionally important and have an annual turnover volume of over 1.5 percent of the market. The majority of the 22 C-cities are regional centers, but most cities (84) are classified as local centers: D-cities. Turnovers in these two city types are significantly lower than in the A- and B-cities. In the present study, we used this classification to look at individual cities in addition to conducting a differentiated analysis of the activity in the real estate market.

¹ For a detailed description of the data, see Bulwiengesa, "Immobilienmarktdaten für Deutschland und ausgewählte Staaten in Europa." (available online in English).

ual cities before spreading to the national market.⁹ This is why the present study employs a differentiated approach that distinguishes between new construction and hous-

ing stock prices, looks at building plot prices separately, and takes cities, groups of cities, and the overall market into account (see Box 1). No other study used such a differentiated perspective before.

⁹ See Allen C. Goodman and Thomas G. Thibodeau, "Where are the speculative bubbles in US housing markets?" *Journal of Housing Economics* 17(2) (2008): 117-137; Min Hwang and John M. Quigley, "Economic Fundamentals in Local Housing Markets: Evidence From U.S. Metropolitan Regions," *Journal of Regional Science* 46(3) (2006): 425-453 and Jesse M. Abraham and Patric H. Hendershott, "Bubbles in metropolitan housing market," *Journal of Housing Research* 7(2) (1996): 191-207.

The approach we used was to test statistically whether or not real estate prices are growing explosively (for methodological details see Box 2). In the long run, the housing prices depend on the evolution of the rental yields and, therefore, on the overall income dynamics, the explo-

Box 2

Identifying spikes

Our analysis of property prices rests on two assumptions: prices are exclusively determined by the present value of future income, and market participants are fully informed and rational. Because these prices directly reflect all known information, they follow the random walk pattern. Applied to the real estate market, this means that housing prices are coupled to rent trends in the long run. If prices are not a perfect map of rental yield, additional factors such as real estate speculation obviously play a role. Speculation leads to expected future increases in real estate prices co-determining price trends alongside the expected trend of real demand. If this estimate becomes the consensus among market participants, the purchase of overvalued real estate is a rational individual choice leading to a speculation bubble and prices that increasingly decouple from demand.

There are a number of approaches to empirically detect speculative bubbles in the real estate market.¹ Part of the relevant literature is explicitly based on the theoretical considerations described above. The Himm and Breitung test was developed to identify explosive behavior of price.² If housing prices are discounted flows of expected rental revenues, it is extremely unlikely that they will grow at an exponential rate. Following this approach, it is possible to test whether or not a time series is following a random walk (null hypothesis) or exploding. The first option reflects the hypothesis of rational expectations and therefore, the fundamental long-run components of the prices.

The test assumes that the time series under examination is an autoregressive process AR(1):

$$y_t = \rho_t y_{t-1} + u_t$$

¹ See Man Cho, "House price dynamics: A survey of theoretical and empirical issues," *Journal of Housing Research* 7 (1996): 145–172.

² See Ulrich Himm and Jörg Breitung, "Testing for speculative bubbles in stock markets: A comparison of alternative methods," *Journal of Financial Econometrics* 10(1) (2012): 198–231.

in which coefficient ρ_t varies over time and ρ_t is a typical error term.

Under the null hypothesis, y_t follows a random walk in all periods:

$$H_0: \rho_t = 1 \text{ for } t = 1, 2, \dots, T$$

Under the alternative hypothesis, the process starts as a random walk but at a certain point in time t^* transforms into an explosive process (spikes).

$$\rho_t = \begin{cases} 1, & \text{if } t = 1, 2, \dots, t^*, \\ \rho^* > 1 & \text{if } t = t^* + 1, \dots, T \end{cases}$$

To test the hypotheses, we used a Chow-type unit-root structural break test. We looked for the point in time t^* at which the process became explosive. With this approach, we were able to test whether speculative price trends are present on the city level and for groups of cities.

