The distribution of residential property price changes across homeowners and its implications for financial stability in Austria

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We employ newly available data of the second wave of the Eurosystem Household Finance and Consumption Survey (HFCS) for Austria to construct a house price index for an analysis of households' financial resilience to possible price shocks in real estate markets. We estimate this house price index based on directly observed object-level information provided by homeowners. This results not only in an accurate index of house price developments as shown in the seminal contribution of Kiel and Zabel (1999), but also allows us to analyze the full distribution of house prices and their changes beyond the mean. We compare our approach to the two other price indices available in Austria, which use hedonic regressions based on transaction or quotation prices, and discuss advantages and disadvantages of the available indices while focusing on our primary objective, analyzing implications for financial stability. We find that the fairly steep increase of house prices recently observed has been driven by a rather small segment of the market. Further results suggest that the observed long-term real estate price increases have been remarkably stable. At the heart of our contribution is an analysis of the impact of house price changes on the loss given default of vulnerable mortgage holders. We base this analysis on scenarios that incorporate the observed empirical distribution of house price changes and show that the risks to financial stability are relatively limited. We conclude with a summary of the findings and provide a general assessment of the Austrian housing market.

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Monitoring asset prices and evaluating associated risks that may arise are a core concern of central banks worldwide, including the OeNB, since financial crises that involve real estate booms and busts have been shown to be particularly severe.

In this study, we employ newly available microdata of the second wave of the Eurosystem Household Finance and Consumption Survey (HFCS) for Austria to construct a house price index to analyze households' financial resilience to possible price shocks in real estate markets.

Real estate holdings are by far the most important asset of Austrian households. The largest part of real estate holdings in households' portfolios are their main residences. In 2014, about 47.7% of households were owner-occupiers, and the value of their main residences amounted to more than half of their total gross wealth. About 15% of households hold mortgage debt, using their main residence as collateral.

The two available house price indices for Austria suggest that the change in real estate prices has been very strong in some segments of the real estate market. In the period from 2010 to 2014, the joint house price index of the Technische Universität Wien (TU) and the OeNB increased by 26.7% and the one recently published by Statistics Austria climbed by 24.1%.

A number of recent OeNB studies have discussed the importance of hous-

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ing wealth and house price developments for the transmission of monetary policy, financial stability, consumption and the economy as a whole (see e.g. Fessler et al., 2009; Albacete and Wagner, 2009; Fessler et al., 2010; Albacete and Fessler 2010; Albacete et al., 2012a; Albacete et al., 2014; Albacete and Lindner, 2013). The contribution of this study is that we examine house price developments at the micro level to investigate the direct link between such developments and financial stability and assess the possible risks to the Austrian banking system stemming from the house price increases observed recently.

For households that finance their house purchases by loans or mortgages, adverse price shocks may be especially critical if they buy their house during a price boom that turns out to be unsustainable. If house prices decrease sharply, the mortgages of such households might easily become "underwater," i.e. the households' mortgage debt exceeds the value of the property. However, only once a large share of indebted households is unable to service their debt, this translates into risks to financial stability. If households default and real estate needs to be (fire) sold to pay back debt, the resulting loss given default (LGD) might turn out to be substantial if the debt exceeds the selling price of the collateral. LGD is the amount in percent of total debt which cannot be recovered by the bank in case of a borrower's default. Similar developments had dramatic consequences in the U.S.A. and Spain in the late 2000s.

The remainder of this study is organized as follows. In section 1, we discuss the theoretical background of house price indices in a comprehensible way. Section 2 presents data background and our contribution in terms of the analysis of property price developments. It includes a short data description (2.1) and the main definitions of our micro-based house price index as well as comparisons with other property price indices (2.2). Subsection 2.3 deals with the distribution of property price changes and subsection 2.4 with house prices in the long run. Section 3 delivers the assessment of risks to financial stability stemming from possible house price shocks. In section 4, we conclude and provide a general assessment, including policy advice with regard to the Austrian housing market.

1 Theoretical background on house price indices

A transacted price is a quantity of payment per unit of a good. The payment is delivered by a person or another entity in exchange for a good or a service. Usually, prices are measured in some monetary unit representing a quantity of goods and services that could be bought at a specific moment in time. Without a payment, i.e. a transaction, such a price does not exist and therefore it can neither be observed nor measured. Note that we restrict our discussion to prices which directly relate to an exchange of goods and/or services as well as their change over time. We do not talk about offering or any other prices which do not directly relate to an exchange of goods and/or services. In short, the number on a price tag in a supermarket is not a price; rather, the amount that you actually pay at the counter is the price.

In classical general equilibrium theory, the pricing problem is solved by the "auctioneer paradigm," which provides economic theory with a so-called market-clearing price vector which equilibrates supply and demand. All goods are priced in a way that markets are cleared. Trade and payments only occur given these prices and are by

definition always related to an exchange of goods and services.

In reality we do not observe such a price vector for all goods and services at any point in time. Many goods and services are not traded for a long time, some are never traded at all, and without an exchange of a good and a corresponding payment, we do not observe a price. Some goods and services are traded at the same time but at different prices. One famous example from the stock market is the so-called Royal Dutch Shell puzzle. See Lamont and Thaler (2003) for a number of such violations of the law of one price in financial markets. In general, the law of one price only holds under very specific circumstances as products are often spatially differentiated (Rogoff, 1996).

Nevertheless, fictional prices play an important role in our daily life and the economy as a whole. If we cannot observe a transaction, we wonder "what would be the price if I paid somebody to repair my car?" or "what would be the price if I sold my old stereo set?" Quite often, decisions in our daily life are based on guessing possible prices and costs. This problem of "measuring" a price which does not exist in reality cumulates once we try to measure price developments over time to construct price indices.

A price index is constructed by observing a series of prices (transactions) referring to a basket of the same set of goods or services over time. However, in reality, neither will transactions occur for all goods and services in such a basket at all points in time nor will the goods and services stay the same. Some may change, some may cease to exist, some new ones may emerge. Often a good or service consists of a bundle of circumstances directly and indirectly connected to the possible occurrence and value of a transaction payment.

Real attempts to construct price indices have to deal with such problems and try to account for such changes over time using a variety of statistical methods. There must be adjustments for quality improvements to existing products, product attrition and new products as well as for prices not observable by proxying such missing observations by "similar" observed transactions in the time-good continuum – quite similarly to "guessing" non-existent, non-observable prices in real life.

When it comes to devising house price indices, these problems are quite substantial. Houses are traded rather rarely; sometimes it takes years, decades or even generations until a house is sold again. A house may be demolished and rebuilt or changed in a way that it cannot be considered the same object when it is sold again and a price change can be observed. In an international comparison the share of owner-occupiers is rather low. People often live their whole lives in the house they have built; houses are also passed on to the next generation without the occurrence of an observable price. Actually, almost one-third of owner-occupiers in Austria live in houses they have inherited (Fessler et al., 2016). We do not observe this phenomenon to that extent in many other countries. In the U.S.A., for instance, people tend to move more often and therefore far more transaction prices are observable. That is the reason why the Case-Shiller house price index is able to sample all available and relevant transaction data to create matched sale pairs for pre-existing houses. It explicitly does not sample sale prices of new constructions, as, obviously, no price change is observed (see S&P/Case-Shiller, 2015). In Austria, such a purist approach is not feasible, as the share of overall houses that have

been the object of transactions and the share of observable prices are too small. In addition, no data source exists which would accurately track such prices. Therefore, methods are used to observe prices of "similar" objects in the time-good continuum and use them as proxies for unobserved real price changes. Such an approach is complex and comes with serious caveats: finding objects "similar" to homes is difficult, as all objects are differentiated by location – and location matters. See Hill (2013) for an extensive survey on hedonic price indices.

Also, the variety of objects is rather large in Austria. If an object is not traded, no transaction will take place and therefore no price will exist; in such cases, it is difficult to find similar objects in terms of location, size, neighborhood and all the other characteristics which may influence transaction prices. In the end, one has to work with rather crude estimates trying to guess unobserved price changes using sophisticated statistical methods.

To summarize, if no repeated transactions of the same house is observed (exists) to construct a price index, it is necessary to observe prices of existing transactions of different houses at different points in time and to try to identify similar houses to construct a price index.

In the case of our micro-based approach we do not have the problem of finding similar houses as we always have information on the same house at two points in time. Our primary objective is however not the construction of a house price index but a micro-based analysis of household vulnerability.

2 A survey-based residential property price index

2.1 Data

We use the second wave of the Austrian HFCS, which was conducted in 2014 and 2015. The HFCS is a euro area-wide project coordinated by the European Central Bank (ECB).[2] The OeNB is responsible for conducting the survey in Austria. HFCS data provide detailed information on the entire balance sheet as well as several socioeconomic and sociodemographic characteristics of households in the euro area. In particular, the survey provides information on the wealth held in various forms of real estate property (households' main residence, other real estate). Additionally to the estimated (fictional[3]) market price of a particular property at the time of the interview, the survey also collects information about the value of each property at the time of the transaction, i.e. at the time the household became the owner of this property.

Homeowners within the representative sample of Austrian households (in 2014) were asked what the price of their house or apartment (henceforth house) was at the time of acquisition. This information can be expected to be of good quality as most owners know quite accurately what they paid. Moreover a transaction really took place.[4] Homeowners tend to know best what the true costs were, especially if many

[2] *The first wave of the HFCS in Austria was conducted in 2010 and 2011. It is envisaged that this survey is conducted about every three years. The HFCS in Austria has no panel component.*

[3] *"Fictional" in that no transaction takes place and therefore no price exists; not "fictional" in that it is self-assessed, i.e. estimated by the respondent.*

[4] *Also in the case of an inheritance the person who inherited may be best informed about the actual price (in this case fictional market price), even though no market transaction takes place.*

different contractors were involved in building the house, if the household partly built it on their own instead of just purchasing a finished house. Of course, the price information will likely be more precise for recent years than for transactions which took place a very long time ago; but given that such large transactions take place rather rarely in most owners' lives, they tend to remember them well. As long as the house price is unbiased in expectation over all households, households' problems recalling the exact price will only increase variance but will not affect the value itself. Additionally, as the price of a property depends heavily on its location, changes to a property may in a lot of cases have little impact on the overall valuation in the long term. The second point in time for which we have information on the value is the time of the interview (2014). We asked the owner to estimate the price they could sell the house for. This is a fictional price as no transaction takes place and no transaction price exists. We also have a large amount of other information on the house, which allows us to estimate values using actual transaction prices of similar houses, similarly to the way price indices are calculated. Such plausibility checks lead to very similar results for house price distributions. However, the literature shows that houses are very different from each other and that even within a small neighborhood price differences can be very large for numerous different reasons; therefore, if the goal is to estimate prices at the object level, direct information from owners is more reliable than residential house price estimates using statistical models. That is especially obvious in cases like Austria, where transaction price data are rather scarce.

Bucks and Pence (2006) assess the ability of respondents to report the value of real estate and find (page 1)

"… that most homeowners appear to report their house values and broad mortgage terms reasonably accurately."

Also Bucchianeri and Miron-Shatz (2010, page 11) conclude that there is a "significant association" between reported values and market prices. Furthermore, Kiel and Zabel (1999, page 1) show that although the average owner overvalues their house by about 5%, the use of owners' valuations "will result in accurate estimates of house price indexes and will provide reliable estimates of the prices of house and neighborhood characteristics" because differences between sale prices and owners' valuations are not related to particular characteristics of the house or the occupants. Benítez-Silva et al. (2009) also show reasonable slightly overestimated self-assessed values and find them to be especially accurate for difficult economic times.

Furthermore, as our primary objective is to analyze vulnerability at the household level, our focus is on obtaining reliable estimates of house price changes at the level of the individual house and household.

Therefore we use the information on the transaction price and the self-assessed fictional market prices provided by the owner at the time of the interview to calculate the change of the house price. Put simply, compared to hedonic price indices that means that instead of guessing which houses of a number of different houses are similar (by controlling for a potentially large set of characteristics of the property) to combine two prices, we use the same house and ask the owner to estimate its current market price. In the case of hedonic models, by contrast, the matching of similar houses does not

take place explicitly but rather implicitly through the functional form of the regression, where in the simplest case of a time-dummy method all houses are implicitly assumed to stay the same over the years. Both matching and regression with controls are valid under the same identifying assumption of conditional independence.

In section 3 of this study, we combine the past behavior of property prices with Austrian households' debt levels and debt sustainability. In the HFCS, various different forms of debt, i.e. mortgage and nonmortgage as well as debt from family and friends, are recorded. Nonmortgage debt includes all possible forms of consumer loans as well as credit card debt and overdrafts in sight accounts. We define the household's total stock of debt as the outstanding amount of all liabilities held at the time of the interview. To assess the risk stemming from household debt, the asset side and income also need to be taken into account appropriately. The HFCS provides detailed information on each of these aspects (for a complete account of the entire balance sheet of a household see Fessler et al., 2016). The results reported in the present paper pertain only to households resident in Austria. All estimates are calculated using the final household weights and taking into account the survey's multiple imputations provided by the data producer (see chapter 5 in Albacete et al. (2016) for a detailed description of the multiple imputation procedure in Austria). Of the total of 2,997 households in the net sample, 891 are homeowners without any outstanding mortgages[5] taken out for the acquisition of their home and 393 are homeowners with at least one outstanding mortgage taken out for the acquisition of their home. Concerning other-than-main residence real estate, 284 are owners of other properties without any outstanding mortgage taken out for the acquisition of these properties and 42 are owners of other properties with at least one outstanding mortgage taken out for the acquisition of at least one other property.