We followed two additional test strategies. First, we analyzed whether there were explosive trends for rents, prices, and the price-to-rent ratio on the individual city level. The second strategy consisted of extracting the most important common price trend and testing it for explosive behavior instead of examining each individual city separately. The common trend represents a weighted average of the price time series in the individual cities, whose weights were determined by performing a principal component analysis. There are two arguments in favor of this approach. First, price trends in individual cities are heterogeneous and the fluctuations compensate for each other when the overall trend is calculated. Second, an overall trend can be calculated for any set of cities, enabling an examination of the extent to which a property bubble already exists in a given market. We calculated the principal components for four city classes and Germany as a whole.

sive housing price increases point out to a decoupling of the actual prices from those determined by the real demand for housing.

However, demand can fluctuate sharply, for example, as a consequence of intensified immigration. Real estate supply is rigid in the short run, so rents rise sharply. To account for developments like these, the analysis included both real estate prices and rents. If the patterns of rental and selling prices are similar, real estate valu-

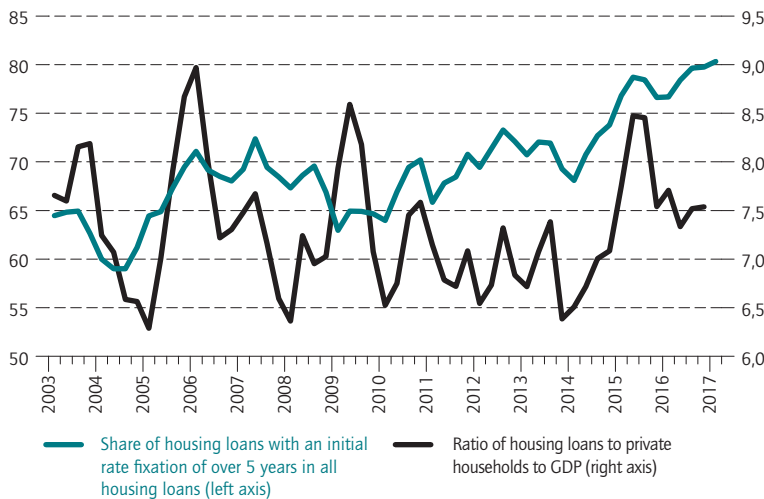
ation is in line with the market. If only prices are explosive, a bubble is likely to be building up. If only rents are explosive, potential investment opportunities are available at the location in question. We also tested price-to-rent ratio for explosiveness, being a standard overvaluation measure.

To account for the spatial dimension of the real estate market, we used a multi-step approach to assessing price development. In the first step, we explored a set of Ger-

Figure 4

Ratio of housing loans to private households to GDP

Per cent



Source: Deutsche Bundesbank.

© DIW Berlin 2017

The financing of private housing resides on solid basis.

many-wide price series from 1996 through 2016. Next, we analyzed price developments in locations classified as A, B, C, or D. This classification was developed by Bulwiengesa AG and is based on the figures on population and turnover of the real estate transactions. “A-cities” are internationally important locations, whereas “D-cities” are centers of local importance. Finally, we tracked price development in the individual cities to identify local bubbles. In the process, we differentiated between the existing and newly built stock of condominium dwellings and single-family houses as well value of residential lots.

Price increases in all segments remain strong

In Germany’s major cities, the price of residential real estate and undeveloped residential land continues to surge upward. In comparison to base year 2009, the price of undeveloped residential land in the 127 largest cities in Germany was around 63 percent higher and condominiums around 54 percent more expensive in both the existing stock and new building segments. For terraced houses—both new and existing—buyers must now pay 40 percent more than seven years prior. During the same period, single-family homes became around 38 percent more expensive (see Figure 1). In comparison, rents for new apartments rose by around 34 percent and for exist-

ing ones by around 32 percent—an expression of the rising demand for living space in large cities.¹⁰

The strongest driver is the market trend in A-cities. In these locations the price for undeveloped residential land has more than doubled since 2009; the price of new condominiums has risen by around 68 percent and existing ones by 78 percent; and price increases for homes were well over 50 percent. Rents, on the contrary, have only risen by one-third for the existing and by 38 percent for the newly built dwellings.