The overall methodology of the second HFCS wave 2014 follows – with some improvements – that of the first HFCS wave (2010) and is documented in Albacete et al. (2016).[6]

2.2 Construction of the indicator for residential property price changes

We analyze the housing market in two subsets. First, we focus on the set of household main residences (HMRs), which are by far the most important asset class and represent all main residences of households in Austria. Second, we focus on the set of most important other properties (HMOPs). This set consists of the most valuable property that households own apart from their main residence. Note that the set of owners is therefore different from the first subset. While the first subset includes all households that own their main residence, the second set includes all households that own any other real estate regardless of whether they own their main residence. The second subset is quantitatively less important in households' asset portfolio structure, but provides some account of the behavior of property prices of

[5] *The HFCS collects only information on outstanding liabilities but not information on mortgages that were used to finance real estate and have already been fully repaid.*

[6] *An extensive methodological documentation of the first wave of the euro area HFCS can be found in ECB (2013). Additionally, similar documentation is planned to be published for the second wave.*

objects which are used by their owners for purposes other than as their main residence (most notably for investment and income-generation purposes but also for recreational purposes). Note that we exclude business ownership-related commercial uses of real estate that arise when a household owns businesses which own real estate. These are subsumed under business assets and not under real estate property of households. Most prominently, this categorization excludes farmers' real estate, which is by definition also counted as business assets.

Let us denote owner households by $i = 1,2, \ldots I$ and years by t. The (estimated) prices of the owners' main residence or, analogously, of the most important other property of owner i at time t are denoted by P_{it}. We observe a price for each property of owner i at two points in time: at the point it was acquired (P_{it}) and in 2014 (P_{iT}). While the first term is the reported transaction price, the second term is the self-assessed (fictional) market price. As a first step, we can construct the average of reported transaction prices over time, which we call the HFCS average transaction index:

$$ATI_t = \frac{\sum_{it} P_{it}}{n_t}, \qquad (1)$$

where n_t is the number of houses for which transaction prices are actually observed in year t, which are all the values homeowners report for the time they acquired their main residence. Using appropriate weighting, this implies that overall, the resulting time series is representative of the dynamics of the prices of all houses in Austria currently in use as a household main residence. This approach does not use any self-assessed (fictional) market prices but relies exclusively on the information reported about actual past transactions. At the same time, once regarded as a "price index," the ATI is closer to indices using transaction information without being able to match houses, as it does not refer to changes in the price of the same objects but reports only changes in the transaction price level over time.

In a next step, we exploit the price information on the same houses over time and use the estimated market value in 2014. The easiest and most straightforward way to construct a price index is to use a simple ratio between the mean of the prices of houses acquired at a specific point in time in the past and the mean of the estimated market value of the same houses in 2014. This method is also applied in Mathä et al. (2014), who use the first wave of the HFCS and data for all euro area countries. The resulting index is then given as

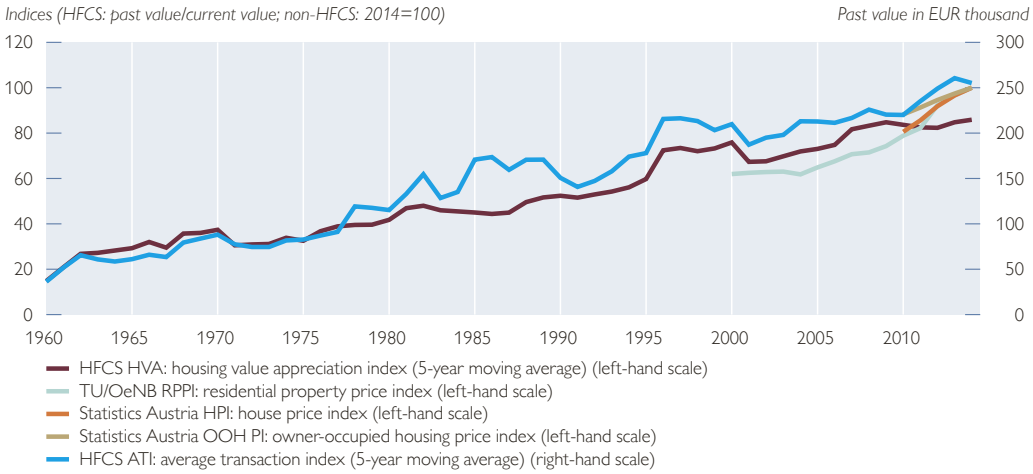
$$HVA_t = ATI_t \left(\frac{\sum_{i \in N_t} P_{iT}}{n_t} \right)^{-1}, \qquad (2)$$

where N_t is the set of houses for which transactions actually took place in year t. We call this index the HFCS housing value appreciation (HVA) index.

Chart 1 shows both resulting time series based on our data as well as the residential property price indices available in Austria. Note that the levels shown in chart 1 are not comparable. The ATI delivers a simple average of reported transaction prices in euro (right-hand scale). The HVA is a measure of past average transaction prices as a share of the estimated current market price, which we show directly as a percentage in chart 1. The micro-based indices are plotted as five-year moving averages, as on average only about 30 observations (for recent decades, i.e. since 1980) underlie each single year.

Chart 1

HFCS main residence price increases versus available property prices



Source: HFCS Austria 2014, OeNB, TU Wien, Statistics Austria.

For interpretational reasons we did not rescale it to be 100 in 2014 like all the other property price indices shown.

The TU/OeNB index shows an increase of about 27% for the period 2010 to 2014, followed by the Statistics Austria HPI (24%), the HFCS ATI (16%) and the Statistics Austria OOH PI (13%), while the HFCS HVA is rather flat at 3%. Note again that by construction of the HVA, that implies a very steep price increase of about 16% for its last observation (HVA roughly equals 86%). The fact that it remains rather flat at the end of the time series reflects owners who purchased their house in the last few years all estimating current prices, which are on average 16% to 20% higher than the value at purchase, no matter if the purchase happened only one year or a few years ago (see caveats at the end of the paragraph). As expected, the HFCS ATI index matches the available property price indices quite well. Its path is close to the steep increase measured by the property price indices available for Austria (see box 1), of which the index best comparable to the HFCS ATI index might be Statistics Austria's OOH PI. The latter also covers only owner-occupied housing (OOH PI) similar to our indices, which are based on main residences only.