The weakest price increases were in D-cities. Residential lots in these locations rose by 40 percent; the price for condominiums of both types rose by around 50 percent; and single-family homes and terraced houses became 35–40 percent more expensive. The trends in B- and C-cities were within the range defined by the price trends in A- and D-cities (see Figure 5 and Table 1).

Bubbles likely in isolated market segments

The statistical tests showed that prices in almost all market segments display a temporary explosive behavior, but in almost all cases this trend is accompanied by corresponding rent increases. This indicates that the valuation is justified by the fundamental factors. However, the price-to-rent ratio in A-cities appears to indicate bubble formation for condominiums—in both the new building and existing building segments—and for residential lots. Prices in these two segments have risen significantly higher than rents, such that the ratio of the two variables shows an unusual pattern in these cases (see Table 2).

The trends in B- and C-cities are sound at present. Only existing apartments and the prices of existing terraced houses suggest possible overvaluation in D-cities, where skyrocketing selling prices out of line with the development of rents can be observed. However, judging by the price-to-rent ratio, this is not cause for alarm.

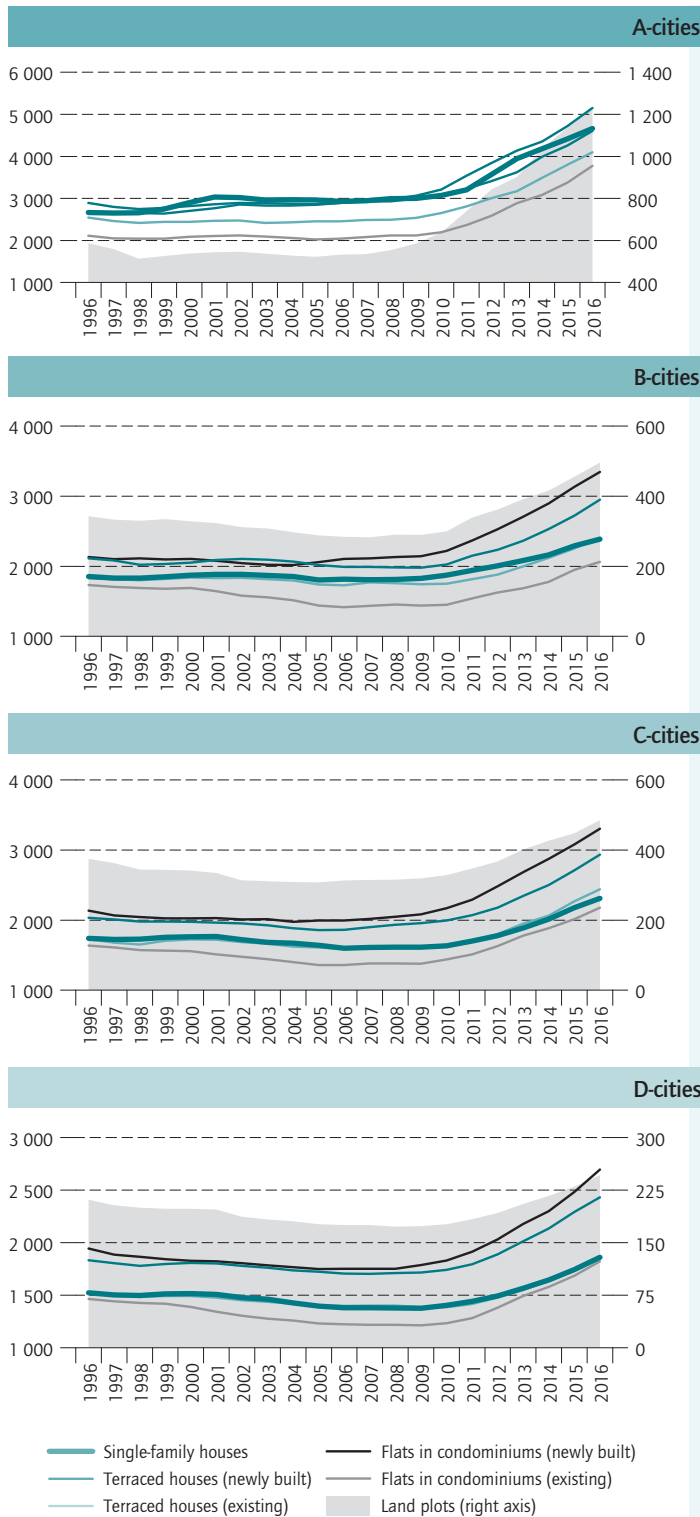
Throughout Germany, bubbles may be building up in the markets for new condominiums and single-family homes as prices further decouple from rents. The segment of newly built dwellings in apartment buildings

¹⁰ Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR), “Renaissance der Großstädte—eine Zwischenbilanz,” BBSR-Berichte KOMPAKT 9/2011 (2011). Also see Kurt Geppert and Martin Gornig, “Die Renaissance der großen Städte—und die Chancen Berlins,” *DIW Wochenbericht* no. 26 (2003): 411–418 (available online); Kurt Geppert and Martin Gornig, “Mehr Jobs, mehr Menschen: Die Anziehungskraft der großen Städte wächst,” *DIW Wochenbericht* no. 19 (2010): 2–10 (available online) and Konstantin Kholodilin, “Wanderungen in die Metropolen Deutschlands,” *Der Landkreis* 1/2 (2017): 44–47.

Figure 5

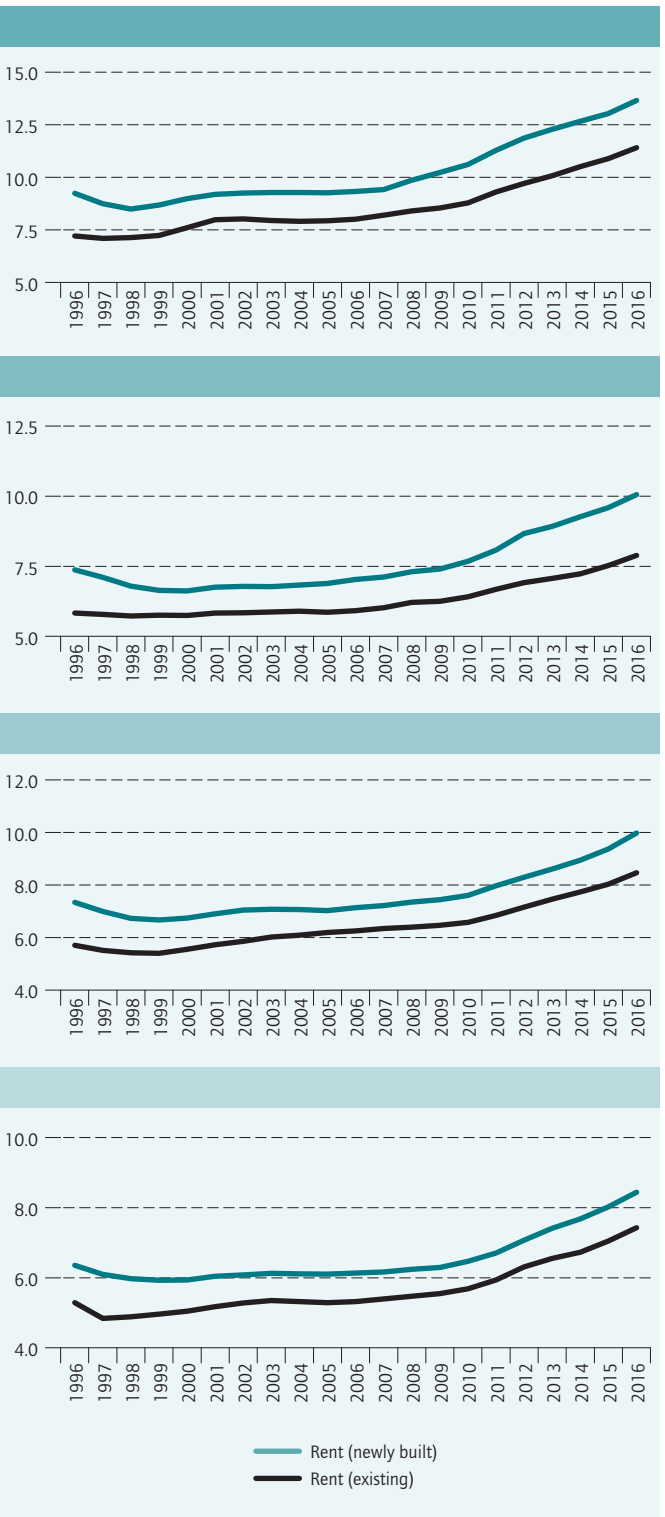
Prices by market segments in all 127 cities