The increase in the prices of owner-occupied housing was less pronounced than the overall increase in the prices of private properties. Furthermore, the HFCS average transaction index also matches the increases in the TU/OeNB property price index fairly well in the period from 2000 to 2010. For more recent years, the HFCS average transaction index is slightly below the TU/OeNB property index, which may reflect the fact that it covers only households' main residences. The TU/OeNB index also includes all other noncommercial real estate not used as main residence, specifically also those belonging to owners living outside Austria. This matters especially for Vienna, as the index also includes transactions related to very wealthy nonresidents buying real estate for investment reasons. The flight to safety witnessed since the economic and financial crisis of 2008–09 has led to a strong increase

in demand at the high end of the real estate market, which has driven up the mean considerably.

Note some caveats of the self-reporting approach with regard to current prices. Firstly, households might give too much weight to the actual building compared to the land it is attached to. That might explain part of the overestimation generally observed in the literature. Secondly, self-reporting might be especially problematic for houses purchased very recently as owners might severely underestimate the speed of devaluation once a house is used. Thirdly, owners may at the same time overestimate the universality of their own taste and preferences. The latter two points might lead to an additional overvaluation of current prices for houses recently purchased. Fourthly, the intensity of observing the market might also affect subjective estimates of current prices.

Box

Residential property price indices for Austria

TU/OeNB

The TU/OeNB residential property price indices use data provided by a private real estate company which cover roughly 80,000 transaction prices for each year. State-of-the-art hedonic regressions to adjust for quality changes are applied. There are different models for different object categories (e.g. new and resale apartments, single-family houses). Some of the data series start in 1986. Semi-parametric models take into account nonlinearity and spatial heterogeneity. It is a state-of-the-art approach given limited data availability.
A detailed documentation can be found here:
https://www.oenb.at/dam/jcr:c2fb0be8-5a1a-4e58-94dc-175b8984ca56/stat_2012_q3_analyse_brunauer_tcm14-249405.pdf (retrieved on April 4, 2016).

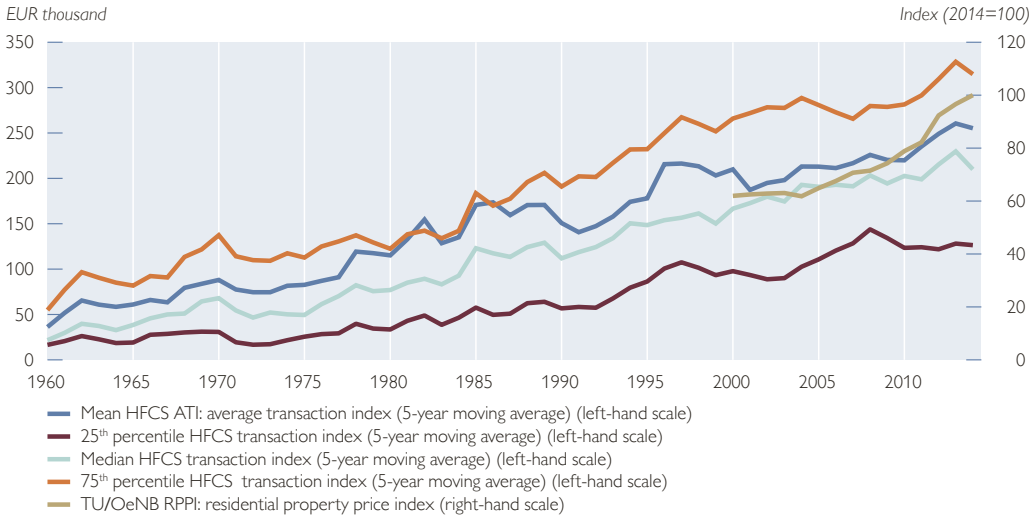
Statistics Austria

In 2014, Statistics Austria also started publishing property price indices (covering the years from 2010 onward). Unfortunately, Statistics Austria has not made available any detailed documentation so far. Therefore it is not possible to comment on the methods used.
http://www.statistik.at/web_de/statistiken/wirtschaft/preise/haeuserpreisindex/index.html (retrieved on April 4, 2016).

To illustrate why classical mean-oriented property price indices might not be the ideal tools for financial stability analysis, we plot also indices of percentiles, analogously to our ATI index (chart 2). It suggests that recent increases in property price indices might mainly reflect developments in the upper part of the distribution. While the TU/OeNB property price index aligns with rather steep increases at the ATI mean and P75, it seems that transaction price increases at P50 and P25 were less pronounced. In times of rather heterogeneous price developments such as those triggered by the flight to safety and the accompanying rise in demand for real estate as investment vehicles, classical property price indices might provide less useful information for financial stability analysis. Mortgage holders investing in real estate for reasons of owner-occupation are very relevant for financial stability analyses. High-end real estate market segments in large cities like Vienna and other market segments characterized mainly by house purchases for investment pur-

Chart 2

HFCS-based transactions versus property price index



Source: HFCS Austria 2014, OeNB, TU Wien.

poses by less vulnerable households may influence overall property price indices in a way that they are deemed less representative of ordinary mortgage-based financing of households' main residences. That is why analyzing real estate price developments beyond the mean is crucial in interpreting results with a view to financial stability.

For our financial stability analysis at the household level as well as a disaggregated analysis of implicit price developments beyond the mean, we additionally need a measure of house price developments at the micro level. Therefore, we construct for each property unit an average annual price change index and call it the unit average change, denoted by UAC_i. For this calculation we make use of the compound interest formula. The average yearly rate of return of a given household's real estate can be calculated by

$$UAC_i = \left(\frac{P_{iT}}{P_{it}}\right)^{\left(\frac{1}{T-t}\right)} - 1. \qquad (3)$$

Thus, the formulation yields an average yearly rate of return for a property from the time of ownership transfer until $T=2014$. Combined with the values P_{iT} and P_{it} this estimate of a price change at the individual property level allows us to analyze possible loss given default under different scenarios. Note the important difference in the indices presented. While the ATI refers to the average price of houses bought in a certain year and the HVA refers to the price change using the average of the set of houses acquired in a certain year and the average of the same set in 2014, the UAC gives the average price change on the individual level implied by the price change between the two years (year of acquisition and 2014).