Euros per square meter of living or ground space in current prices



Rents by market segments in all 127 cities

Euros per square meter of living or ground space in current prices



Source: Bulwiengesa; own calculations.

Especially in A-cities, the prices and rents substantially increased.

Table 1

Evolution of housing prices and rents by types of cities, 2009–2016

Change with respect to 2009, per cent

	Germany	A-cities	B-cities	C-cities	D-cities
Land plots	64	110	71	52	42
Single-family houses	38	55	31	43	35
Terraced houses (newly built)	45	54	49	50	42
Terraced houses (existing)	41	62	38	51	35
Flats in condominiums (newly built)	54	68	56	59	51
Flats in condominiums (existing)	54	78	44	58	50
Rents (newly built)	34	33	36	34	34
Rents (existing)	32	33	26	31	34

Source: Bulwiengesa; own calculations.

© DIW Berlin 2017

represents only a small share of the overall market: new apartments built since 2010 make up around 1.4 percent of the housing stock in Germany. Single-family homes, on the contrary, are a significantly higher proportion, but not in the large cities included in our study where apartment buildings dominate.

Observations of individual local markets showed price trends in many cities that were not accompanied by parallel trends for rents. When using the price-to-rent ratio measure, the speculative bubbles in at least one market segment are detected in 20 of the 127 large cities in Germany (see Map 1 and Table 3). The values of new condominiums and undeveloped residential land in particular form a critical pattern. A-cities are affected rather frequently, but the trend in other city categories is less striking.

Table 2

Assessment of the market dynamics by segments and types of cities

	Price-to-rent ratios	Prices and rents tested separately
A-cities		
Flats in condominiums (existing)	possible speculative bubble	no signs of speculative bubble
Flats in condominiums (newly built)	possible speculative bubble	no signs of speculative bubble
Single-family houses	no signs of speculative bubble	no signs of speculative bubble
Land plots	possible speculative bubble	no signs of speculative bubble
Terraced houses (existing)	no signs of speculative bubble	no signs of speculative bubble
Terraced houses (newly built)	no signs of speculative bubble	no signs of speculative bubble
B-cities		
Flats in condominiums (existing)	no signs of speculative bubble	no signs of speculative bubble
Flats in condominiums (newly built)	no signs of speculative bubble	no signs of speculative bubble
Single-family houses	no signs of speculative bubble	no signs of speculative bubble
Land plots	no signs of speculative bubble	no signs of speculative bubble
Terraced houses (existing)	no signs of speculative bubble	no signs of speculative bubble
Terraced houses (newly built)	no signs of speculative bubble	no signs of speculative bubble
C-cities		
Flats in condominiums (existing)	no signs of speculative bubble	no signs of speculative bubble
Flats in condominiums (newly built)	no signs of speculative bubble	no signs of speculative bubble
Single-family houses	no signs of speculative bubble	no signs of speculative bubble
Land plots	no signs of speculative bubble	no signs of speculative bubble
Terraced houses (existing)	no signs of speculative bubble	no signs of speculative bubble
Terraced houses (newly built)	no signs of speculative bubble	no signs of speculative bubble
D-cities		
Flats in condominiums (existing)	no signs of speculative bubble	possible speculative bubble
Flats in condominiums (newly built)	no signs of speculative bubble	no signs of speculative bubble
Single-family houses	no signs of speculative bubble	no signs of speculative bubble
Land plots	no signs of speculative bubble	no signs of speculative bubble
Terraced houses (existing)	no signs of speculative bubble	possible speculative bubble
Terraced houses (newly built)	no signs of speculative bubble	no signs of speculative bubble
Deutschland		
Flats in condominiums (existing)	no signs of speculative bubble	no signs of speculative bubble
Flats in condominiums (newly built)	possible speculative bubble	no signs of speculative bubble
Single-family houses	possible speculative bubble	no signs of speculative bubble
Land plots	no signs of speculative bubble	no signs of speculative bubble
Terraced houses (existing)	no signs of speculative bubble	no signs of speculative bubble
Terraced houses (newly built)	no signs of speculative bubble	no signs of speculative bubble