2.3 Distribution of residential property price changes

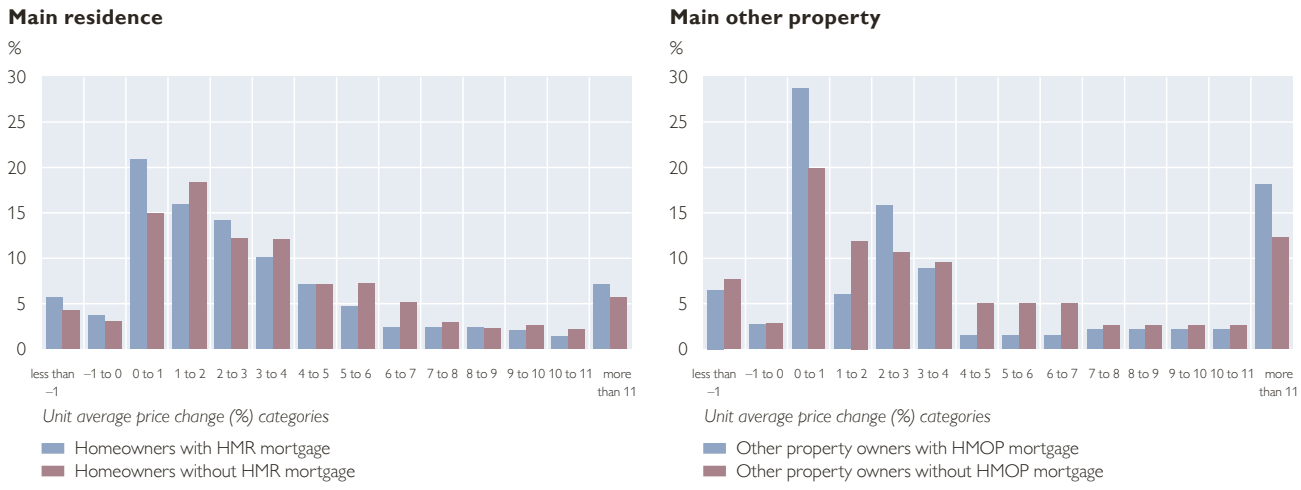
Chart 3 shows the UAC over all housing units (HMR and HMOP), regardless of when they were acquired. The majority of households experienced a yearly UAC of about 0% to 5%. The structure of this price behavior seems

to be similar for both the HMR and the other real estate or mortgage holders and non-mortgage holders. Less than around 10% of homeowners (with and without a mortgage) have experienced negative UACs on average.

Some households have experienced a relatively high increase in the value of their house as can be seen by the bars furthest to the right of both diagrams of chart 3. These high increases are mostly related to parts of the properties recently acquired, which have experienced more pronounced price changes than the rest (see also charts 4 and 5).

Chart 3

Distribution of unit average price changes

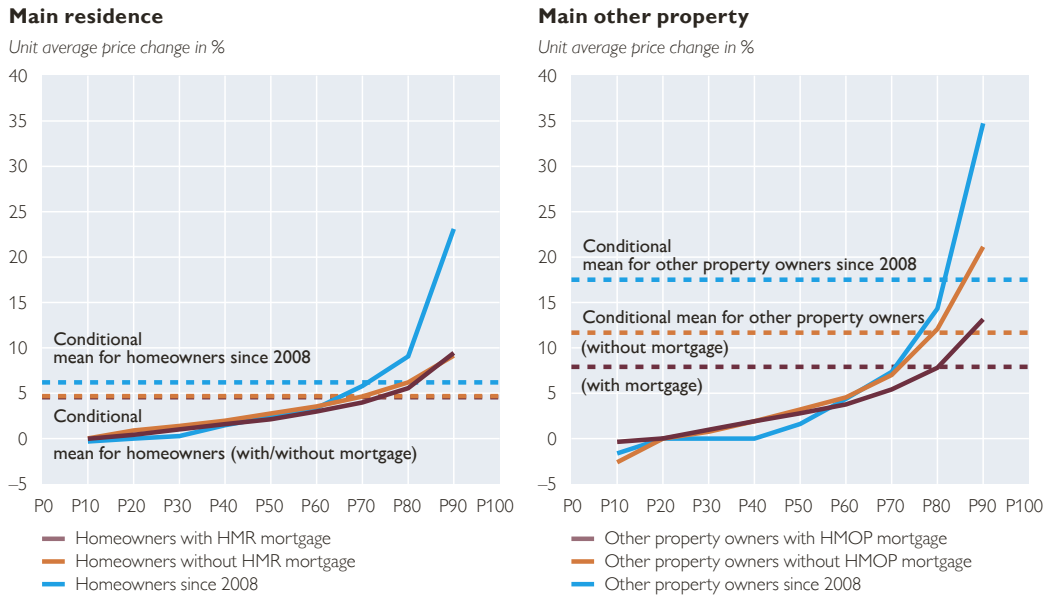


Source: HFCS Austria 2014, OeNB.

Note: HMR=household main residence; HMOP=household main other property.

Chart 4

Percentiles and mean of unit average price changes



Source: HFCS Austria 2014, OeNB.

Note: HMR=household main residence; HMOP=household main other property.

Chart 4 shows quantile functions of the UAC, again divided into HMR and HMOP as well as mortgage holders and households without mortgages.

A relatively large majority (i.e. about 80% of properties used for the HMR and about 70% of main other properties) saw a yearly increase in value of 5% at most. The mean is always above the median, pointing to a small fraction of houses whose prices have increased relatively strongly. This small fraction seems to belong to a great extent to households that became homeowners since 2008 (see blue line in chart 4). Note that the distribution of unit average price changes is more right-skewed in the case of households' main other properties and even more so in the case of the subsample of owners since 2008. This suggests that recent increases measured in property price indices are mainly driven (1) by the upper tail of the market and (2) by properties not considered main residences. This implies that these increases are driven by acquisitions of households which are either fairly rich and/or using real estate purely for investment purposes and are therefore usually less vulnerable.

However, it cannot be excluded that some recent mortgage-based homeowners who bought their home during the recent period of steep price increases in the upper part of the main residence price distribution may encounter difficulties in case of negative price shocks. In section 3 we analyze the potential vulnerability of households stemming from such detrimental house price developments.

2.4 Residential property prices in the long run

We now plot the UAC for different subgroups of households depending on the year when they purchased their house. To do so we construct two types of time series. First, we show the yearly average of the UAC of all owners who purchased their property in a specific year, i.e. the mean of the average yearly price change that the buyers faced until 2014 (top panels in chart 5 labeled "housing transactions"). This gives us an idea of the periods in which properties may have been comparably expensive or cheap; i.e. we can find out whether certain years were a particularly good time to enter the market compared to 2014. We find that this was not the case – at least until recently. According to our data, average price developments were remarkably stable. In general, prices for main residences tend to increase between about 3.5% and 4.5% annually. Only since 2008 have the rates of increase been higher. In the case of main other properties the rates are somewhat higher, and the increase larger since the 2000s and even more since 2008. The pattern resembles the part of the TU/OeNB property price index that covers Vienna.

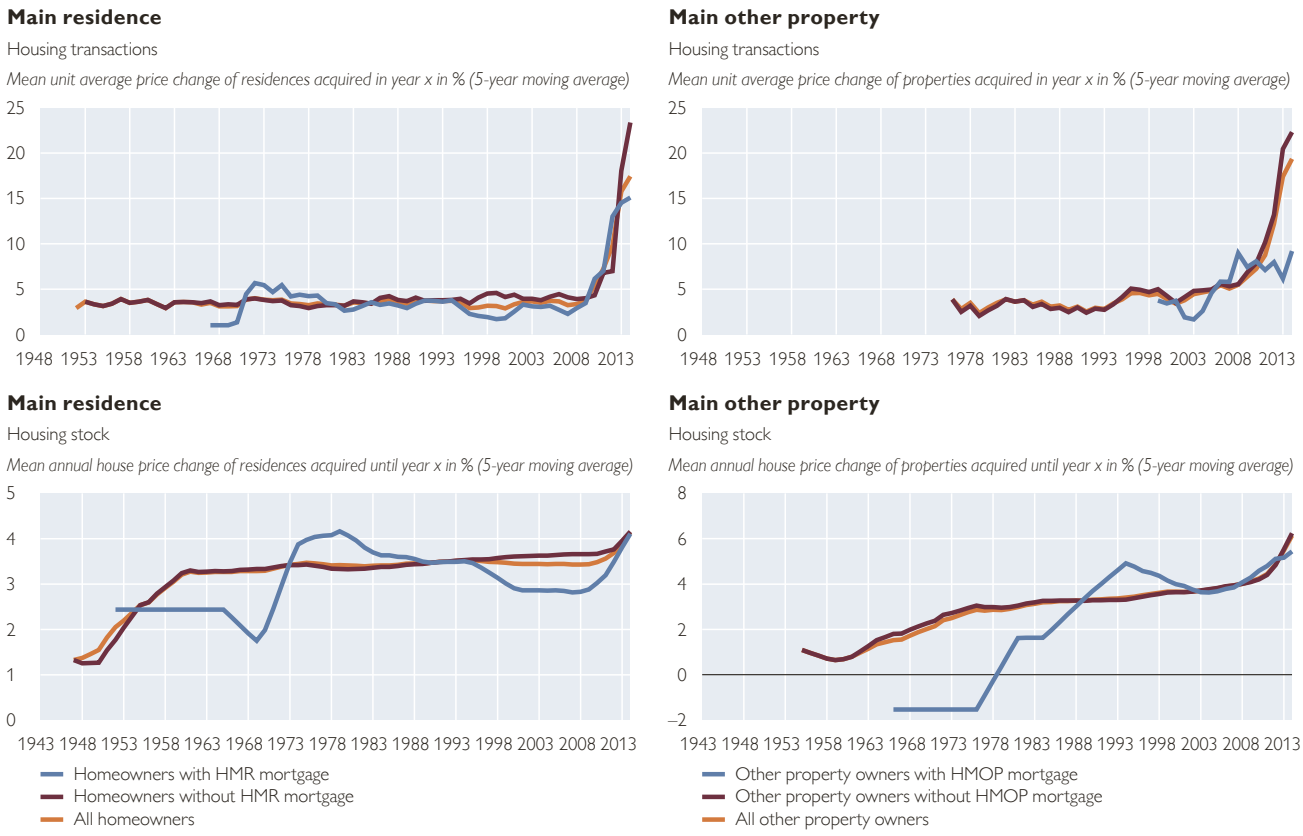
In the annex (chart A1), we plot a similar chart using the median instead of the mean average yearly price change. It confirms the long-run stability and is very similar to the mean index, which points to the robustness of our approach. It also confirms the finding that prices behaved differently in the upper part of the price distribution. While the mean index, which is highly influenced by this segment, shows a strong increase for all homeowners in recent years, it shows no increase in the median index for all homeowners and homeowners with a mortgage. Only those few homeowners who bought recently without a mortgage show increases also in the median index. Such homeowners are fairly wealthy households in the upper market segment. For main other properties, the index based on the median even shows a declining

price increase in recent years, which is especially pronounced for those with a mortgage. Again, this index resembles the overall pattern described by the TU/OeNB index for Vienna. As less than 20% of households in Vienna are owner-occupiers, and those who buy in such a market are comparably wealthy, Vienna can be considered a market that is driven more by investment-based motives than the rest of Austria.

These long-term averages for all years point to a remarkable stability of long-term price developments. Secondly, we look at the average of the UAC of all owners who acquired their properties up to a certain year in the past so that the number of observations increases from left to right (bottom panels in chart 5 labeled "housing stock"). The second method provides an estimate of the long-term average price change. Whereas the estimate for the long run hardly changes over time for household main residences, the long-run estimate for other main properties increases slightly. However, keeping in mind that properties used for investment purposes may be sold more often than main residences, such a long-term perspective may be problematic; we can only measure the unit price developments since its last transaction (change of ownership).

Chart 5

Unit average price changes by year



Source: HFCS Austria 2014, OeNB.

Note: HMR=household main residence; HMOP=household main other property.

3 Loss given default of vulnerable mortgage holders under an adverse house price scenario

We now turn to the risk-bearing capacity of indebted households, focusing on developments in the real estate market. In order to do so we focus only on mortgage holders and restrict the discussion to households' main residences (HMRs), as this combination is most characteristic of households which are indebted and own real estate.[7] We use standard risk measures extensively discussed in Albacete and Fessler (2010) and Albacete and Lindner (2013).

We first look at some risk indicators and then define vulnerable households, their exposure at default (EAD) and loss given default (LGD) by the year of HMR acquisition.

Table 1 shows some owner characteristics of mortgage holders by three different periods in which they bought their HMR. All groups show gross income and net wealth levels far above the median, which is typical for Austria, as most households with lower income and wealth are tenants benefiting from a largely subsidized and highly regulated rental market. The share of households among the top 5% wealth class households is disproportionately high for households having acquired the HMR prior to 2008 and almost proportional for younger mortgage holders. This reflects the fact that relative to other households, many households who have mortgages also hold large amounts of wealth other than their HMR. Maturities and outstanding amounts are – as expected – lower for households who acquired their HMR earlier. Note, however, that the share of foreign currency mortgage holders drives up outstanding amounts, as many foreign currency loans are bullet

Table 1

Risk indicators for homeowners with HMR mortgage by year of HMR acquisition

	HMR acquisition		
	before 2000	2000 to 2007	after 2007
Household characteristics			
Gross income (median), EUR thousand	52	57	55
Net wealth (median), EUR thousand	281	246	229
Share of households in top 5% wealth class, %	10.6	9.1	4.7
Characteristics of highest HMR mortgage			
Remaining maturity (median), years	13	19	24
Share of outstanding amount (median), %	49.9	67.0	84.5
Subjective risk measures			
Households whose expenses exceed income, %	14.3	10.7	12.5
Households with above-average expenses, %	41.0	35.8	37.5
Households able to borrow EUR 5,000 from friends, %	58.3	58.5	65.7
Debt ratios			
Initial LTV ratio for main residence (median), %	50.2	72.1	62.2
LTV ratio for main residence (median), %	9.6	34.1	43.9
Debt-to-assets ratio (median), %	7.9	23.6	33.8
Debt-to-gross income ratio (median), %	49.8	155.4	230.3
Debt service-to-gross income ratio (median), %	5.0	10.1	10.5

Source: HFCS Austria 2014, OeNB.