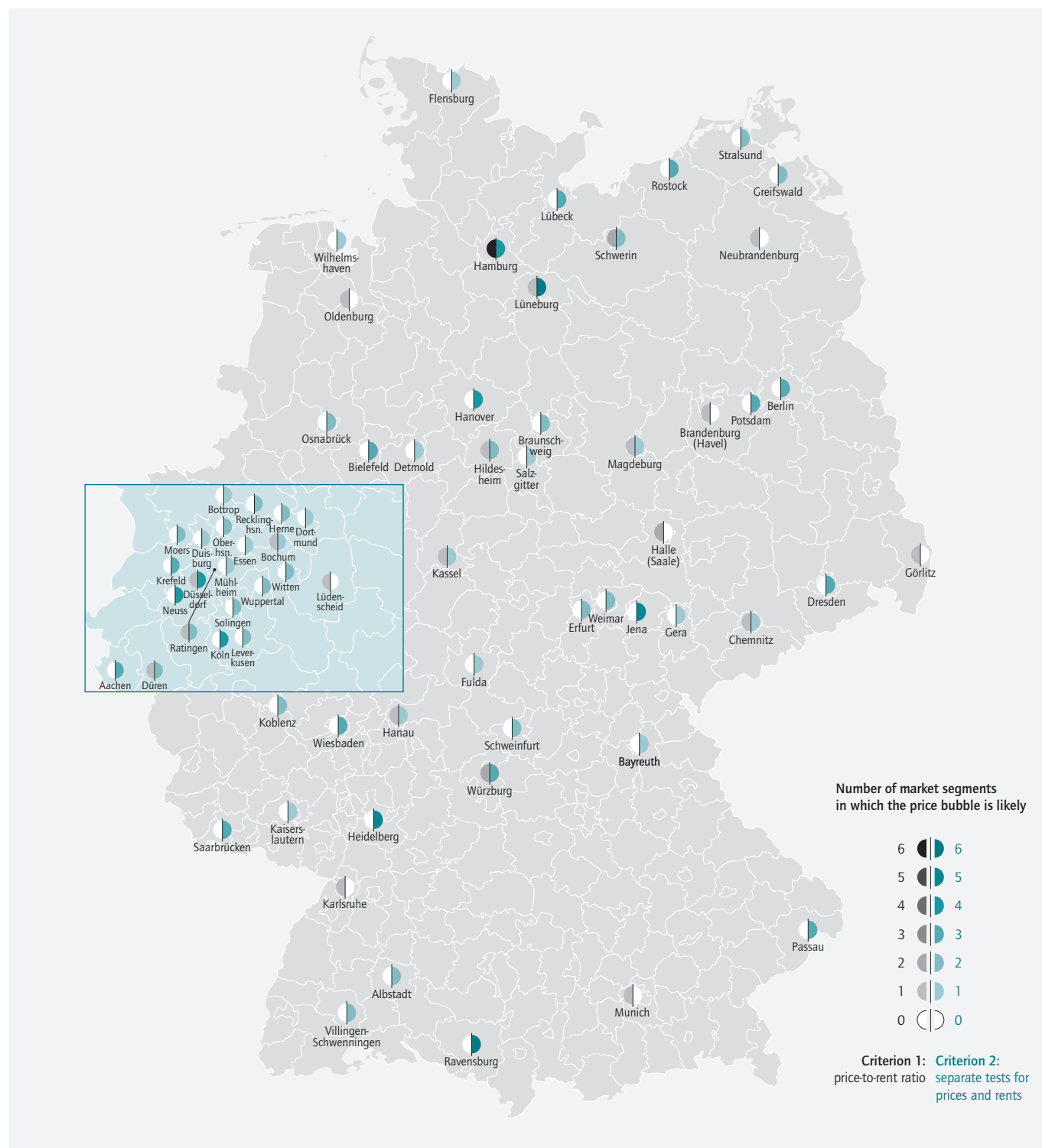
Source: Bulwiengesa; own calculations.