Note: HMR=household main residence; LTV ratio=loan-to-value ratio.

[7] *Less than 2% have an outstanding mortgage for real estate other than their HMR.*

Table 2

Share of vulnerable households, EAD and LGD for homeowners with HMR mortgages by year of HMR acquisition

Household group	DSTI>40% % of households	EAD % of debt	LGD % of debt
Homeowners before 2000	1.5	3.7	0.0
Homeowners between 2000 and 2007	3.1	8.9	0.6
Homeowners since 2008	4.4	6.5	1.2
All homeowners	2.7	6.5	0.7

Source: HFCS Austria 2014, OeNB.

Note: EAD=exposure at default; LGD=loss given default; HMR=household main residence; DSTI=debt service-to-income ratio.

loans. Subjective risk measures show no clear patterns across time, and debt-related median ratios show – as expected – increasing actual loan-to-value, debt-to-assets and debt-to-income ratios. Debt service-to-gross income ratios are lower for households that purchased their home prior to 2000 and rather stable (at about 10% to 11%) for those who bought their home after 2000.

Table 2 shows the results for EADs and LGDs when using the DSI>40% vulnerability measure. This can be regarded as a baseline describing the status quo and characterizing the types of vulnerable households across time. There are more vulnerable households among those homeowners who bought their house in 2000 or later. The group of homeowners who bought their house in 2008 or later, who – as we have seen in the previous section – experienced an extraordinary high increase of the value of their HMR, has average EAD and above-average LGD ratios; this means that those who are vulnerable have as much debt as the others in relative terms but less gross wealth to cover their debt. However, we can see that the estimated LGDs are generally very low, especially as the LGDs presented here must be seen as an upper bound of the actual LGD because our estimates are based on the DSTI>40% vulnerability measure, which is not equal to default (see Albacete and Lindner, 2013). Therefore, the crucial part of the analysis are the observed differences between resulting LGDs of different scenarios and not the level of the LGDs per se. Note, however, that these analyses are all static and do not include any second- or higher-order effects, but are designed to descriptively illustrate approximate relative differences in LGDs.

We now concentrate on the impact of possible adverse house price developments on the LGD of the group of vulnerable households. We use different definitions of vulnerable households, such as a current debt service-to-gross income (DSTI) ratio higher than 40%, a current debt-to-income (DTI) ratio higher than 300%, a current debt-to-assets (DTA) ratio higher than 100%, as well as a combination (the intersecting set) of all three to get an idea of the robustness of the results.

To explore the impact of adverse real estate price developments on our measure of LGD, we simulate various scenarios. Table 3 reports these changes of LGD related to a decrease in the value of HMRs and HMOPs. The first scenario takes into account the extraordinary high increase in the value of HMRs and HMOPs purchased since 2008 and simulates a price shock of the house of those homeowners that leads

Table 3

Loss given default for homeowners with HMR mortgages by house price decrease scenarios

House price decrease scenario	(1) DSTI>40% of debt	(2) DTI>300% of debt	(3) DTA>100% of debt	(4) All combined
Baseline (status quo)	0.66	3.24	3.25	0.66
Decrease of the current value of all HMRs and HMOPs acquired in 2008 or later to a value corresponding to the same acquisition value quintile in 2008	0.77	6.01	3.99	0.67
Decrease of the current value of all HMRs and HMOPs by 20%	0.74	4.27	4.12	0.74
Decrease of the current value of all HMRs and HMOPs by 30%	0.79	5.21	4.56	0.78
Decrease of the current value of all below-the-mean HMRs and HMOPs by 30% and of those above the mean by 50%	0.84	6.56	5.22	0.83

Source: HFCS Austria 2014, OeNB.

Note: DSTI=debt service-to-income ratio; DTI=debt-to-income ratio; DTA=debt-to-assets ratio.

to a decrease in value to the level of 2007 depending on their position in the house acquisition value distribution. This is useful as it is a scenario which returns house prices to lower levels than those considered by banks when deciding on LTVs. In the next two scenarios, a decrease by 20% and 30% in the value of all HMRs and HMOPs is simulated. The last and more severe scenario simulates a decrease by 30% in the value of the HMRs and HMOPs below the mean current house price value and a decrease by 50% in the value of the HMRs and HMOPs above the mean current house price value to reflect the fact that recent house price increases were mainly driven by the upper tail of the distribution (see charts 4 and 5).

The last and most severe scenario increases households' LGD by 26%, from 0.66% to 0.84% according to the DSTI vulnerability measure. This impact is even higher according to the other vulnerability measures (according to the DTI vulnerability measure, the LGD doubles, and according to the DTA measure, it increases by 60%).

However, when combining all three definitions of vulnerability and therefore coming closer to a measure of default even for the last and most severe adverse scenario, LGD stays well below 1% of debt. So even a fall in the house value by between 30% and 50% yields an increase in the potential LGD by only about 0.17 percentage points from 0.66% to 0.83%. These results point toward relatively small risks for financial stability stemming from recent house price increases.

4 Concluding remarks

Findings

The two available house price indices in Austria – the TU/OeNB index and Statistics Austria's – show strong house price increases in recent years. We used HFCS data to construct a set of house price indices and find that the most comparable one yields similar increases like the existing indices. The TU/OeNB index shows an increase of about 27%, followed by Statistics Austria's HPI (24%) and the HFCS ATI (16%) and Statistics Austria's OOH PI (13%). The HFCS ATI index matches the available property price indices rather well; the index best comparable with the HFCS ATI index is most likely the index of Statistics Austria, which, like the HFCS ATI, also covers only owner-occupied housing (OOH PI).

Analyzing the distribution of house price changes beyond the mean, we then show that:

1. House prices and house price changes are very heterogeneous, and mean indices alone do not adequately represent the market. Strong increases in available house price indices are likely driven by the upper part of the house price distribution (see charts 2, 3 and 4).
2. The upper part of the house price distribution is also the part with the highest price increases, leading to house price indices which do not represent median house prices well (see chart 2).
3. The average as well as the median long-term increases of owner-occupied housing were remarkably stable – between 3.5% and 4.5% per year in nominal terms – over the past decades and measured by the existing stock of owner-occupied housing (see chart 5 and chart A1 in the annex).
4. Recent increases in average housing prices are also driven by home purchases without a mortgage and especially by the acquisitions of properties other than the household main residence, which are likely to be attributable also to buyers living abroad (see chart 5 and chart A1).
5. Roughly 80% of the average yearly price increases of individual properties are below the mean price increases (see chart 4). The distribution of house price changes of properties bought since 2008 is more skewed to the right. However, it almost resembles the long-term distribution up to the 60th percentile.
6. Even in adverse scenarios assuming house price decreases, we find that the effects on the losses given default of vulnerable households are rather limited (see table 3). This is mainly due to the fact that the overlap of the set of those who experienced high price increases, i.e. bought in the upper market segment, and the set of those who are vulnerable is fairly limited.

These findings underline that indices trimmed toward representing developments at the mean (average or total) are of limited use for assessing underlying risks to financial stability. Instead, the full distribution of price changes, debt, assets, income or any other relevant criteria, and combinations thereof, have to be considered. Those risk indicators that are defined at the borrower level are relevant (ESRB, 2014).

General interpretation

The connection of real estate price developments and household debt sustainability is of particular relevance for financial stability. Developments in the U.S.A. and Spain have shown that trend reversals in the real estate market may adversely affect risks stemming from the household sector. It is crucial to understand that only once the debt-servicing capacity of households is endangered and households default, house price developments will become a risk to financial stability. As long as households are able to service their debt, actual (fictional) house prices do not matter for financial stability. They do matter, however, to buyers who purchase houses in a booming market. They may get higher mortgage loans in absolute terms because the value of the house they purchase is considered higher, even though these buyers' LTVs might be similar to other periods. In a crisis, when vulnerability may increase due to increased unemployment, stagnating wages and other adverse economic developments, the share of vulnerable households is also likely to increase. However, this is not the result of changing house prices, which mainly

affect financial stability with regard to the EADs and LGDs of vulnerable households.

Due to the large share of tenants (about half of all households) and the relatively low share of mortgage holders (roughly one-third of all owner-occupiers) in Austria, the risks to financial stability in the household sector that are related to recent house price developments are rather limited in Austria. Most low-wealth, low-income households (actually almost all households below median wealth levels) benefit from the highly subsidized and regulated rental market, which prevents these households from engaging in highly leveraged real estate investments in owner-occupied housing. This allows them to consume more. At the same time, it remains rather difficult for lower-income households to build the necessary capital needed to invest in owner-occupied housing. Furthermore, owner-occupied housing is also subsidized directly ("Wohnbauförderung") and indirectly (through the non-taxation of imputed rents) in Austria. The large rental market, especially in Vienna, also leads to a large number of young single-person households who could not afford to buy a home at an early stage in life. Austria has almost double the share of one-person households than – for instance – Spain. In Vienna owner-occupied housing among households is below 20%, and owner-occupiers are predominantly higher-income and higher-wealth households. Therefore, the risks from possible trend reversals in house prices are rather low in Austria and especially in the rallying Viennese real estate market. The low share of owner-occupied housing and the low share of mortgage holders in Austria and Germany can be regarded as one important reason for the resilience of these two countries in the economic and financial crisis (see Deutsche Bundesbank, 2016; Fessler et al., 2016). Countries with a booming housing market driven by mortgages allocate risks to households in the lower part of the income and wealth distribution that these households may not be able to bear. At the same time, these households are also more likely to be affected by negative shocks such as illness or unemployment.

Future research

Further topics deserving additional research include the extension of the simulation with a stronger focus on the differences in volatility of real estate prices across regions or subgroups of households. It would also be interesting to analyze regional differences in more depth and to put a special focus on foreign currency loan holders. In this context it is also relevant to investigate the potential impact of macroprudential policy measures on house price changes and potential indirect implication for the risk-bearing capacity of households. Furthermore, besides taking into account potential LGDs resulting from the default of households, banks have to adjust collateral values on a regular basis. They mostly do so by using simple models instead of object-based evaluations. Nevertheless, banks' risk-taking behavior will likely be influenced well before defaults and regardless of their number. An evaluation of such collateral pricing behavior could also provide insights into future credit supply and banks' risk-taking behavior.

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Annex

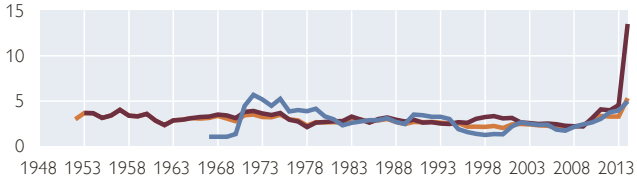
Chart A1

Unit average price changes by year

Main residence

Housing transactions

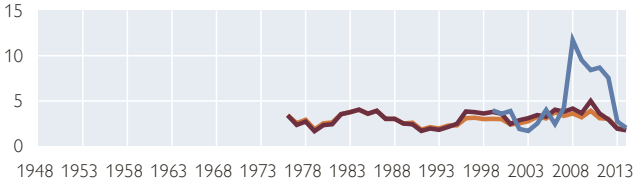
Median unit average price change of residences acquired in year x in % (5-year moving average)



Main other property

Housing transactions

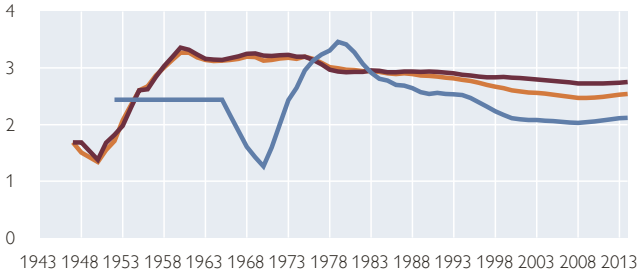
Median unit average price change of properties acquired in year x in % (5-year moving average)



Main residence

Housing stock

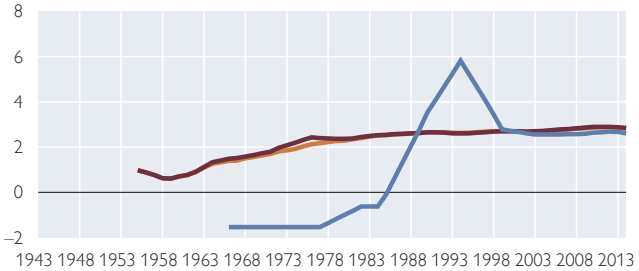
Median annual house price change of residences acquired until year x in % (5-year moving average)



Main other property

Housing stock

Median annual house price change of properties acquired until year x in % (5-year moving average)



Source: HFCS Austria 2014, OeNB.

Note: HMR=household main residence; HMOP=household main other property.