© DIW Berlin 2017

Map

Results of speculative bubble test for individual cities

The number of market segments in which the price bubble is likely



Source: Bulwiengesa; own calculations.

Table 3

Test results for individual cities

Type of city (total number of cities)	Speculative bubble present in at least one segment (price-to-rent ratios)	Speculative bubble present in at least one segment (prices and rents tested separately)
A-city (7)	3	4
B-city (14)	2	7
C-city (22)	1	13
D-city (84)	14	41
Overall (127)	20	65

Source: Bulwiengesa; own calculations.

© DIW Berlin 2017

Including the separate tests using prices and rents separately demonstrated that in half of the cities examined, a speculative bubble is likely in at least one market segment (see Map 2). There as well, the value trend of new condominiums (47 cities) and undeveloped residential lots (28 cities) primarily indicates that selling prices have decoupled from rents. The proportion of cities with alarming price trends in the new building segment has significantly increased since the last study. Based on price information up to 2014, only 28 cities with possible aberrations were identified. The proportion of A-cities was relatively large at that time. But as measured by the separate tests of price and rent trends, the likelihood of a bubble in at least one market segment of all other city types is high.

Conclusions

In recent years, real estate prices in Germany's large cities have risen significantly. However, the results of the present analysis show that to a great extent, this is in line with the development of rents. Some cities also experienced catch-up effects as a result of the real estate market's long-lasting sluggishness—especially in international comparison. In retrospect, trends that seemed critical before now appear to have been justified. The overall

results show that the speculative investor behavior in the USA, for example, which triggered a severe global economic and financial crisis, is not evident in Germany at this time. Real estate transactions are being made on solid financial bases, the volume of loans is stable, and the statistical tests introduced in the present study show no sign of aggregate bubble build up. However, this does not mean that prices will remain stable at their present level. On the one hand, they have the potential to continue rising as a result of the housing shortage and sluggish construction activity in large cities. On the other hand, a more austere monetary policy could lead to a significant drop in demand for housing and an ensuing price correction. This would not be due to a bubble bursting, however. Instead, it would be the result of a fundamental change in the general conditions.

A close-up view of regional market segments shows that the likelihood of a bubble in A-cities (large cities of international importance) has increased because selling prices are rising more rapidly in these locations than rents. However, many smaller cities are now exhibiting a lower likelihood of forming property bubbles than before. This is primarily because rents in smaller cities have virtually caught up—which could also be the result of the previous upsurge in prices. To ensure investment profitability in markets where real estate prices are surging upward, there is pressure to charge higher rents and set prices at the limit of what households are willing to pay.

But policy makers should not lapse into passivity as a result of the findings of the present study. Recently, the measures suggested by the International Monetary Fund and other institutions were adopted that allow intervening in lending and financing of real estate if worse-case scenarios arise. However, the regulatory measures were diluted and defused in the federal legislative process. The great challenge is to detect worrisome trends on the aggregate level. There are no clear criteria for doing so yet. Systematic monitoring that is suggested in this study would improve the early bubble detection and facilitate targeted application of the new instruments.

Konstantin Kholodilin is a Research Associate in the Department for Macroeconomics at DIW Berlin | kkholodilin@diw.de

Claus Michelsen is a Research Associate in the Department of Forecasting and Economic Policy and in the Department of Climate Policy at DIW Berlin | cmichelsen@diw.de

JEL: C21; C23; C53.

Keywords: House prices, speculative bubble, explosive root, German cities